Appendix D
Selection and Description of the Alternatives

September 2020

Chehalis River Basin Flood Damage Reduction Project

NEPA Environmental Impact Statement

US Army Corps of Engineers

1 ALTERNATIVES SCREENING

Section 1 of this appendix describes the alternatives screening process, which consisted of two phases. Section 2 describes the alternatives analyzed in the EIS.

1.1 Phase 1 Screening

Phase 1 considered whether an alternative would meet the purpose of the proposed project. The U.S. Army Corps of Engineers, Seattle District (Corps) identified 61 alternatives for consideration in this screening process. An alternative was required to meet all of the following screening criteria for achieving the project purpose to move forward to Phase 2 screening:

- Geographic Area of Flood Damage Reduction
- Flood Damage Reduction Metrics
  - Reduction of 1 foot at the Mellen Street gage (USGS 12025500)
  - Reduction of 4 feet at the Adna gage (USGS 12021800)
  - Reduction of 0.9 foot at the Chehalis Wastewater Treatment Plant gage (USGS 12025100)
  - Reduction of 0.8 foot at the Grand Mound gage (USGS 12027500)
- No Substantial Increase in Redirected Negative Impacts

Based on information submitted by the Applicant and an independent review of existing documentation, the following alternatives were identified for Phase 1 screening. The following subsections briefly describe each alternative. Alternatives are grouped by type, but each has been assigned an individual number for reference. Table 1.1-1 summarizes the Phase 1 screening process for each of these alternatives.

1.1.1 Alternatives Considered in Phase 1 Screening

1.1.1.1 Bypass Options

1. Floodwater Bypass Routes/Structures Near Mellen Street and Scheuber Road. Construct a high-flow bypass on the Chehalis River around the constricted reach at the Mellen Street Bridge and provide culvert or bridge connections under State Route (SR) 6 near Scheuber Road to reduce flood levels in the City of Chehalis by passing high flows downstream and through the bypass. The bypass would be approximately 700 feet wide and up to 10 feet deep, and extend from river mile (RM) 67.7 to downstream of the Skookumchuck River confluence (RM 66.16) (Ruckelshaus 2012).

1.1.1.2 Levees and Floodwalls

2. Chehalis-Centralia Airport Levee Improvements. This is the Airport Levee Improvements component of the proposed project.

3. Corps Twin Cities Project. Construct 11 miles (from RM 75 to RM 64) of new levees on the Chehalis River, the lower 2 miles of Dillenbaugh and Salzer creeks, and the lower 2 miles of the Skookumchuck River to the confluence with Coffee Creek. This alternative would include raising approximately eight structures near the airport, Interstate 5 (I-5), Skookumchuck River, and Salzer Creek. This alternative would also modify the Skookumchuck Dam to increase flood storage by 11,000 acre-feet (Ruckelshaus 2012).

1.1.1.3 Dredging

4. Dredge the Mainstem Chehalis River. Excavate the river channel from just downstream of Mellen Street (RM 67.29) to just downstream of Lincoln Creek (RM 60.51). The excavated channel would have a bottom width of 120 feet with a trapezoidal channel, lowering the channel bottom by as much as 15 feet in some locations. There is a natural bedrock rise in this reach, and blasting would be required. This alternative would also require some dredging in the Skookumchuck River between RM 3.32 and the mouth to create a 20-foot-wide trapezoidal channel (Ruckelshaus 2012).

1.1.1.4 Flood Retention Facilities

These alternatives include both new flood retention facilities at four main locations in the upper basin. Alternatives include temporary and permanent reservoir options.

1.1.1.4.1 Upper Chehalis River (Near Pe Ell)

5. Flood Retention Expandable (FRE). This is the flood retention facility component of the proposed project. This alternative would be operated as a flood retention facility with the capacity to withhold 65,000 acre-feet of floodwaters during major or greater floods only.
6. Flood Retention Only (FRO). A flood retention facility and temporary reservoir identical to that component of the proposed project (Alternative 5), but without the larger base needed to potentially support the expanded structure in the future.
7. Flood Retention Maximum Capacity (FRMC). A flood retention facility similar to the proposed project (Alternative 5), but higher and capable of temporarily storing more water, up to 130,000 acre-feet of storage.
8. Flood Retention Flow Augmentation (FRFA). A flood retention facility similar to Alternative 7, except the larger 130,000-acre-foot reservoir would be permanent and water would be released during the summer to augment low flows and provide cold water to reaches downstream.

1.1.1.4.2 Other Chehalis River Locations

9. Ruth Flood Retention Facility. Construct a new flood retention facility on the mainstem Chehalis River approximately 1.25 miles upstream of the Adna Gage. This flood retention facility was identified by the Corps (1982) as a potential flood storage location, with a maximum reservoir storage capacity of 108,000 acre-feet.

10. Meskill Flood Retention Facility. Construct a new flood retention facility approximately 6.75 miles upstream of the Adna Gage on the Chehalis River, as identified by the Corps (1982). The maximum reservoir storage capacity of this facility would be 54,000 acre-feet.

1.1.1.4.3 Newaukum River

11. North Fork Newaukum River Flood Retention Facility. Construct a new flood retention facility on the North Fork Newaukum River near where it crosses North Fork Road. This facility was identified by the Corps (1982) to provide up to 9,000 acre-feet of water storage capacity.
12. South Fork Newaukum River Flood Retention Facility. Construct a new flood retention facility on the South Fork Newaukum River, approximately 4 miles northeast of Onalaska, to allow up to 15,000 acre-feet of flood storage. This alternative was initially identified by the Corps (1982).
13. Alpha Creek Flood Retention Facility. Construct a new flood retention facility on Alpha Creek, a tributary to the upper portion of the South Fork Newaukum River, just north of Pigeon Springs Road. The facility, identified by Tetra Tech (2003), would be located just upstream of the Alpha Creek/South Fork Newaukum confluence and provide a maximum storage capacity of 54,000 acre-feet.

1.1.1.4.4 South Fork Chehalis River

14. Boistfort Flood Retention Facility. Construct a new flood retention facility on the South Fork Chehalis River south of Boistfort to allow up to 16,000 acre-feet of flood storage (Corps 1982).
15. South Fork Chehalis Site Flood Retention Facility. Construct a new flood retention facility on the South Fork Chehalis River south of Wildwood to allow up to 20,000 acre-feet of flood storage (EES Consulting 2011).
16. Above Hanlon Flood Retention Facility. Construct a new flood retention facility on the South Fork Chehalis River near the Lewis County/Cowlitz County border. This alternative was identified by Tetra Tech (2003) and would allow up to 7,000 acre-feet of flood storage.
17. Lake Creek Flood Retention Facility. Construct a new flood retention facility on Lake Creek, a tributary to the South Fork Chehalis River, approximately 8 miles upstream of the confluence of these two waterways. This alternative was identified by Tetra Tech (2003) and would provide up to 40,000 acre-feet of flood storage.
18. Lost Creek Flood Retention Facility. Construct a new flood retention facility on Lost Creek, which drains to Stillman Creek, a tributary to the South Fork Chehalis River. This alternative, identified by Tetra Tech (2003), would be located approximately 0.5 mile north of Pe Ell McDonald Road and provide up to 9,000 acre-feet of water storage.

1.1.1.4.5 Deep Creek

19. Bunker Creek Flood Retention Facility. Construct a new flood retention facility on Bunker Creek just upstream of its confluence with Deep Creek, a tributary to the mainstem Chehalis River. This alternative was developed by Tetra Tech (2003) and would provide up to 6,000 acre-feet of water storage capacity.

20. Upper Deep Creek Flood Retention Facility. Construct a new flood retention facility on Deep Creek, approximately 8 miles upstream of its confluence with the mainstem Chehalis River. This alternative was developed by Tetra Tech (2003) and would provide up to 3,000 acre-feet of water storage capacity.

1.1.1.4.6 Elk Creek

21. Little Elk Creek. Construct a new flood retention facility on Little Elk Creek, a tributary to Elk Creek that drains to the mainstem Chehalis River. This alternative, identified by Tetra Tech (2003), would be located approximately 27 miles upstream of the City of Chehalis and have a maximum storage capacity of 9,000 acre-feet.

1.1.1.4.7 Skookumchuck River

22. Skookumchuck Dam Modifications. Modify the existing private, water supply dam on the Skookumchuck River (RM 22), east of Bucoda, to increase flood storage capacity to a maximum 20,000 acre-feet in the existing reservoir. This project would change the function of the dam from a water supply facility to a facility with flood control features to reduce flood damages in the Skookumchuck valley, the Town of Bucoda, and the City of Centralia. Modifications to the dam would include creating an outlet structure, modifying the spillway, and providing a maximum pool elevation (Corps 2003).

1.1.1.5 Interstate 5 Projects

23. I-5 Levees and Walls. Implement several actions to protect I-5 and the Chehalis-Centralia Airport, including raising the existing airport levee and constructing a new 1-mile-long Chehalis Avenue levee, additional earthen levees and flood walls, and bridge replacements over Dillenbaugh and Salzer creeks. The levees and walls would begin just south of the I-5/13th Street Interchange and continue as needed to the north, where they would tie into the Mellen Street Interchange (WSDOT 2014).
24. Raise and Widen I-5. Raise I-5 using fill material to elevate the road surface above the desired flood protection elevation, widening I-5 from four to six lanes, and raising bridges. Raising I-5 would require reconstruction of all pavement, stormwater systems, illumination systems, and guardrail in the affected area. In addition, the I-5 interchanges at 13th Street, SR 6, and Chamber Way, and the West Street bridge would need to be reconstructed (WSDOT 2014).
25. I-5 Express Lanes (berms). Construct 4 miles of new express lanes adjacent to I-5 to provide traffic the opportunity to bypass I-5 if the main interstate was closed by floods. The express lanes would diverge from I-5 at 13th Street and follow the existing Tacoma Rail line through Chehalis. This alternative would include construction of new bridges over West, Prindle, and Main streets in Chehalis. The express lanes would be at least 3 feet above the 100-year flood elevation and would be available to traffic with or without flood conditions (WSDOT 2014).
26. I-5 Temporary Bypass. Construct 4 miles of temporary bypass lanes diverging from I-5 at 13th Street, and then follow the existing Tacoma Rail line through Chehalis, with a bridge over Main

Street. These lanes would only be used during floods. The intersections with Prindle and West Streets would be at-grade, and flood gates would close during flood events to keep floodwaters out of the temporary bypass. The bypass lanes would be constructed a minimum of 3 feet above the 100-year flood elevation. This would provide a local bypass opportunity if the main part of I-5 were to be closed by major floods (WSDOT 2014).

27. I-5 Viaduct. Elevate I-5 on piers to build a viaduct from SR 6 to Mellen Street, widen I-5 to six lanes, and reconstruct all interchanges in the affected area (WSDOT 2014).
28. I-5 Relocation. Relocate I-5 outside the flood area, including widening I-5 to six lanes and constructing new interchanges (WSDOT 2014).

1.1.1.6 Local Actions

Some local actions to reduce flood damage in the Chehalis Basin are being implemented by other entities. Those actions will be included as elements of the No Action Alternative, because they would move forward regardless of whether the proposed project is built. The alternatives listed below are not included in the No Action Alternative.

29. Floodproofing. Protecting existing structures in the floodplain by elevating them, building levees or floodwalls around them, demolishing or purchasing them, or other measures. Approximately 75% of residential structures and 25% of other structures within the Chehalis River floodplain could feasibly be floodproofed (Ecology 2016).
30. Protecting Local Critical Infrastructure and Priority Areas. Local flood protection projects, including the following:
    - Protection of wastewater treatment plants (WWTPs), such as the Elma WWTP outfall stabilization project and the Montesano WWTP Wynoochee River bank protection project
    - Protection of roads and infrastructure, such as the Grays Harbor County Wishkah Road flood hazard reduction project
    - Certification of existing levees, such as the Aberdeen Southside Dike/Levee Certification, which could include some dike improvements
    - Restoration of floodplains, such as the Satsop River Floodplain Restoration (Ecology 2016)
31. Land Use Management. Revising land use regulations and practices on the local level to protect floodplain functions and minimizing floodplain development. This alternative may include restricting the creation of developable parcels in the floodplain through open space preservation, subdivision set-asides, and low-density zoning. Other elements may involve increasing the cost of future development in the floodplain, and include filling restrictions and freeboard elevation requirements (Ecology 2016).
32. Regulatory Flood Data. Requiring additional flood data beyond those provided on Flood Insurance Rate Maps (FIRMs) to be used in flood regulations. The regulatory floodplain and flood elevation would be defined by the flood of record where there is no Base Flood Elevation (BFE) on the FIRM, or where the flood of record is higher than the BFE. In addition, all permit applicants in areas without a BFE on the FIRM would be required to conduct an on-site flood

study, or use an existing, current study, to calculate the BFE. Permit applicants for single-family residences on existing lots would have the option of elevating the house 5 feet or more above grade without funding a study (Ecology 2016).

