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

Appendix K
Transportation Discipline Report

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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 discipline report describes the transportation system in the study area, including roadways, transit routes, and railroad and airport facilities that are currently affected by flooding. It also describes potential impacts and proposed mitigation for the Proposed Action and alternatives (Local Actions Alternative and No Action Alternative). These impacts are summarized in Tables K-1 and K-2.

Within the study area, past flooding has affected Interstate 5 (I-5); State Route 6 (SR 6); U.S. Route 12 (US 12); major roadways in Lewis, Thurston, and Grays Harbor counties; the Centralia-Chehalis Airport; and railroad facilities. This discipline report describes this transportation system and the detours that are used during flooding and roadway closure processes. Forest roads and local roadways that may provide access for the Proposed Action, including potential construction routes, are also described.

This discipline report analyzes probable impacts to transportation from the Proposed Action and alternatives. It analyzes potential impacts for major and catastrophic floods in the future, including expected increases in precipitation and flood peaks from climate change. The analysis used hydraulic modeling to provide the expected duration and height of flooding at key intersections in the study area.

One of the Chehalis River Basin Flood Control Zone District (Applicant) goals for the Proposed Action is to reduce closure of I-5 and SR 6 to less than 24 hours. The Proposed Action would reduce the flood duration on these highways and would not cause additional significant impacts; however, the I-5 interchange at NW Chamber of Commerce Way, under the late-century catastrophic flood scenario, would still be flooded for 48 hours. Another Applicant goal is to reduce closure at the Chehalis-Centralia Airport in a catastrophic flood. The Proposed Action would reduce the flood depth and duration at the airport and would not cause additional significant impacts; however, the airport would still be flooded in a late-century catastrophic flood.

Table K-1

Summary of Transportation Impacts from the 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			
Construction traffic for the Flood Retention Expandable (FRE) facility would impact local roadways, including SR 6 to Pe Ell and S 3rd Street/Muller Road. Truck and vehicle traffic would increase by 80 vehicle trips for workers and 8 truck trips a day, but it would be temporary and would not decrease level of service.	Moderate	None	No
Construction traffic on local roadways would increase by 88 vehicle and truck trips a day for the Airport Levee Changes. A Traffic Control Plan would be required by the City of Chehalis. The impact would be temporary and would not decrease level of service.	Moderate to minor	None	No
Roads constructed, upgraded, or used for bypass and access in the FRE facility and temporary reservoir area (which would not be managed as commercial forest) could impact streams, wetlands, unstable slopes, and other sensitive sites.	Moderate to minor	**TRANSP-1:** Meet all Forest Practices requirements for road building, maintenance, and abandonment for protection of streams, wetlands, unstable slopes, or other sensitive sites. **WATER-1:** Develop and implement a Surface Water Quality Mitigation Plan.	No
Roads constructed, upgraded, or used in managed forests for bypass and access could impact streams, wetlands, unstable slopes, and other sensitive sites. Roads in managed forests would be required to meet Forest Practices standards.	Minor	None	No
Construction of the FRE facility and Airport Levee Changes would not affect rail or transit.	No impact	None	No

IMPACT	IMPACT FINDING	MITIGATION PROPOSED (SUMMARIZED, SEE SECTION 3.2.4)	SIGNIFICANT AND UNAVOIDABLE ADVERSE IMPACT
PROPOSED ACTION (FRE FACILITY AND AIRPORT LEVEE CHANGES) – OPERATIONS			
Operations and maintenance trips would be limited. The FRE facility would cause a negligible increase in traffic on local roadways.	No impact	None	No
Operation of the Airport Levee Changes and raising of NW Louisiana Avenue would not change roadway capacity or travel patterns.	No impact	None	No
Changes in inundation: Slightly longer duration (1% to 2.5%) of flooding at 188th Avenue and Moon Road.	No impact	None	No
Operation of the FRE facility and Airport Levee Changes would not affect rail or transit.	No impact