33. Floodplain Protection. Implementing higher development standards in flood-prone locations, including the following:
    - Preserving open space in the floodplain
    - Requiring new subdivisions and other large developments to set aside all or part of their flood-prone areas as open space
    - Prohibiting any fill in the floodplain or requiring compensatory flood storage
    - Not allowing low-density zoning districts within the floodplain to be amended to allow more dense development (Ecology 2016)
34. Modifying Construction Standards. Setting more stringent construction standards in the floodplain, including the following:
    - Increasing the amount of required freeboard for new construction or substantial improvements of existing structures
    - Prohibiting new critical facilities (e.g., hospitals, fire stations, hazardous materials facilities) from being constructed in the 500-year floodplain or protecting them from damage or loss of access during a 500-year flood
    - Requiring a permit applicant seeking to elevate or improve a building already protected by floodwalls to sign an agreement that areas below the BFE or flood protection elevation would not be converted to a use (e.g., a residential living space) or be constructed with materials that are subject to water damage (Ecology 2016)
35. Flood Warning System Improvements. Improving the existing Chehalis River Basin Flood Warning System. Improvements would include the following:
    - Implementing a program to confirm the river gage rating curve/table for the Chehalis River at Centralia
    - Expanding the inundation mapping program to include the community of Bucoda
    - Adding a new National Weather Service (NWS) river forecast point on the Skookumchuck River near Bucoda
    - Working with the NWS River Forecast Center to implement a new hydraulic model in the lower Chehalis River that would account for tides, storm surge, and sea level rise, and extend the ability to provide river forecasts between Porter and the mouth of the Chehalis River
    - Revising inundation maps after significant floods to incorporate information obtained during the events
    - Funding the addition of all Chehalis River inundation maps to the NWS inundation map website (Ecology 2016)

1.1.1.7 Other Actions

36. Restorative Flood Protection. Rebuild the natural flood storage capacity of the Chehalis Basin by a large-scale reversal of landscape changes that contribute to downstream flooding and erosion, including the following:
    - Add engineered large wood and plantings to create "roughness" to river and stream channels and the floodplain. Roughness would raise water elevations in the waterway, causing water to spill overbank more frequently. Overbank flows would spread across the floodplain, slowing flow speeds, increasing floodwater storage periods, and discouraging drainage flowing back to channels. These actions would reduce the magnitude of flooding downstream.
    - Reconnect river channels to floodplain storage to slow flows through the basin and reduce the magnitude of flooding downstream (Ecology 2016).
37. Community Flood Assistance and Resilience Program. Develop a program to protect individual properties, including the following measures:
    - Floodproofing of properties through any combination of structural and non-structural additions, changes, or adjustments to structures. Floodproofing typically involves elevating existing structures on properties prone to flooding or acquiring inhabited properties and converting the land to other uses to eliminate the risk of flood damage.
    - Protection of properties due to channel migration, which can erode land adjacent to the channel and damage structures or uses of this land (OCB 2018).

1.1.1.8 Bridge Replacements

38. Removing the SR 6 Bridge and Approach Fills. Move the SR 6 Bridge, west of Chehalis over the mainstem Chehalis River, and associated features, out of the floodplain (Ruckelshaus 2012).
39. Removing the Mellen Street Bridge and Approach Fills. Move the Mellen Street Bridge, in Chehalis over the mainstem Chehalis River, and associated features, out of the floodplain (Ruckelshaus 2012).
40. Removing the Galvin Road Bridge and Approach Fills. Move the Galvin Road Bridge, in Galvin over the mainstem Chehalis River, and associated features, out of the floodplain (Ruckelshaus 2012).
41. Removing the Porter Creek Road Bridge and Approach Fills. Move the Porter Creek Road Bridge, in Porter over the mainstem Chehalis River, and associated features, out of the floodplain (Ruckelshaus 2012).
42. Removing the Wakefield Road (South Elma) Bridge and Approach Fills. Move the Wakefield Road Bridge, in Elma over the mainstem Chehalis River, and associated features, out of the floodplain (Ruckelshaus 2012).
43. Removing Multiple Bridges and Approach Fills in the Upper Chehalis Basin. Move the SR 6 Bridge, Mellen Street Bridge, and Galvin Road Bridge over the mainstem Chehalis River, and associated features, out of the floodplain (Ruckelshaus 2012).

1.1.1.9 Other Combinations

The following alternatives are combinations of the flood retention alternatives identified previously and the Airport Levee Improvements. Only the flood retention facilities were used in these combinations because they are the only alternatives that would potentially provide the reduction in flood levels needed to meet the purpose. All other alternatives would involve fill in the floodplain (and therefore contribute to expanding the 100-year floodplain), target only specific local areas for flood damage reduction, or would not come close to meeting the flood damage reduction metrics. The Airport Levee Improvements were selected for combination with the flood retention facilities for consistency with the proposed project and to determine whether any other alternatives similar to the proposed project would meet the essential screening criteria.

The components of these alternatives have been discussed previously, so they are only listed here:

44. FRE plus Airport Levee Improvements
45. FRO plus Airport Levee Improvements
46. FRMC plus Airport Levee Improvements
47. FRFA plus Airport Levee Improvements
48. Ruth Flood Retention Facility plus Airport Levee Improvements
49. Meskill Flood Retention Facility plus Airport Levee Improvements
50. North Fork Newaukum River Flood Retention Facility plus Airport Levee Improvements
51. South Fork Newaukum River Flood Retention Facility plus Airport Levee Improvements
52. Alpha Creek Flood Retention Facility plus Airport Levee Improvements
53. Boistfort Flood Retention Facility plus Airport Levee Improvements
54. South Fork Chehalis Site Retention Facility plus Airport Levee Improvements
55. Above Hanlon Flood Retention Facility plus Airport Levee Improvements
56. Lake Creek Flood Retention Facility plus Airport Levee Improvements
57. Lost Creek Flood Retention Facility plus Airport Levee Improvements
58. Bunker Creek Flood Retention Facility plus Airport Levee Improvements
59. Upper Deep Creek Flood Retention Facility plus Airport Levee Improvements
60. Little Elk Creek Flood Retention Facility plus Airport Levee Improvements
61. Skookumchuck Dam Modifications plus Airport Levee Improvements

Table 1.1-1
Phase 1 Alternatives Screening

	ESSENTIAL SCREENING CRITERIA	1. WITHIN THE GEOGRAPHIC AREA OF FLOOD DAMAGE REDUCTION	2. MEETS FLOOD DAMAGE REDUCTION METRICS	3. NO SUBSTANTIAL INCREASE IN REDIRECTED NEGATIVE IMPACTS	CARRIED TO PHASE 2?
(1)	Floodwater Bypass Routes/Structures Near Mellen Street and Scheuber Road				No
(2)	Chehalis-Centralia Airport Levee Improvements				No
(3)	Corps Twin Cities Project				No
(4)	Dredge the Mainstem Chehalis River				No
(5)	Flood Retention Expandable	✓		✓	No
(6)	Flood Retention Only	✓		✓	No
(7)	Flood Retention Maximum Capacity	✓		✓	No
(8)	Flood Retention Flow Augmentation	✓		✓	No
(9)	Ruth Flood Retention Facility	✓			No
(10)	Meskill Flood Retention Facility	✓			No
(11)	North Fork Newaukum River Flood Retention Facility			✓	No
(12)	South Fork Newaukum River Flood Retention Facility			✓	No
(13)	Alpha Creek Flood Retention Facility			✓	No
(14)	Boistfort Flood Retention Facility	✓		✓	No
(15)	South Fork Chehalis Site Retention Facility	✓		✓	No
(16)	Above Hanlon Flood Retention Facility	✓		✓	No
(17)	Lake Creek Flood Retention Facility	✓		✓	No
(18)	Lost Creek Flood Retention Facility	✓		✓	No
(19)	Bunker Creek Flood Retention Facility			✓	No
(20)	Upper Deep Creek Flood Retention Facility			✓	No
(21)	Little Elk Creek Flood Retention Facility	✓		✓	No
(22)	Skookumchuck Dam Modifications			✓	No
(23)	I-5 Levees and Walls				No
(24)	Raise and widen I-5				No

ESSENTIAL SCREENING CRITERIA		1. WITHIN THE GEOGRAPHIC AREA OF FLOOD DAMAGE REDUCTION	2. MEETS FLOOD DAMAGE REDUCTION METRICS	3. NO SUBSTANTIAL INCREASE IN REDIRECTED NEGATIVE IMPACTS	CARRIED TO PHASE 2?
(25)	I-5 Express Lanes (berms)				No
(26)	I-5 Temporary Bypass				No
(27)	I-5 Viaduct				No
(28)	I-5 Relocation			✓	No
(29)	Floodproofing	✓			No
(30)	Protecting Local Critical Infrastructure and Priority Areas	✓			No
(31)	Land Use Management	✓		✓	No
(32)	Regulatory Flood Data	✓		✓	No
(33)	Floodplain Protection	✓		✓	No
(34)	Modifying Construction Standards	✓			No
(35)	Flood Warning System Improvements	✓		✓	No
(36)	Restorative Flood Protection	✓		✓	No
(37)	Community Flood Assistance & Resilience Program	✓			No
(38)	Removing the SR 6 Bridge and Approach Fills				No
(39)	Removing the Mellen Street Bridge and Approach Fills				No
(40)	Removing the Galvin Road Bridge and Approach Fills				No
(41)	Removing the Porter Creek Road Bridge and Approach Fills				No
(42)	Removing the Wakefield Road (South Elma) Bridge and Approach Fills				No
(43)	Removing Multiple Bridges and Approach Fills in the Upper Chehalis Basin				No
(44)	FRE plus Airport Levee Improvements	✓	✓	✓	Yes
(45)	FRO plus Airport Levee Improvements	✓	✓	✓	Yes
(46)	FRMC plus Airport Levee Improvements	✓	✓	✓	Yes
(47)	FRFA plus Airport Levee Improvements	✓	✓	✓	Yes

ESSENTIAL SCREENING CRITERIA	1. WITHIN THE GEOGRAPHIC AREA OF FLOOD DAMAGE REDUCTION	2. MEETS FLOOD DAMAGE REDUCTION METRICS	3. NO SUBSTANTIAL INCREASE IN REDIRECTED NEGATIVE IMPACTS	CARRIED TO PHASE 2?
(48) Ruth Flood Retention Facility plus Airport Levee Improvements	✓			No
(49) Meskill Flood Retention Facility plus Airport Levee Improvements	✓			No
(50) North Fork Newaukum River Flood Retention Facility plus Airport Levee Improvements			✓	No
(51) South Fork Newaukum River Flood Retention Facility plus Airport Levee Improvements			✓	No
(52) Alpha Creek Flood Retention Facility plus Airport Levee Improvements			✓	No
(53) Boistfort Flood Retention Facility plus Airport Levee Improvements			✓	No
(54) South Fork Chehalis Site Retention Facility plus Airport Levee Improvements			✓	No
(55) Above Hanlon Flood Retention Facility plus Airport Levee Improvements			✓	No
(56) Lake Creek Flood Retention Facility plus Airport Levee Improvements			✓	No
(57) Lost Creek Flood Retention Facility plus Airport Levee Improvements			✓	No
(58) Bunker Creek Flood Retention Facility plus Airport Levee Improvements			✓	No
(59) Upper Deep Creek Flood Retention Facility plus Airport Levee Improvements			✓	No
(60) Little Elk Creek Flood Retention Facility plus Airport Levee Improvements			✓	No
(61) Skookumchuck Dam Modifications plus Airport Levee Improvements			✓	No

Note:
Blank cells indicate that a considered alternative did not meet a screening criterion.

1.1.2 Phase 1 Screening Results

There are three essential screening criteria. The flood damage reduction criterion identified reduced flood level metrics at four locations. Four alternatives met the flood level metrics at three of the four locations. This was considered to have met the flood damage reduction criterion. Therefore, these four alternatives were carried into Phase 2.

1.2 Phase 2 Screening

Phase 2 screening criteria included whether alternatives carried from Phase 1 were reasonably available to the Applicant. Phase 2 screening also evaluated whether any of the alternatives would cause substantially greater impacts on the aquatic environment relative to each other.

Of the four remaining alternatives, two were carried forward for analysis in the Draft Environmental Impact Statement (EIS) as Alternatives 1 and 2. These are summarized in Sections 3.4 and 3.5 of the EIS and discussed in greater detail in Section 2 of this appendix. The other two alternatives were eliminated in Phase 2. These alternatives included Airport Levee Improvements with a flood retention facility in the same location as the proposed project. The flood retention facility components of the eliminated alternatives were defined as follows:

- **Flood Retention Maximum Capacity (FRMC):** A flood retention facility similar to the proposed project (Alternative 1 in this EIS), but taller and capable of temporarily storing more water. The FRMC facility would be able to store up to 130,000 acre-feet of water, which is twice the 65,000 acre-feet of storage capacity of the proposed project.
- **Flood Retention Flow Augmentation (FRFA):** A flood retention facility similar to the FRMC facility, except a portion of the 130,000-acre-foot reservoir would be permanent. Water would be released during the summer to increase water levels during low flows and to provide colder water to the river.

The FRMC and FRFA facilities would have larger reservoirs than those associated with Alternatives 1 and 2, and would therefore result in greater impacts on the aquatic environment. The aquatic environment includes wetlands and other waters that may be protected under Section 404 of the Clean Water Act (CWA). The impacts associated with the FRFA facility would also be permanent, including permanent impacts to fish rearing habitat and spawning grounds. The CWA Section 404(b)(1) Guidelines (40 Code of Federal Regulations [CFR] 230) prohibit the Corps from authorizing a discharge into wetlands and other special aquatic sites if there is a practicable alternative that would have less adverse impacts on the aquatic ecosystem. The FRMC and FRFA facilities combined with the Airport Levee Improvements would have greater impacts than the proposed action. Therefore, these alternatives were eliminated from further consideration.

2 DESCRIPTION OF THE ALTERNATIVES

Section 2 of this appendix provides a detailed description of the three alternatives evaluated in the National Environmental Policy Act (NEPA) EIS:

- No Action Alternative (Section 2.1)
- Alternative 1 (Proposed Project): Flood Retention Expandable (FRE) and Airport Levee Improvements (Section 2.2)
- Alternative 2: Flood Retention Only (FRO) and Airport Levee Improvements (Section 2.3)

2.1 No Action Alternative

2.1.1 Introduction

NEPA and its implementing regulations require an EIS to include a No Action Alternative (40 CFR 1502.14). A No Action Alternative describes the consequences of not implementing an action alternative and includes changes that would occur without the proposed project. This allows decision makers and the public to compare the effects of approving the proposed project with the effects that would occur if the project were not approved.

A No Action Alternative is not a baseline for evaluating the environmental effects of the proposed project or action alternatives. The baseline condition against which the proposed project is compared is defined as the existing conditions at the time the Notice of Intent was published in the Federal Register. The Notice of Intent for the proposed project was published on September 28, 2018.

Under the No Action Alternative, the U.S. Army Corps of Engineers, Seattle District (Corps) would not issue the requested Department of the Army permit under Section 404 of the CWA. The proposed project would not be constructed under the No Action Alternative.

The upper part of the upper Chehalis Basin was chosen as the appropriate area to consider for the No Action Alternative because it represents the area of the Chehalis Basin that contributes the most flow to the Chehalis-Centralia area targeted for flood damage reduction. The No Action Alternative includes projects that are funded and permitted or are in the process of being constructed at the time of the EIS was drafted (January 2019). It also includes other actions reasonably likely to occur during the NEPA EIS analysis period (2025 to 2080). These actions are listed in Table 2.1-1 and described in the following sections.

Table 2.1-1
Reasonably Foreseeable Future Actions

PROJECT	PROPONENT	LOCATION	DESCRIPTION	WATER QUANTITY AND QUALITY	GEOLOGY AND GEOLOGIC HAZARDS	GEOMORPHOLOGY	WETLANDS AND OTHER WATERS	AQUATIC SPECIES AND HABITATS	TERRESTRIAL SPECIES AND HABITATS	AIR QUALITY	VISUAL QUALITY	NOISE AND VIBRATION	LAND USE	RECREATION	CULTURAL RESOURCES	TRANSPORTATION	PUBLIC SERVICES AND UTILITIES	ENVIRONMENTAL HEALTH AND SAFETY	SOCIOECONOMICS	ENVIRONMENTAL JUSTICE	SCHEDULE OR STATUS
Aquatic Species Restoration Plan (ASRP) (CBS 2019)	Office of the Chehalis Basin and Washington Department of Fish and Wildlife	Upper Chehalis Basin (WRIA 23)	The goal of the ASRP is to create a comprehensive restoration plan that improves and protects habitats, ecosystem processes, and populations of aquatic species. The cumulative effects analysis only includes select projects that could contribute to cumulative effects of the alternatives. These restoration projects are located on the South Fork Newaukum River, Stillman Creek in the South Fork Chehalis sub-basin, and the Skookumchuck River. The projects evaluated under the ASRP would improve long-term conditions for fish and other aquatic species, terrestrial species, and flooding and hydrology.	●		●	●	●	●	●			●	●	●			●			Ongoing; ASRP Phase 1 Draft Plan published in 2019; final plans in 2020
Multi-Jurisdictional Flood Warning and Response Plans (Lewis County 2019)	Lewis County	WRIA 23	These plans address actions to improve flood preparedness through identification of flood hazards and potential actions to minimize damage. Implementation of this plan would result in flood damage reduction, benefiting elements of the built environment.	●		●	●	●	●				●		●	●		●	●		Ongoing
Berwick Creek Flood Reduction, Restoration (Office of Chehalis Basin 2019)	Port of Chehalis	WRIA 23, southeast of Chehalis	This is a habitat restoration project that includes streambank stabilization in a currently degraded area. This project would result in flood damage reduction and benefit the built environment and fish and wildlife habitat.	●		●	●	●	●	●				●	●			●			2020
Livestock Pad Project (Lewis County 2019)	Chehalis River Basin Flood Authority	Chehalis	This is a farm pad project that includes platforms to provide refuge to livestock during floods. This project would protect agricultural land use but may impact habitats.				●		●				●		●			●			2020

PROJECT	PROPONENT	LOCATION	DESCRIPTION	WATER QUANTITY AND QUALITY	GEOLOGY AND GEOLOGIC HAZARDS	GEOMORPHOLOGY	WETLANDS AND OTHER WATERS	AQUATIC SPECIES AND HABITATS	TERRESTRIAL SPECIES AND HABITATS	AIR QUALITY	VISUAL QUALITY	NOISE AND VIBRATION	LAND USE	RECREATION	CULTURAL RESOURCES	TRANSPORTATION	PUBLIC SERVICES AND UTILITIES	ENVIRONMENTAL HEALTH AND SAFETY	SOCIOECONOMICS	ENVIRONMENTAL JUSTICE	SCHEDULE OR STATUS
Floodproofing	Local governments in the Upper Chehalis Basin	WRIA 23	These actions include numerous measures to protect structures from flooding, including elevating structures, building levees or floodwalls around structures, or demolishing or purchasing structures. Floodproofing would improve conditions for elements of the built environment. Depending on where floodproofing measures are located, they may impact wetlands and other waters, terrestrial habitats and species, and aquatic habitats and species.	●			●	●	●	●			●		●			●	●	●	Ongoing
Timber Harvest in Managed Forests	Various entities	WRIA 23, upstream of Adna	Timber harvest would continue in the managed forestlands in the Upper Chehalis Basin. The Washington Department of Natural Resources Forest Practices Habitat Conservation Plan would continue to be implemented for timber harvest and related activities. Timber harvests would contribute to impacts on water quality and quantity because of stormwater runoff from harvested areas. Water quality and quantity degradation has lasting effects on aquatic and terrestrial species, wetlands, and numerous other resources.	●	●	●	●	●	●	●	●	●		●	●			●	●		Ongoing
Chehalis Fisheries Restoration Program (USFWS 2020)	U.S. Fish and Wildlife Service	WRIA 23	This program includes projects involving habitat restoration. This includes correcting fish passage barriers, removing invasive species and replanting native species, enhancing or restoring riparian and off-channel fish rearing habitat, and restoring agricultural wetlands for fish use throughout the upper Chehalis Basin. These projects are anticipated to benefit habitat and result in flood damage reduction over the long term.	●		●	●	●	●	●				●	●			●			The schedule for implementation is unknown at this time

PROJECT	PROPONENT	LOCATION	DESCRIPTION	WATER QUANTITY AND QUALITY	GEOLOGY AND GEOLOGIC HAZARDS	GEOMORPHOLOGY	WETLANDS AND OTHER WATERS	AQUATIC SPECIES AND HABITATS	TERRESTRIAL SPECIES AND HABITATS	AIR QUALITY	VISUAL QUALITY	NOISE AND VIBRATION	LAND USE	RECREATION	CULTURAL RESOURCES	TRANSPORTATION	PUBLIC SERVICES AND UTILITIES	ENVIRONMENTAL HEALTH AND SAFETY	SOCIOECONOMICS	ENVIRONMENTAL JUSTICE	SCHEDULE OR STATUS
Chehalis Basin Partnership Watershed Plan Update	Chehalis Basin Partnership	WRIAs 22, 23	This update would provide a plan to manage water throughout the Chehalis Basin. Implementation of the updated plan would include building specific projects to improve hydrology and aquatic habitats. Plan implementation would benefit water resources, habitats, and elements of the built environment that would benefit from flood damage reduction.	●		●	●	●	●	●			●		●			●			Anticipated in early 2020
Chehalis-Centralia Airport Property Master Plan (Chehalis-Centralia Airport 2018)	Chehalis-Centralia Airport	Chehalis-Centralia Airport	Implementation of this plan would include new commercial and recreational development in the northeast portion of the airport property, in addition to expansion of the airport (Chehalis-Centralia Airport 2018). Implementation of the master plan could impact wetlands and terrestrial habitats. Further development in the floodplain may increase the risk of flood damage. The recreational improvements would benefit recreational opportunities.	●			●		●	●	●	●	●	●	●			●	●		The schedule for implementation is unknown at this time
Chehalis Flood Storage and Habitat Enhancement Master Plan (Office of Chehalis Basin 2019)	City of Chehalis	156-acre basin between the Chehalis River and Louisiana Avenue, and between Highway 6 and Airport Road in Chehalis	The master plan provides information relevant to the design of a flood storage facility. It will evaluate the potential flood storage volume within the 156-acre basin to determine the level of flood damage reduction. Master plan implementation will ultimately protect elements of the built environment from flood damage. Construction of master plan elements may impact wetlands, land uses, and fish and wildlife.	●		●	●	●	●	●			●	●	●			●	●	●	Phase II is scheduled to be completed by June 30, 2020
Chehalis River Basin Comprehensive Flood Hazard Management Plan (Office of Chehalis Basin 2019)	Chehalis River Basin Flood Control Zone District	Lewis County	This plan defines flooding in the Chehalis Basin and proposes conceptual solutions to these problems. This plan also includes implementation of Alternative 1. Implementation of this plan would result in flood damage protection, benefiting elements of the built environment.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	December 2020

PROJECT	PROPONENT	LOCATION	DESCRIPTION	WATER QUANTITY AND QUALITY	GEOLOGY AND GEOLOGIC HAZARDS	GEOMORPHOLOGY	WETLANDS AND OTHER WATERS	AQUATIC SPECIES AND HABITATS	TERRESTRIAL SPECIES AND HABITATS	AIR QUALITY	VISUAL QUALITY	NOISE AND VIBRATION	LAND USE	RECREATION	CULTURAL RESOURCES	TRANSPORTATION	PUBLIC SERVICES AND UTILITIES	ENVIRONMENTAL HEALTH AND SAFETY	SOCIOECONOMICS	ENVIRONMENTAL JUSTICE	SCHEDULE OR STATUS
China Creek Flood and Habitat Mitigation (Office of Chehalis Basin 2019)	City of Centralia	Centralia	The project will provide flood storage using excavated naturally shaped landforms, stream channel friction and natural instream fish habitat features. These features will slow down and store flows in the upper China Creek watershed during high-flow runoff events. This project will result in flood damage reduction and benefit the built environment and fish and wildlife habitat.	●		●	●	●	●					●	●			●			Construction to be complete in 2021
Community Flood Assistance and Resilience (CFAR) Program (Office of Chehalis Basin 2018)	Office of the Chehalis Basin	WRIA 22, WRIA 23	Implementation of this program would include technical assistance and funding to local entities to reduce flood damage in the Chehalis Basin. Program implementation would benefit elements of the built environment as a result of flood damage reduction.	●			●	●	●				●		●	●		●	●	●	The schedule for implementation is unknown at this time
Recreation and Conservation Office Salmon Recovery Funding Board Projects (Washington State Recreation and Conservation Office Salmon Recovery Funding Board 2019)	RCO, Chehalis Basin Lead Entity	WRIA 23	RCO provides grants for select projects and monitoring efforts that protect or restore salmon habitat. Projects evaluated for cumulative impacts include installation of fish screens on 15 irrigation diversions, removal of six fish barriers, and land acquisitions to protect stream habitats. These projects are anticipated to benefit habitat and result in flood damage reduction.	●		●	●	●	●				●	●	●			●	●	●	Ongoing
Washington State Department of Transportation Culvert Replacement Program (WSDOT 2019)	WSDOT	Statewide	Culvert replacement in the Upper Chehalis Basin would be part of a statewide fish passage restoration program. WSDOT would replace culverts that are impassible to fish with culverts or bridges that allow fish to move upstream and downstream. This program would benefit hydrology, fish, and wildlife over the long term.	●		●	●	●	●					●	●	●	●	●			By 2030

PROJECT	PROPONENT	LOCATION	DESCRIPTION	WATER QUANTITY AND QUALITY	GEOLOGY AND GEOLOGIC HAZARDS	GEOMORPHOLOGY	WETLANDS AND OTHER WATERS	AQUATIC SPECIES AND HABITATS	TERRESTRIAL SPECIES AND HABITATS	AIR QUALITY	VISUAL QUALITY	NOISE AND VIBRATION	LAND USE	RECREATION	CULTURAL RESOURCES	TRANSPORTATION	PUBLIC SERVICES AND UTILITIES	ENVIRONMENTAL HEALTH AND SAFETY	SOCIOECONOMICS	ENVIRONMENTAL JUSTICE	SCHEDULE OR STATUS
2020 – 2023 Regional Transportation Improvement Program (Cowlitz-Wahkiakum Council of Governments 2019)	Cowlitz-Wahkiakum Council of Governments, Longview-Kelso-Rainier Metropolitan Planning Organization, Southwest Washington Regional Transportation Planning Organization	Lewis County	The Regional Transportation Improvement Program identifies transportation projects to be implemented between 2020 and 2023. The cumulative effects analysis only evaluates larger projects located within the upper part of the Upper Chehalis Basin. These projects include the following: a. SR 6/Two Tributaries to Chehalis River - Fish Passage (downstream of Mill Creek confluence): 2020 b. SR 6/Mill Creek Bridge - Replace Bridge: 2023 c. SR 6/Chehalis River Bridge to I-5 – Americans with Disabilities Act (ADA) Upgrades: 2020 d. SR 6/Chehalis River Riverside Bridge - Deck Overlay: 2020 e. I-5/Chamber Way - Interchange Improvements: 2023 f. SR 507/I-5 to Skookumchuck River Bridge Including Couplet - ADA Upgrades: 2021 g. SR 507/Skookumchuck River Bridge - Replace Bridge: 2023 h. SR 507/Skookumchuck River to Thurston County Line - ADA Upgrades: 2021 i. US 12/Cedar Creek Bridge - Scour Repair: 2023 Some of these transportation projects would provide fish passage through replacement of culverts with fish-passable culverts and bridges. These projects would benefit habitats and hydrology. All of these projects have the potential to negatively impact habitats and species and affect water quality and quantity as a result of increased impervious surfaces.	●		●	●	●	●	●	●	●	●		●	●	●	●	●	●	2019 to 2024

2.1.2 Chehalis River Basin Flood Authority Projects

The Flood Authority's purpose is to develop flood hazard mitigation measures and to identify and implement flood control projects in the Chehalis Basin. Flood Authority projects in the upper part of the upper Chehalis Basin included as part of the No Action Alternative are listed in Table 2.1-2 and shown in Figure 2.1-1. These projects include actions to restore floodplains, improve conditions of existing dikes and levees, and protect WWTPs, roads, and other infrastructure.

Table 2.1-2
Chehalis River Basin Flood Authority Proposed Project List

PROJECT	SPONSOR	STATUS	START/END
Multi-Jurisdictional Flood Warning and Response Plans	Lewis County	Proposed	July 2019–June 2021
China Creek Flood and Habitat Mitigation[1]	City of Centralia	Proposed	November 2015–June 2021
Flood Storage and Habitat Enhancement Master Plan (Phase II)	City of Chehalis	Proposed	November 2016–June 2021
Berwick Creek Flood Reduction, Restoration	Port of Chehalis	Proposed	July 2019–June 2021

Note:
1. This project is a voluntary restoration effort and not associated with any regulatory mitigation action.
Source: Lewis County 2019

The Flood Authority has prepared the *Chehalis River Basin Comprehensive Flood Hazard Management Plan* (CRBFA 2010). This plan defines flooding problems and proposes conceptual solutions to these problems. These solutions may include improved flood warning and emergency management systems, an economic analysis to value ecosystem services, and recommendations for regulatory program improvements. This plan also includes implementation of Alternative 1, which is not included in the No Action Alternative.

The Flood Authority also documented farm pad projects completed since 2012 and those planned to be completed through 2021. These projects provide elevated areas for livestock use, reducing mortality and economic loss during floods. One livestock pad project in the upper part of the upper Chehalis Basin is currently in progress and is included in the No Action Alternative.

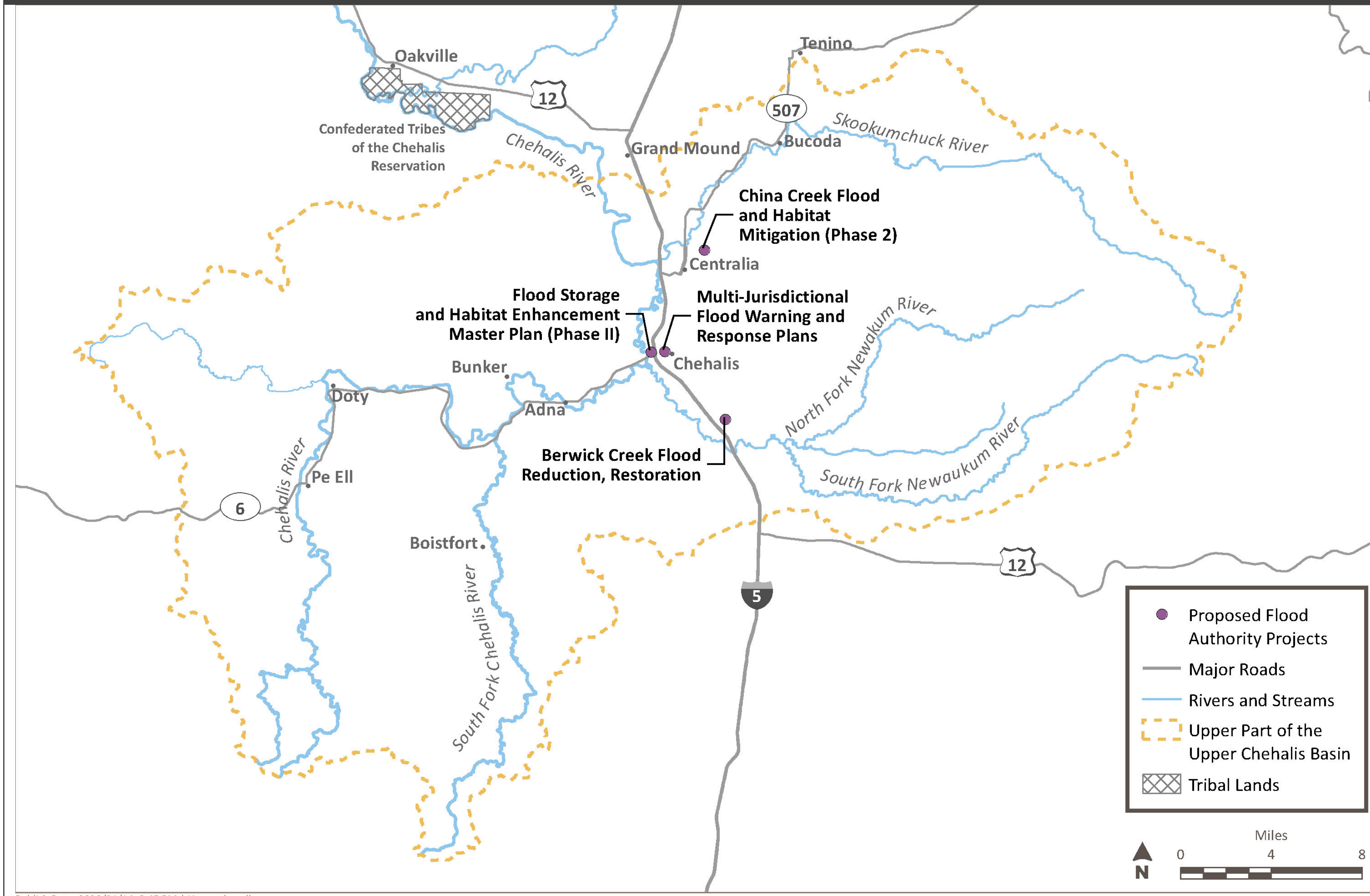
2.1.3 Chehalis Basin Partnership Watershed Plan Update

The Chehalis Basin Partnership released the *Chehalis Basin Watershed Management Plan* (CBP 2004) in 2004 to better manage water resources in the Chehalis Basin. This plan sought to implement a flexible and targeted system to manage water that maximizes the involvement of the residents of the Chehalis Basin. The update to this plan would provide a strategy to implement specific projects to improve hydrologic conditions and aquatic habitats.

2.1.4 Floodproofing

Floodproofing includes efforts that are formally planned or funded for completion to protect existing structures in the Chehalis River floodplain. Floodproofing would include measures to protect structures in areas that are prone to flooding. These measures would include elevating structures, building levees or floodwalls around structures, or demolishing or purchasing structures. Floodproofing would be led primarily by local governments in the upper Chehalis Basin, such as Lewis County. It may be funded through Federal Emergency Management Agency programs. Local flood damage reduction efforts, such as floodproofing, would likely continue based on local planning and regulatory actions. Therefore, they are included in the No Action Alternative.

Figure 2.1-1
Flood Authority Projects Under No Action Alternative



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Filepath: \\orcas\gis\Jobs\WA_OFM_1023\NEPA\Maps\Chapter_3\AQ_NEPA-EIS_Ch3_Fig-2_UpperChehalisRiverBasin_NoActionAlternative.mxd

2.1.5 Chehalis-Centralia Airport Property Master Plan

The Chehalis-Centralia Airport has developed a master plan to expand use of the airport property. Implementation of this master plan would include new aviation facilities to provide airport-related education and new hangars, and new commercial development of undeveloped land east of the existing runway. In addition, the master plan includes new recreational facilities around Airport Lake in the northeastern portion of the airport property (WH Pacific 2018).

2.1.6 Community Flood Assistance and Resilience Program

The Office of the Chehalis Basin is developing the Community Flood Assistance and Resilience Program to protect individual properties through floodproofing and other methods to address property damage resulting from channel migration. Implementation of this program would include technical assistance and funding to local entities in the Chehalis Basin for floodproofing measures and protection of properties from channel migration.

2.1.7 Washington State Department of Transportation Programs

Under the No Action Alternative, the Washington State Department of Transportation (WSDOT) would continue to use its existing emergency detour routes when I-5 is closed due to flooding. One route uses State Route (SR) 7 and U.S. Highway 12. The other route detours trucks around I-5 through eastern Washington.

WSDOT would also continue its statewide fish passage restoration program. Under this program, WSDOT replaces culverts that do not allow fish to move upstream and downstream with culverts or bridges that allow fish to move upstream and downstream. Fish passage restoration under this program would continue at existing levels under the No Action Alternative.

2.1.8 2020 - 2023 Regional Transportation Improvement Program

The Cowlitz-Wahkiakum Council of Governments, in cooperation with Longview-Kelso-Rainier Metropolitan Planning Organization and Southwest Washington Regional Transportation Planning Organization, have developed the 2020 - 2023 Regional Transportation Improvement Program to identify transportation projects to be implemented. The No Action Alternative only includes certain projects located within the upper part of the upper Chehalis Basin. Information about these projects is provided in Table 2.1-3.

Table 2.1-3
2020 - 2023 Regional Transportation Improvement Program Projects included in the No Action Alternative

PROJECT	DESCRIPTION	AGENCY	COUNTY
SR 6/Two Tributaries to Chehalis River - Fish Passage (downstream of Mill Creek confluence)	Removal of two fish passage barriers between SR 6 MP 46.38 and 46.51	WSDOT SW Region	Lewis

PROJECT	DESCRIPTION	AGENCY	COUNTY
SR 6/Mill Creek Bridge - Replace Bridge	Replacement of a functionally obsolete bridge between MP 47.81 and 47.82	WSDOT SW Region	Lewis
SR 6/Chehalis River Bridge to I-5 – Americans with Disabilities Act (ADA) Upgrades	Upgrading the highway to meet ADA requirements between MP 27.99 and 51.33	WSDOT SW Region	Lewis
SR 6/Chehalis River Riverside Bridge - Deck Overlay	Rehabilitation of an existing bridge between MP 50.94 and 51.14	WSDOT SW Region	Lewis
I-5/Chamber Way - Interchange Improvements	Rebuilding the interchange and construct auxiliary lanes between MP 78.40 and 81.29	WSDOT SW Region	Lewis
SR 507/I-5 to Skookumchuck River Bridge Including Couplet - ADA Upgrades	Upgrading of the existing bridge to meet ADA requirements between MP 0.13 and 2.35.	WSDOT SW Region	Lewis
SR 507/Skookumchuck River Bridge - Replace Bridge	Replacement of a functionally deficient bridge between MP 2.28 and 2.48.	WSDOT SW Region	Lewis
SR 507/Skookumchuck River to Thurston County Line - ADA Upgrades	Upgrading of the highway to meet ADA requirements between MP 2.35 and 5.44.	WSDOT SW Region	Lewis
US 12/Cedar Creek Bridge - Scour Repair	Repairing damage to the bridge and prevent further erosion between MP 31.80 and 31.82.	WSDOT Olympic Region	Grays Harbor

2.1.9 Land Use and Development

Under the No Action Alternative, it is expected that growth and continued development within the upper part of the upper Chehalis Basin will continue as projected by Ecology (2016). Population in the 100-year floodplain is expected to increase by up to 1,541 in Lewis County over the next 100 years. This growth means that up to 824 residential and commercial buildings could be built in the 100-year floodplain over that period. Use of the following plans and regulations are all considered part of the No Action Alternative:

- Existing state and local floodplain regulations
- Existing land use regulations
- Planned updates to Comprehensive Plans
- Planned or ongoing updates to Shoreline Master Programs

2.1.10 Timber Harvest in Managed Forests

Under the No Action Alternative, timber harvest would continue in the managed forestlands in the upper part of the upper Chehalis Basin under current forest practice regulations and typical harvest cycles. Approximately 54% of the Chehalis Basin is managed forestland (Ecology 2017). Timber harvesting takes place primarily in the upper portions of the basin, upstream of the Adna gage (USGS 12021800).

The Washington Department of Natural Resources Forest Practices Habitat Conservation Plan would continue to be implemented within the Chehalis Basin. The plan applies to forest practice activities such as timber harvesting and forest road construction. The plan also applies to maintenance that can affect aquatic and riparian habitat on private and state forestlands.

2.1.11 Restoration and Stream Modifications

The No Action Alternative also includes habitat restoration actions that are underway or planned to occur within the NEPA EIS analysis period (2025 to 2080). The following activities are included in the No Action Alternative:

- Aquatic Species Restoration Plan projects within the upper part of the upper Chehalis Basin, including the following three projects currently being designed:
  - **South Fork Newaukum River.** Restore riparian habitat between RM 11 and RM 13 by installing large wood along the channel and floodplain, removing riprap from the banks, reconnecting the floodplain, and creating off-channel habitat.
  - **Stillman Creek (in the South Fork Chehalis sub-basin)**. Restore riparian habitat near the mouth of the creek by installing large wood along the channel and floodplain, removing riprap from the banks, reconnecting the floodplain, and creating off-channel habitat.
  - **Skookumchuck River.** Restore riparian and adjacent habitat between RM 19 and RM 22 by removing invasive species, installing engineered log jams, creating off-channel habitat, removing riprap from the banks, and planting native riparian forest and oak prairie species.
- U.S. Fish and Wildlife Service's (USFWS's) Chehalis Fisheries Restoration Program
  - Projects involving habitat restoration, environmental assessment, education, and outreach
  - Projects correcting fish passage barriers, removing invasive species and replanting native species, enhancing or restoring riparian and off-channel fish rearing habitat, restoring agricultural wetlands for fish use, and monitoring fish use of these habitats
- Washington State Recreation and Conservation Office's Salmon Recovery Funding Board projects
  - Installation of fish screens on 15 irrigation diversions throughout the Chehalis Basin
  - Removal of six fish barriers
  - Land acquisitions to protect stream habitats

2.2 Alternative 1: (Proposed Project) Flood Retention Expandable (FRE) and Airport Levee Improvements

Alternative 1 is the Applicant's proposed project. Alternative 1 includes the FRE facility and Airport Levee Improvements. The following sections describe the proposed components of the alternative and how they would be constructed and operated.

2.2.1 Proposed Components

2.2.1.1 Flood Retention Expandable Facility Components

The proposed FRE facility would store floodwater only during predicted major or larger floods. Major or larger Chehalis River floods are defined in Chapter 3, Table 3.6-1 of the EIS. At all other times, the river would flow through openings in the facility.

The FRE facility would be built so its foundation could support a larger structure if the Applicant decided to increase the storage capacity in the future. This future expansion could increase temporary reservoir storage from 65,000 acre-feet to 130,000 acre-feet, but is not proposed at this time. If expansion of the facility were ever proposed, the expansion would need to go through a new, separate environmental review and permitting process.

The following sections describe the components of the proposed FRE facility.

2.2.1.1.1 FRE Facility

A drawing of the proposed FRE facility is shown in Figure 2.2-1. The facility would include a vertical concrete structure, an overflow spillway, a flip bucket, five gated outlets, a stilling basin, a fish passage facility, and a diversion tunnel to be used during construction.

The vertical concrete structure would be made of roller-compacted concrete (RCC). RCC is a type of concrete that is drier than conventional concrete, allowing it to be compacted by vibratory rollers. It would be designed so the weight of the structure would be enough to hold the temporary reservoir water back. The top of the FRE facility would be 1,550 feet wide and approximately 270 feet high, including 3 to 5 feet of extra space, or freeboard, for safety.

The FRE facility would also include a 200-foot-wide overflow spillway. The spillway would let water spill out of the temporary reservoir if it fills beyond its capacity. This would only happen during extreme flooding and would not last very long. Water would flow through the spillway to a concrete-lined chute to a flip bucket. The flip bucket would launch water flowing through the emergency spillway to a safe distance downstream of the FRE facility. This would slow the flow of the water in the river channel.

Figure 2.2-2 shows a side view of how water would normally flow through the FRE facility. The FRE facility would have five gated outlets, which are tunnels at the base of the vertical concrete structure. The gated outlets would be made of concrete and would allow water to flow through the facility during non-flood conditions. One gated outlet would be 12 feet wide by 20 feet high. The other four would be 10 feet wide by 16 feet high. The gated outlets would be 310 feet long. The gated outlets would typically be open, allowing for a bed of natural substrate to form on the bottom of the tunnel. However, they could be partially closed for an anticipated major or greater flood using radial control gates (Figure 2.2-2). Radial control gates are used to block flow or allow water through outlets by rotating on a hinge. Most sediment and small debris would pass through the gated outlets when they are open.

The gated outlets would discharge to a 230-foot-long stilling basin. A stilling basin is a concrete structure designed to slow down the flow and minimize downstream channel erosion. The stilling basin would discharge to the natural river channel downstream of the FRE facility (Figure 2.2-3). The FRE facility would also include fish passage facilities, as discussed in Section 2.2.1.1.3.

2.2.1.1.2 Temporary Reservoir

During major or greater floods, the gated outlets would close partially, and water would begin to create a temporary reservoir behind the FRE facility. Some water would continue to flow through the gated outlets to provide water to the river downstream of the FRE facility. Operation, including how often the temporary reservoir would be expected to be filled with water, is described in Section 2.2.3.1. The FRE facility would be designed to store up to 65,000 acre-feet of water in the temporary reservoir. The maximum extent of the reservoir is shown in Figure 1.2-1 of the EIS.

Figure 2.2-1
Proposed Flood Retention Expandable Facility

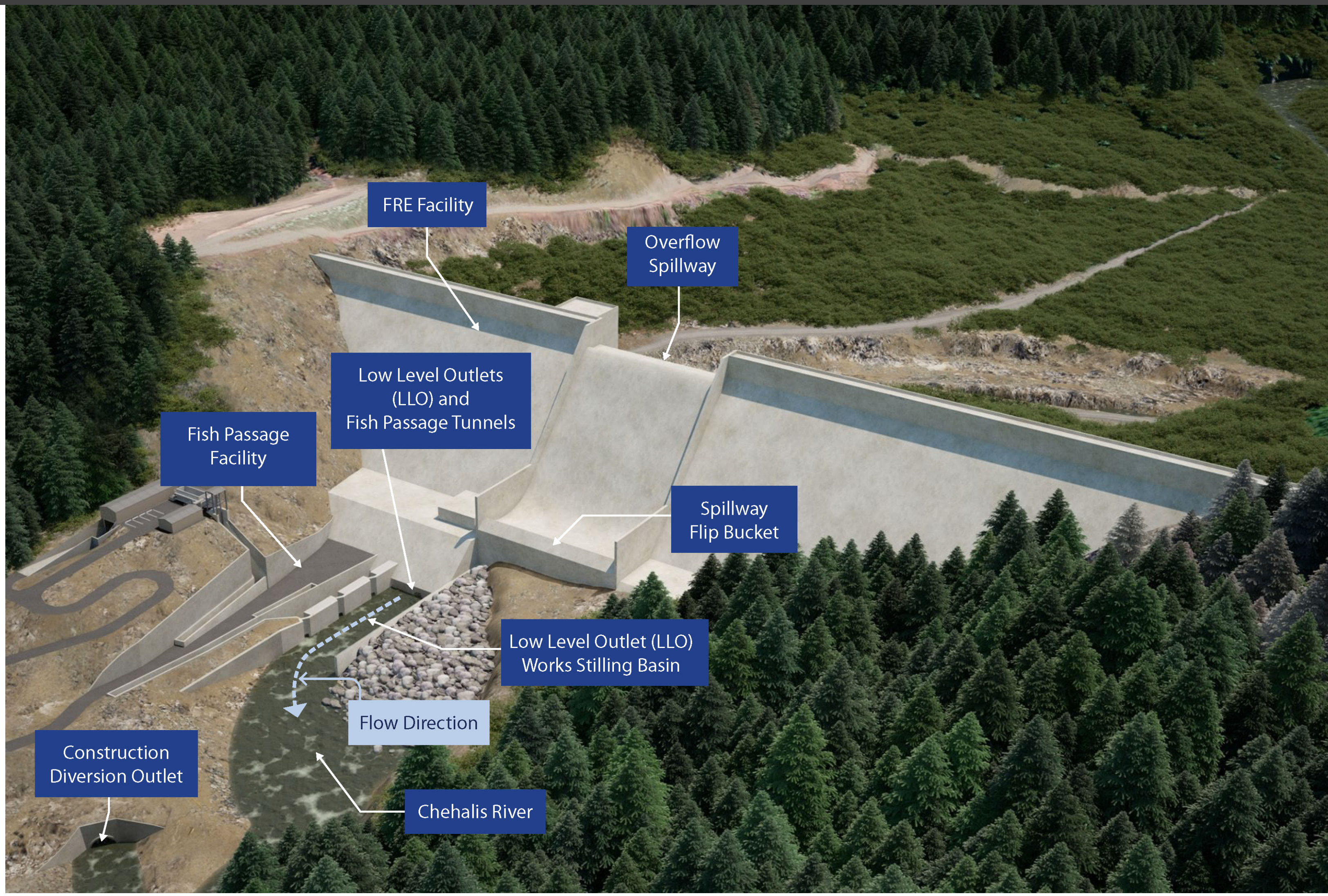


Figure 2.2-2
Facility Section Showing Flow

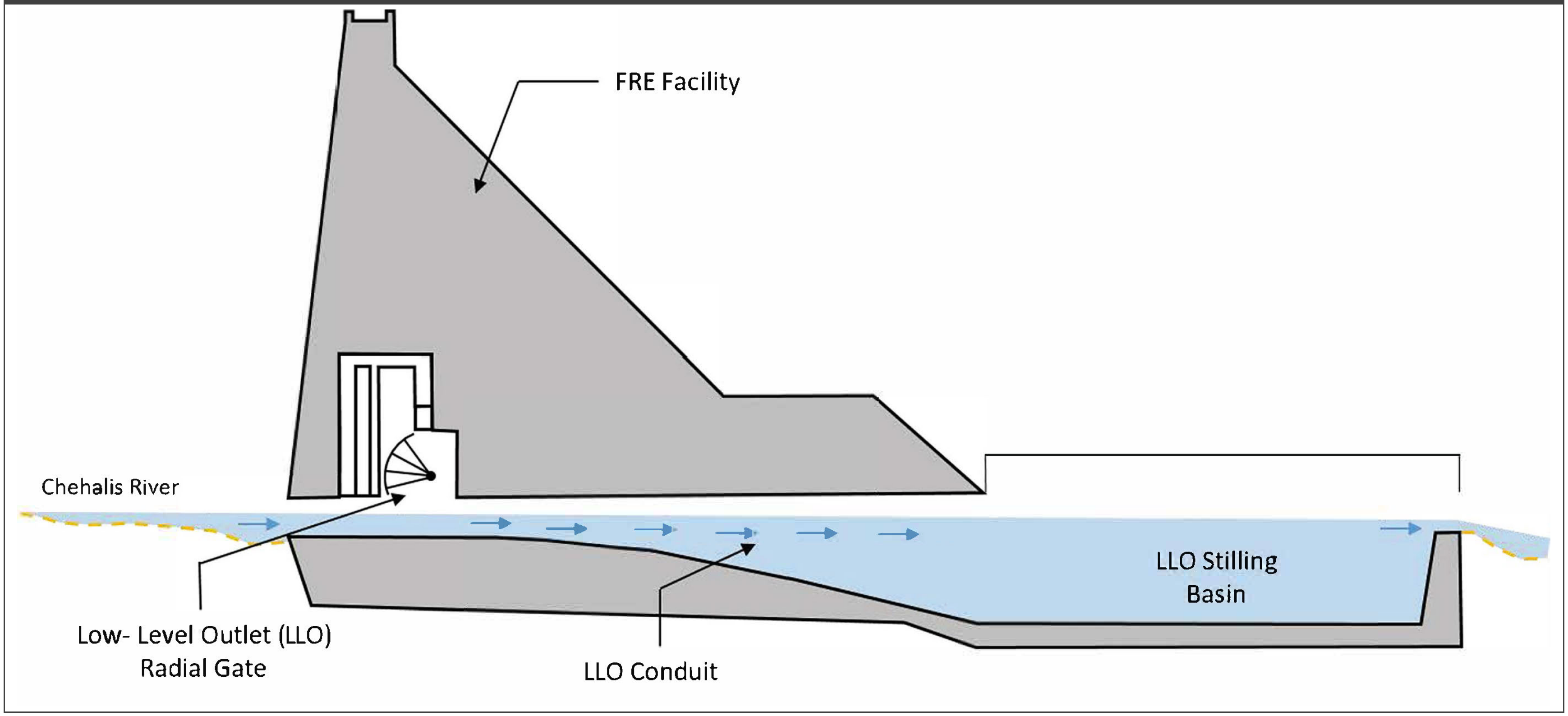
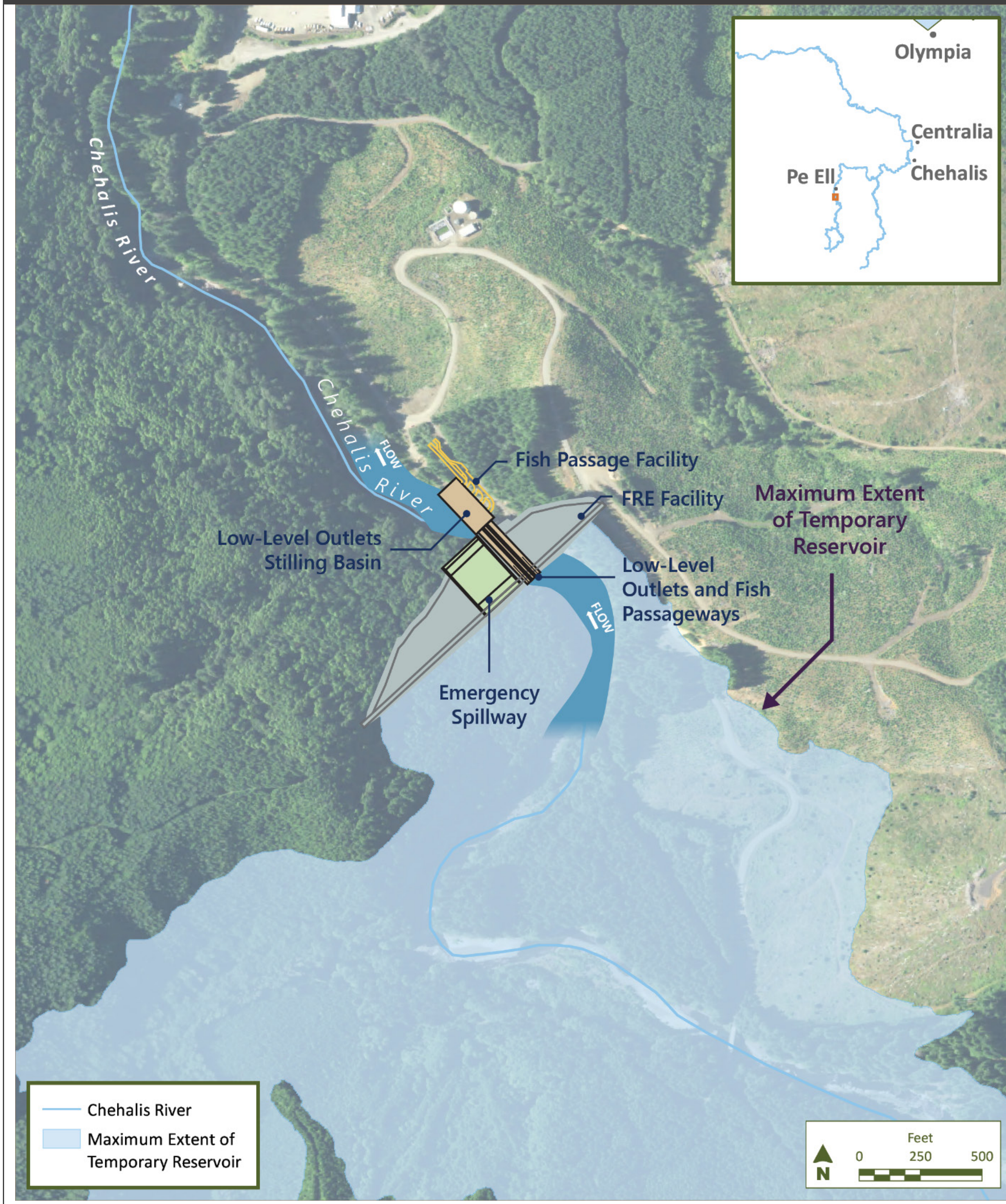


Figure 2.2-3
FRE Facility Plan View

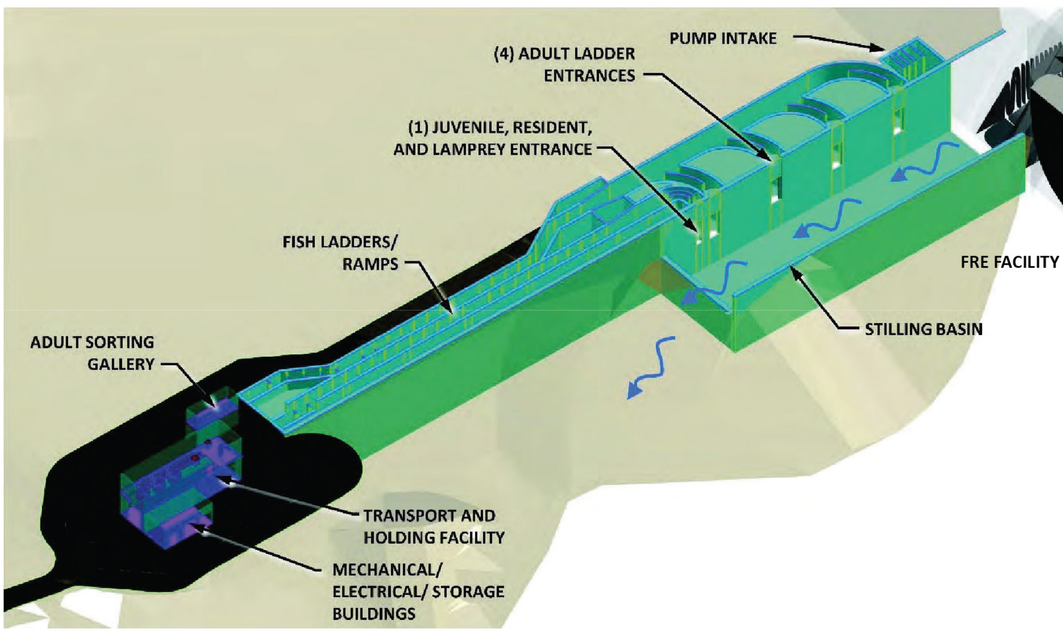


2.2.1.1.3 Fish Passage Facility

When the gated outlets are open, fish would move upstream and downstream through the FRE facility. The gated outlets would be designed to replicate the natural stream flow and speed during non-flood flow conditions.

When the gated outlets close partially, upstream fish passage would be provided by a Collection, Handling, Transport, and Release (CHTR), or trap and haul, facility. The CHTR facility would be located on the east side of the river immediately downstream of the FRE facility. A diagram of the CHTR facility is shown in Figure 2.2-4.

Figure 2.2-4
Diagram of the Collection, Handling, Transport, and Release Facility



The CHTR would be designed to collect migrating adult salmon and steelhead, juvenile salmon and steelhead, resident fish, and lamprey moving upstream, for transport upstream of the FRE facility. The CHTR would not provide downstream fish passage. The CHTR would consist of fish ladders, a lamprey ramp, trap and holding facilities, a fish sorting building, fish transport tanks and trucks, and associated support structures. An attraction water supply would draw fish into the facility. Operation of the CHTR during floods is described in Section 2.2.3.1.4.

2.2.1.1.4 Access Roads

When the FRE facility is operating and the temporary reservoir is holding water, up to 6 miles of the existing Forest Road (FR) 1000 would be flooded upstream of the FRE facility. This is a main access road currently used for forestry operations. When flooded, a bypass route would be used to provide access to the temporary reservoir area and to managed forestlands in areas outside of the temporary reservoir. The bypass route would consist of existing forest roads located outside of the area that would be underwater when the temporary reservoir would be in use. Specific locations of and improvements to the bypass route for FR 1000 would be defined during the detailed design and permitting phase. For purposes of the NEPA EIS analysis, improvements to the existing roads that make up the bypass route would include adding gravel to the surface and compacting it. Areas of the existing roads that may have eroded may need additional gravel to widen the roads to their previous widths.

2.2.1.1.5 Utilities

A new power line would be installed to operate the FRE facility's pumps, gates, instruments, and other controls. New power lines would also be installed for the fish passage facility. The new power lines would connect to existing local transmission lines and would be located along existing road alignments and areas cleared for FRE facility construction. Construction power requirements may also be provided by the new power lines. Aboveground and belowground power lines are being considered by the Applicant. For purposes of the NEPA EIS analysis, the new power lines are assumed to be below ground.

2.2.1.2 Airport Levee Component

The Airport Levee Improvements would include completing the following construction at the Chehalis-Centralia Airport (Figure 1.2-2 of the EIS):

- Modify the airport levee by:
  - Adding 4 to 7 feet to the height of the existing 9,511-foot-long levee with earthen materials or floodwalls
  - Raising 810 feet of NW Louisiana Avenue along the southern extent of the airport to a height equal to the raised levee height to protect against flooding
  - Widening portions of the existing levee base
- Replace utility infrastructure

2.2.2 Construction

This section describes the activities that would take place to construct the FRE facility and Airport Levee Improvements. It was assumed that FRE facility construction would take up to 5 years and that the Airport Levee Improvements would take 1 year and occur during the same 5-year period.

2.2.2.1 Flood Retention Expandable Facility

If the Applicant receives al necessary approvals for the proposed project, construction of the FRE facility is expected to begin in 2025. Although the Applicant has proposed a 4.5-year construction period, the NEPA EIS analysis assumes construction could last up to 5 years through 2030.

2.2.2.1.1 Quarry Development and Concrete Production

Construction of the FRE facility would require concrete aggregate. Concrete aggregate consists of small earthen materials such as sand, gravel, or crushed stone that are mixed with concrete to add strength. Concrete aggregate could be mined within the FRE facility site or at a quarry site located nearby, depending on aggregate availability. Blasting would be used to break up rock in the quarries. Blasting would occur up to four times per week for up to 3 years. The proposed quarry sites include the North Quarry, South Quarry, and Huckleberry Ridge (Figure 2.2-5). One or more quarries would be selected for mining to support the proposed project.

Quarry development would include identifying material storage and processing sites, constructing areas for offices and storing equipment, and constructing or upgrading roads to the quarry. Because a large quantity of aggregate would be needed for constructing the FRE facility, the roads would need to accommodate large, off-highway, earthmoving equipment. Improvements to the roadways may include removing the existing base materials, placing new base materials, resurfacing the roads, widening the roads, and improving drainage. These road improvements would occur in select areas and depend on which quarries would be needed for construction. New and improved access roads would remain in place following construction. Access roads are shown in Figure 2.2-5. Access road improvements, as shown in Figure 2.2-5, and defined as follows:

- Mainline Type Road Improvement: Widen the existing 18- to 22-foot-wide road to 24 feet wide if reasonable.
- Simple/Minor Road Improvement: Widen the existing 18- to 20-foot-wide road to 24 feet wide as needed.
- Moderate Road Improvement: Widen the existing 14- to 18-foot-wide road to 24 feet wide as needed.
- Complex Road Improvement: Widen the existing 12- to 14-foot-wide road to 24 feet wide if possible.

It was assumed that approximately 937,000 cubic yards of aggregate would be required to construct the FRE facility. This is assumed to require 40,000 to 55,000 truck round trips between the quarries and the construction site.

A concrete production facility would also be located near the FRE facility. The production facility would be used to store and produce the materials needed to construct the FRE facility. This would provide a place to crush and screen aggregate, make concrete, and store materials such as aggregate, fly ash, and cement (Figure 2.2-6).

2.2.2.1.2 FRE Facility

The NEPA EIS analysis assumed that work in the flowing channel of the river would happen from July through September of each year. Once the work area is isolated from the river, work below the ordinary high water mark would occur in the dry year-round during the construction period.

To construct the FRE facility in the dry river channel, the water must first be diverted around the construction site. The Applicant is proposing to construct a 1,630-foot-long diversion tunnel that would be about 20 feet in diameter to temporarily redirect river flows (Figure 2.2-6). The diversion tunnel would be designed to pass up to approximately 7,000 cubic feet per second (cfs), which corresponds approximately to a 2.8-year flood (i.e., a flood that would occur on average every 2.8 years). If flows above 7,000 cfs are predicted, equipment and debris would be moved, and the work area would be allowed to flood. Once these flows pass, the work area would be dewatered, fish would be removed and placed back in the river downstream, and work would resume.

A temporary trap-and-transport facility for upstream fish passage would be installed before the diversion tunnel, at a downstream location assumed to be approximately 200 feet downstream of the diversion tunnel outlet. The temporary trap-and-transport facility would include a fish passage barrier extending into the river from the west riverbank and a fish ladder and fish trap along the west riverbank. It was assumed the temporary trap-and-transport facility and fish barrier would be constructed in a dry area of the river behind a cofferdam. Cofferdams are enclosures built in waterbodies that can create a dry work area between the cofferdams when the water is pumped out of the area. Use of the temporary trap-and-transport facility during construction is described in Section 2.2.2.1.3.

Construction of the diversion tunnel would begin with the isolation and installation of upstream and downstream diversion tunnel portals. Temporary upstream and downstream berms across the river channel would then be constructed. A temporary upstream cofferdam would be constructed behind the temporary berm and a smaller downstream cofferdam would be constructed to protect the construction area on the downstream side (Figure 2.2-6). Precipitation and small amounts of seepage water that may collect inside the cofferdam would be pumped to appropriate containment for treatment before being returned to the river. The diversion tunnel would be constructed by drilling and controlled blasting. Blasting to construct the diversion tunnel would occur outside of the river up to twice a day for approximately 9 months. When the diversion tunnel is complete, the area between the upstream and downstream cofferdams would be slowly dewatered to allow safe removal of fish from the area. It was assumed that the diversion tunnel could be used for up to 5 years. After this time, it could be left in place once construction is complete.

Figure 2.2-5
Potential Quarry Sites and Road Improvement Types

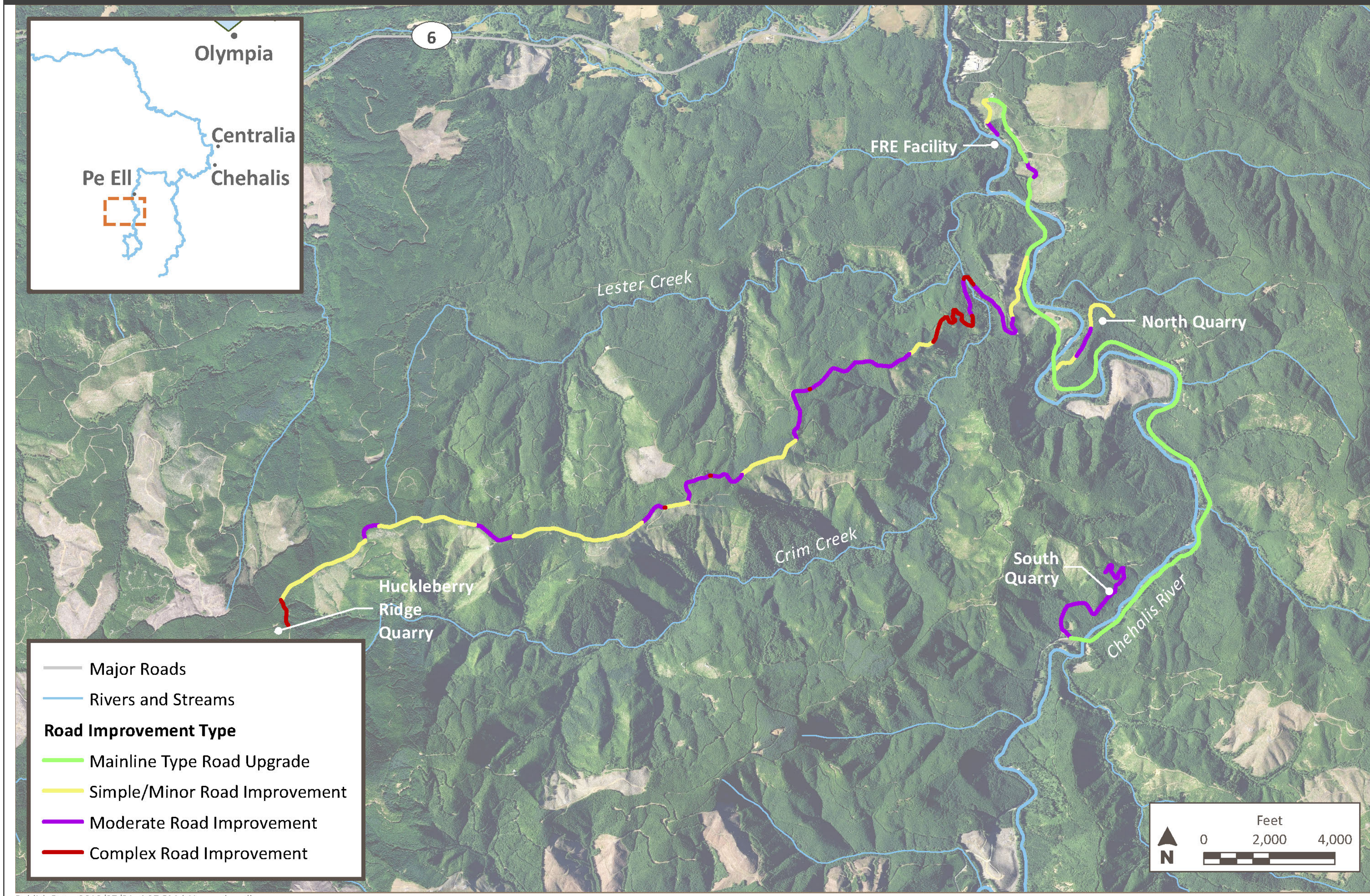


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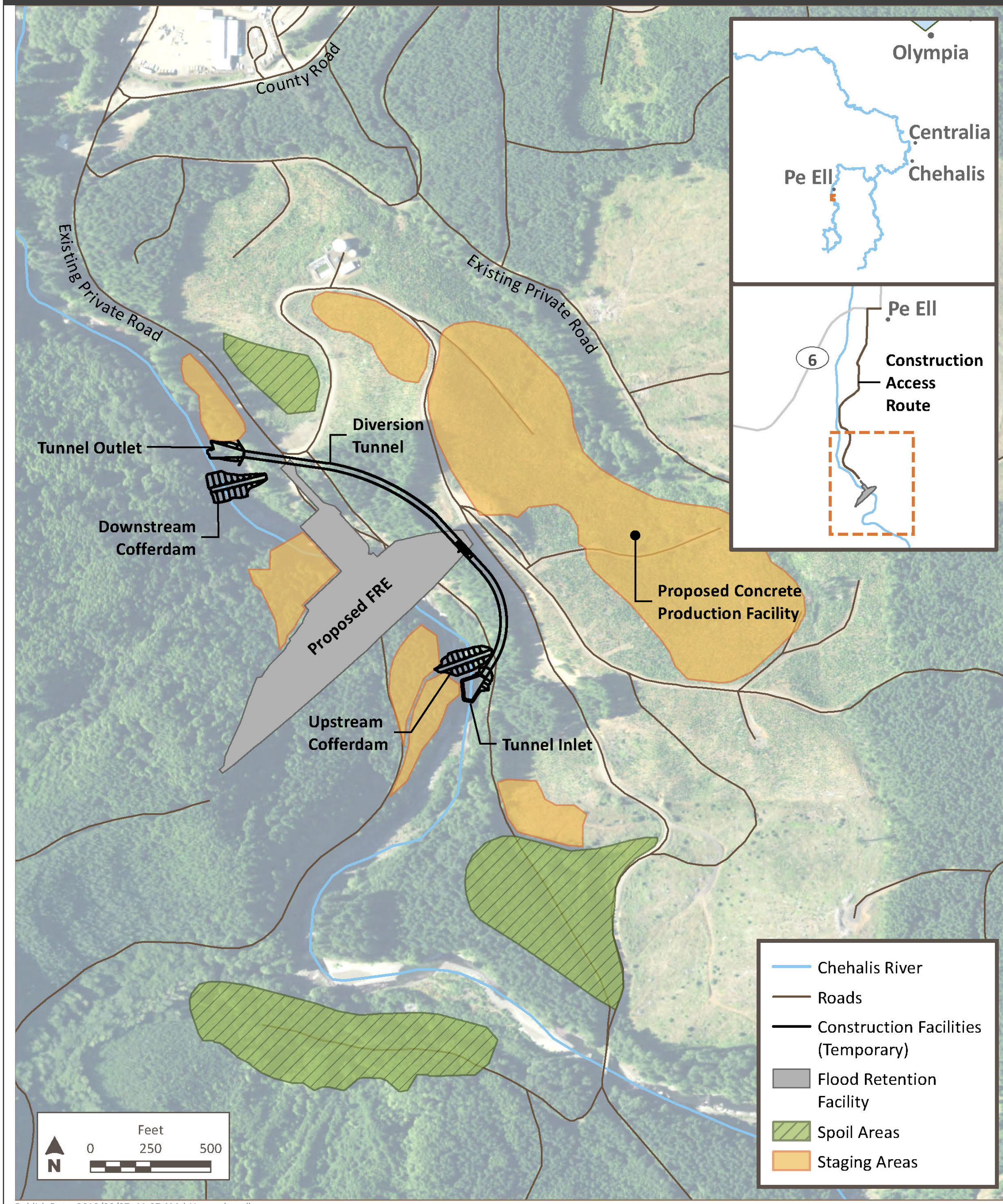
Figure 2.2-6
Proposed Flood Retention Expandable Facility Construction Site Plan



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Once the diversion is in place, the FRE facility foundation would be constructed. Excavation in the riverbed would be required to get to an appropriate depth for the foundation. The foundation depth would range from 20 to over 50 feet below the existing elevation of the riverbed. Specialized construction equipment would be used to dig into rock in the riverbed. Areas of rock would also be removed using controlled blasting. Blasting would occur up to four times per week for approximately 12 months. Once the excavation is complete, the surface would be cleaned and treated with concrete or grout to create a surface to build the vertical concrete structure. A leakage barrier called a grout curtain would then be constructed on the foundation. A grout curtain is typically constructed by drilling vertical holes in the foundation and filling the holes with pressurized grout.

The vertical concrete structure would be constructed of RCC. RCC dam construction typically begins with pouring concrete in sequential layers. After each concrete layer is placed, it would be compacted and allowed to cure before the next layer is placed. Grout would be used to seal the base layers of the RCC to the prepared foundation to make a leak-proof connection. The gated outlets and stilling basin would be constructed as the RCC is placed. When the FRE facility is constructed to its design elevation, excavated areas around the footprint would be backfilled to the preexisting ground level.

Staging areas would be used for material storage, laydown areas, concrete production facilities, and vehicle and equipment parking. Spoil stockpile areas would be designated to store soil and rock excavated for the FRE facility foundation. Proposed staging and spoil areas are shown in Figure 2.2-6.

Water for construction would be drawn from the Chehalis River, most likely upstream of the upstream cofferdam. It was assumed between 75 and 150 million gallons would be needed. Most of the water needed (about 80% of the total use) would be drawn during a 10- to 20-month period. A more detailed plan for where and how much water would be drawn would be developed as the design for the FRE facility progresses.

Upon completion of the FRE facility and permanent fish passage facilities (discussed in Section 2.2.1.1.3), the cofferdams would be removed, and river flows would be returned to the channel. Berms would be constructed to isolate the upstream and downstream diversion tunnel portals so they could be plugged.

Access to the construction site is assumed to be via Muller Road and FR 1000. Trips to and from the construction site would include personnel, all permanent materials and consumable materials, and construction equipment. Approximately 40,000 to 60,000 truck round trips are expected between the construction site and various off-site locations.

2.2.2.1.3 *Temporary Fish Passage*

During construction, downstream fish passage would be provided by the diversion tunnel described above. The Applicant intends to construct the diversion tunnel according to the guidance provided in the National Marine Fisheries Service's (NMFS's) *Anadromous Salmonid Passage Facility Design*

(NMFS 2011) and the Washington Department of Fish and Wildlife's (WDFW's) *Water Crossing Design Guidelines* (Barnard et al. 2013) to meet NMFS and WDFW fish passage criteria.

Upstream fish passage would be provided by the temporary trap-and-transport facility. This facility would include a fish passage barrier downstream of the diversion tunnel outlet to direct the fish passing upstream into the fish trap. The fish trap would be designed to collect adult spring-run Chinook salmon, fall-run Chinook salmon, coho salmon, winter-run steelhead, and coastal cutthroat trout. Resident fish and lamprey would also would also be collected incidental to the collection of the targeted adult salmonid species. Once in the trap, fish would be transferred to holding tanks specially designed for their transportation. Personnel would drive the holding tanks upstream to predetermined release sites selected by fisheries biologists. The fish would then be released back into the river.

2.2.2.1.4 Pre-Construction Vegetation Management Plan

Prior to construction, the Applicant would remove vegetation from the FRE facility site. It is also assumed that the Applicant would remove select trees and other vegetation within the temporary reservoir area prior to operations beginning in 2030. Within the temporary reservoir footprint, it was assumed the Applicant would remove all trees from the areas that have a 5% chance of being flooded in a year (20-year flood). Trees in the area of the temporary reservoir that have a 1% chance of being flooded in a year (100-year flood) would be left in place. In total, it was assumed that approximately 485 acres of vegetation would be removed.

2.2.2.2 Airport Levee Improvements

The Applicant proposed to construct the Airport Levee Improvements over 10 to 12 months. Construction would likely take place in the following general sequence:

- Mobilization, 1 month
- Erosion control, clearing, and grubbing, 1 month
- Removal of structures or obstructions, 1 month
- Material placement and compaction, 6 to 8 months
- Trimming, cleanup, and sod placement, 1 month

Earthwork would include removing existing retaining walls, removing the gravel surface currently on top of the levee, and excavating to place hydraulic structures such as culverts. No new quarries or borrow pits would be developed. Only existing sources would be evaluated for acceptable fill material, which would be brought in from off site. Typically, soil would only be displaced in areas to create safe slopes or in areas of culvert placement.

Approximately 5,725 truck round trips are assumed to be needed between off-site locations and the airport levee during construction. Trucks would use NW Airport Road to haul materials to and from the site, and the top of the levee would be used for site access. NW Louisiana Avenue to the south is the preferred off-site route to avoid the congested traffic area east of the airport.

2.2.3 Operation

This section describes operational details for the FRE facility and Airport Levee Improvements. The operational phase is assumed to begin in 2030. The analysis extends through 2080.

2.2.3.1 Flood Retention Expandable Facility

This section addresses operational details for how and when the FRE facility would operate, how often and by how much the temporary reservoir would fill, and how it would be drawn down. This section also describes vegetation and debris management procedures during flood and non-flood conditions.

2.2.3.1.1 Threshold for Operation

The FRE facility would begin to hold back floodwaters when flood forecasts predict a major or greater flood. This means the FRE facility would start holding water during floods that are predicted to have a flow rate exceeding 38,800 cfs at the Grand Mound gage (USGS 12027500). This would occur approximately once every 7 years. Water retention would begin approximately 48 hours before the predicted flow rate at this location reached 38,800 cfs.

The Grand Mound gage is approximately 48 miles downstream from the FRE facility site. Therefore, the operators of the FRE facility would rely on flood predictions up to 4 days in advance. The source of the forecast for major flooding would be the Northwest River Forecast Center, operated by the National Oceanic and Atmospheric Administration (NOAA). The Northwest River Forecast Center uses the NWS Community Hydrologic Prediction System to model soil, snow, and stream channel and temporary reservoir conditions. Daily forecasts are made using observations of temperature and precipitation. Forecasts of meteorological parameters are included in the river forecast model, which includes predicted flow rates (NOAA 2019).

2.2.3.1.2 Operations Prior to and During Floods

Two days before major flooding is predicted to occur, outflow through the FRE facility would be reduced by a maximum rate of 200 cfs every hour. Flow retention would begin by partially closing the radial control gates. This maximum rate of change in outflow was selected for this period to minimize the potential for fish stranding downstream of the temporary reservoir (WSE 2014). The rate of change would be adjustable and would be adaptively managed based on observed flows and revised predictions during operations.

FRE facility outflows would decrease by 200 cfs per hour until reaching a flow of 300 cfs, the minimum outflow during flood operations. A 300-cfs flow is a naturally occurring winter low flow on the Chehalis River. The 300-cfs outflow would increase downstream of the FRE facility, where tributary streams provide additional flow to the Chehalis River. The 300-cfs outflow would continue until the peak of the flood passes the Grand Mound gage, which typically takes 48 to 72 hours. At this time, water would flow through the open gated outlets according to the drawdown procedures described in Section 2.2.3.1.5.

2.2.3.1.3 Temporary Reservoir Conditions

The temporary reservoir would be designed to hold water associated with up to a 100-year, or catastrophic flood. The chance a catastrophic flood could occur in any year is 1%. However, depending on the size of the flood, the FRE facility could be activated but the temporary reservoir may not fill to its maximum capacity. Figure 2.2-7 shows the extent of the temporary reservoir for both major (7-year)[1] and catastrophic (100-year) flood conditions. Table 2.2-1 lists additional temporary reservoir conditions for the different floods.

Table 2.2-1
FRE Facility Temporary Reservoir Conditions

ELEMENT	MAJOR FLOOD CONDITIONS	CATASTROPHIC FLOOD RESERVOIR CONDITIONS
Flood probability	Once in 7 years	Once in 100 years
Duration of the temporary reservoir	27 days	32 days
Maximum length of the temporary reservoir	5.6 miles	6.1 miles
Maximum elevation of the temporary reservoir[1]	568 feet	604 feet
Maximum storage of the temporary reservoir	25,580 acre-feet	48,150 acre-feet
Maximum depth of the temporary reservoir	143 feet	179 feet

Note:
1. Elevation of the riverbed at the proposed FRE facility site is 420 feet. The estimated water surface elevation at that location is 425 feet.

2.2.3.1.4 Fish Passage During Operations

Operation of the CHTR facility, which would provide upstream fish passage, would begin immediately prior to the closure of the radial gates on the gated outlets. The CHTR would continue to operate during the impoundment of water behind the FRE facility until the last remaining water in the temporary reservoir is released. Fish would be released into the river at pre-selected release sites determined by fisheries biologists.

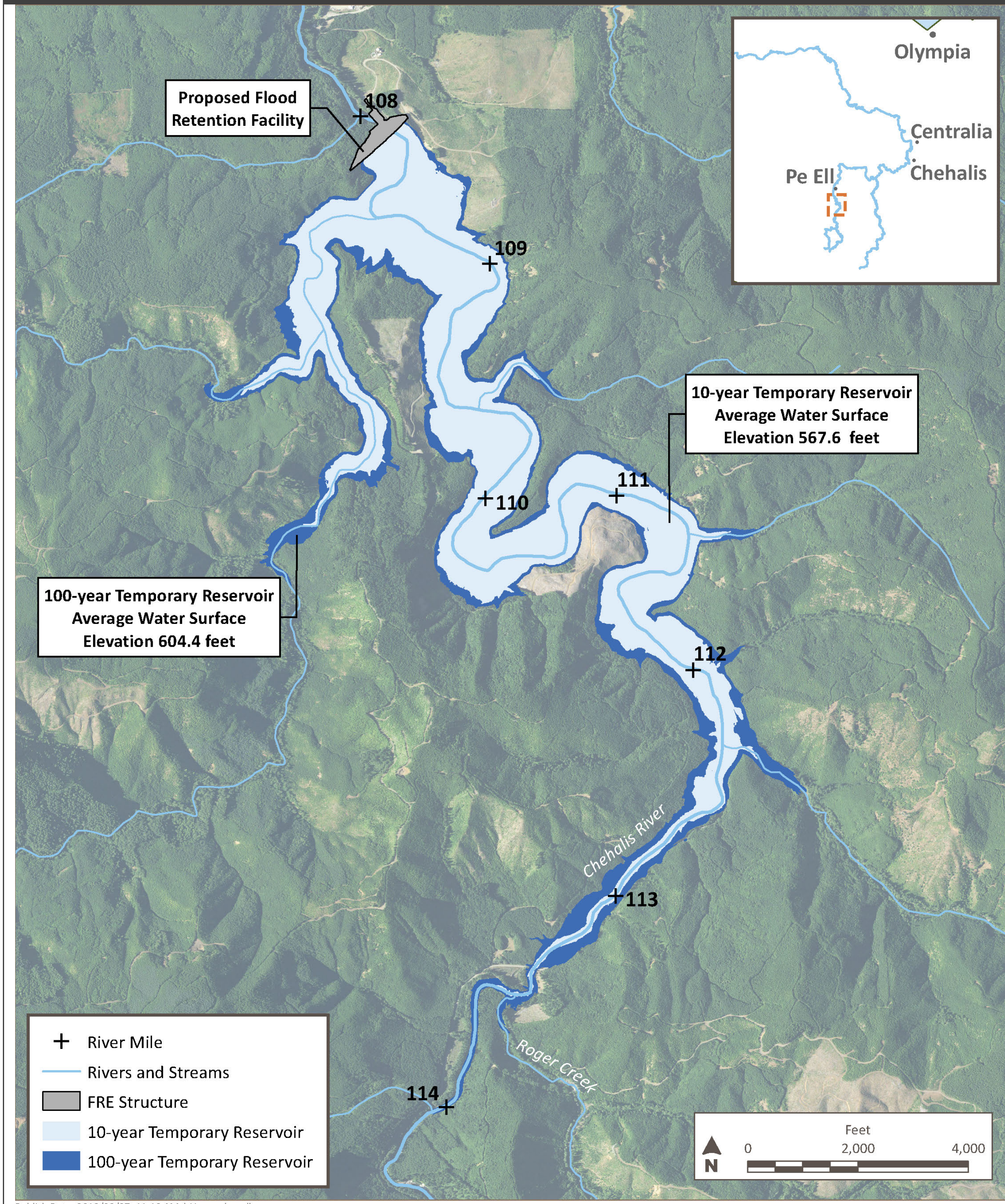
Downstream fish passage would not be provided during the impoundment of water behind the FRE facility. Fish would be able to pass downstream of the FRE facility as the temporary reservoir empties.

2.2.3.1.5 Initial Drawdown After Floods

Once the flood was over, the temporary reservoir would begin to drain, a process called drawdown. To drain the temporary reservoir, the temporary reservoir gated outlets would open and increase outflow by 1,000 cfs every hour to a maximum outflow of 5,000 to 6,500 cfs. The Applicant proposes to slowly release water through the gated outlets to reduce the risk of erosion downstream and within the temporary reservoir.

[1] Although a "major" flood is defined as the 7-year recurrence interval elsewhere in this EIS, modeling of major floods is based on a 10-year flood occurrence interval. The difference between 7-year flows and 10-year flows is relatively small.

Figure 2.2-7
Extent of the Temporary Reservoir for Major and Catastrophic Floods



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2.2.3.1.6 Debris Management

When the temporary reservoir is holding water, debris from surrounding tributaries and hillsides may enter it. Large woody material (LWM) could affect the FRE facility by blocking the gated outlets and preventing efficient drawdown.

Upstream of the FRE facility, an anchored log boom would capture LWM floating on the surface of the temporary reservoir. At the FRE facility, steel bar racks would protect the gated outlets from LWM that could not pass through the gated outlets downstream. During drawdown, boats would be used to move large debris to an existing log sorting yard. Debris would remain floating on the water surface as the reservoir holds water. The log sorting yard would be located on the west bank of the Chehalis River between RM 109.6 and RM 109.9 (Figure 2.2-8).

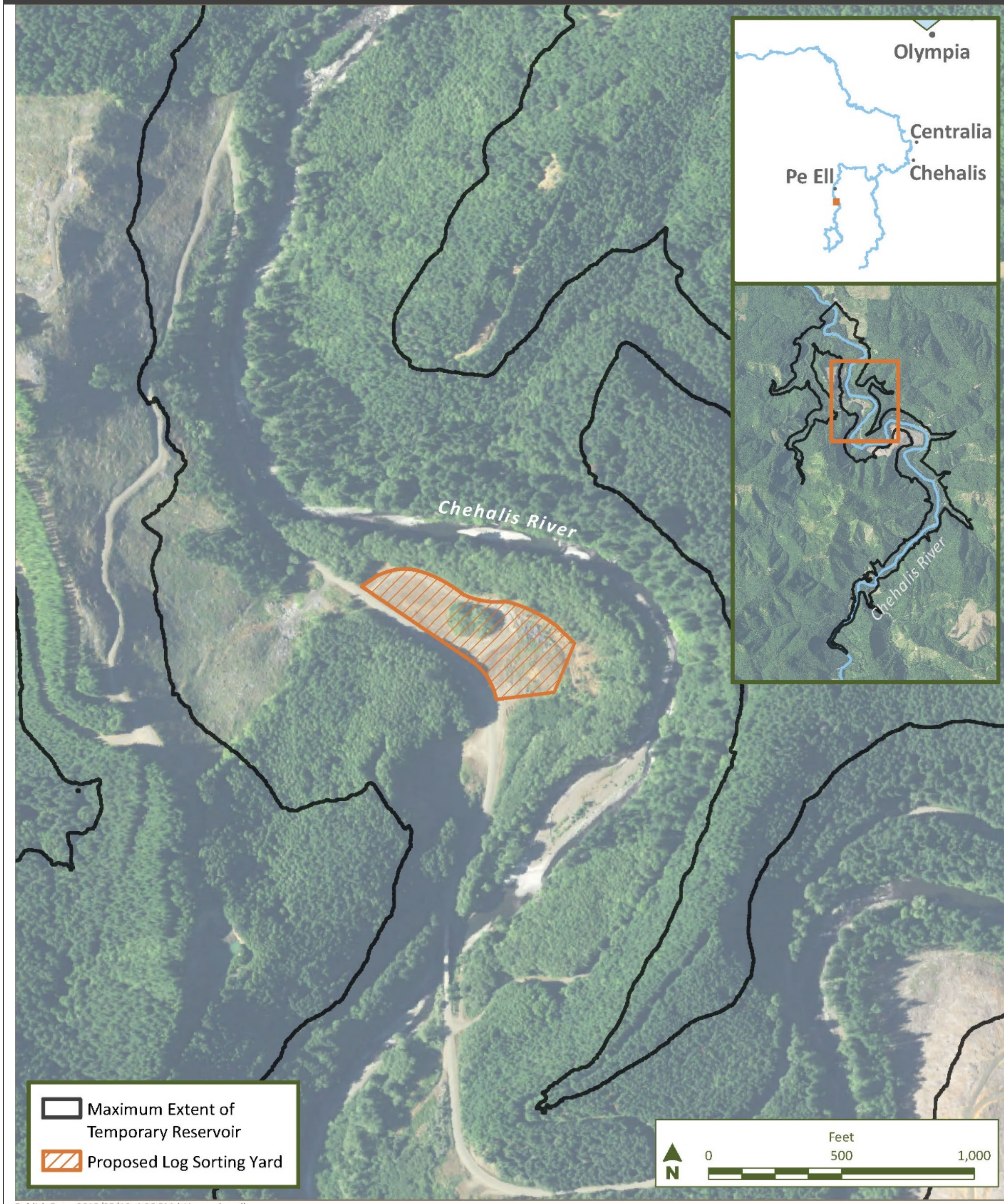
To give boats time to move logs to the sorting yard location, drawdown rates would be slowed to 2 feet per day (1 inch per hour) for a 2-week period. The decrease in drawdown rate would occur when the temporary reservoir elevation reaches approximately 528 feet. After the debris was moved onto the sorting yard, drawdown would continue at the previous rates. As water levels fell, the sorting yard would no longer be flooded, and the debris would settle on the ground of the sorting yard.

Wood that is suitable for habitat projects in the Chehalis Basin would be sorted and trucked out of the temporary reservoir area. The remainder of the debris would be hauled off site and disposed of at an approved facility. The removal of the wood debris would occur after the temporary reservoir is drained and once the ground dries out enough to allow heavy equipment onto the sorting yard. The operation of the temporary reservoir to manage debris accumulations may be altered based on observations during operation.

2.2.3.1.7 Continued Drawdown After Debris Management

When all necessary debris had been removed, and temporary reservoir elevation reaches 500 feet, drawdown rates would increase to 10 feet per day (5 inches per hour). Drawdown would continue at this rate until the temporary reservoir is emptied (elevation of 425 feet). At this point, the Chehalis River would return to a free-flowing state.

Figure 2.2-8
Proposed Log Sorting Yard Location



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2.2.3.1.8 Operation Outside of Flood Storage Periods

Outside of the flood storage period, the Chehalis River would flow through the FRE facility via the open gates in the gated outlets. The gated outlets are designed to simulate the natural flow conditions in the surrounding river channel to the extent possible. The gated outlets would be expected to freely pass flows up to approximately 8,000 cfs, which occur every 3 years on average.

For flows between 8,000 cfs and 12,500 cfs, the flow would transition from a free-flowing condition to a ponding condition upstream of the entrance to the gated outlets. Water would pond upstream of the gated outlets because they can only pass up to 8,000 cfs. For flows greater than 12,500 cfs, water ponding on the upstream side of the gated outlets would increase. This ponded water would hold some water back that could otherwise contribute to high flows in downstream areas.

2.2.3.1.9 Vegetation Management During Operation of the FRE Facility

Routine maintenance in the temporary reservoir footprint would involve periodic tree removal in the 20-year flood zone (below elevation 584 feet), or the area that has a 5% chance of flooding in a year. This corresponds to the average pool elevation during a 20-year flood. Periodic removal would occur about every 7 to 10 years during operations and maintenance of the FRE facility. Trees larger than 6 inches in diameter at breast height would be removed within the 20-year flood zone. This would include any trees that grew back after tree removal under the pre-construction vegetation management plan (Section 2.2.2.1.4). Trees would be felled and either left to decay or salvaged for other uses, including engineered log jams, restoration projects, and wood fuel.

Adaptive management activities would focus primarily on maximizing the amount of shading on aquatic resources, reducing potential LWM accumulation at the gated outlets, and vegetating areas to provide slope stability. In addition, the adaptive management program would focus on maintenance of flood-tolerant vegetation that does not produce LWM or experience large-scale die-off in response to extended submergence during the flood season or growing season. Plant composition would also be monitored over time to determine which native species persist in this changing environment and to encourage the growth of these species.

2.2.3.2 Airport Levee Improvements

Regular maintenance of the levee would include mowing and vegetation management.

Ongoing levee inspections would occur to evaluate overall condition, identify deficiencies, and recommend maintenance needs. Two different types of levee inspections would be conducted: routine inspection and periodic inspections. Routine inspections consist of a visual assessment to verify and rate levee system operation and maintenance. Periodic inspections involve a review of existing data, a field inspection, and development of a report led by a professional engineer. Routine inspections typically occur every year, and periodic inspections occur every 5 years. Maintenance needs would be determined through the inspection process.

2.3 Alternative 2: Flood Retention Only (FRO) and Airport Levee Improvements

The FRO facility and Airport Levee Improvement locations under Alternative 2 would be the same as under Alternative 1, as described in Section 2.2.

2.3.1 Components

The Airport Levee Improvements would be the same as described in Alternative 1 (Section 2.2.1.2). The Alternative 2 flood retention facility would be the same as Alternative 1, except the facility would be built on a smaller foundation (Figure 2.3-1). The Alternative 2 flood retention facility is referred to as FRO. Unlike the FRE facility, the foundation would not be designed to allow for potential future expansion of flood storage capacity. The foundation for the FRO facility would be about 20 feet smaller in width than the FRE facility on the downstream (north) side.

2.3.2 Construction

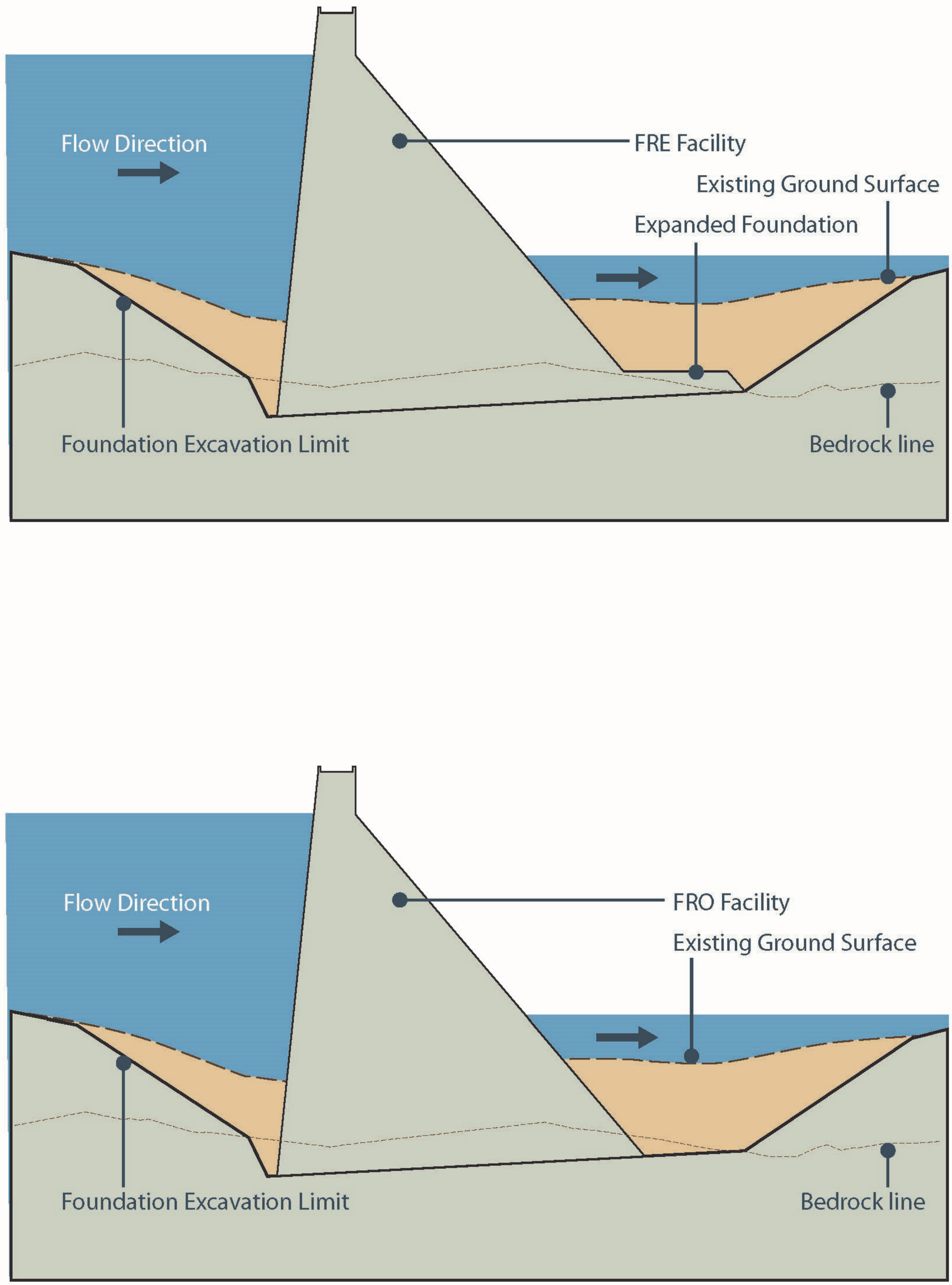
Construction of the Airport Levee Improvements would be the same as described in Alternative 1 (Section 2.2.2.2).

Construction of the FRO facility would involve the same construction methods, in-water work activities, and fish passage elements as the FRE facility described for Alternative 1. However, the duration of construction and the amount of materials required to build the FRO facility would be less than the FRE facility. It was assumed that the flood retention facility construction period for Alternative 2 would be about 9 months less than Alternative 1. For purposes of the NEPA EIS analysis, it was also assumed that approximately 796,450 cubic yards of aggregate would be needed to construct the FRO facility. It was assumed this would result in 34,000 to 46,750 truck round trips between the quarries and the construction site. A total of 3,400 to 5,100 truck round trips would be expected between the construction site and off-site locations.

2.3.3 Operation

Operation of the Airport Levee Improvements and flood retention facility components of Alternative 2 would be the same as those components of Alternative 1, as described in Section 2.2.3.2.

Figure 2.3-1
Section Diagram: FRO Facility and FRE Facility



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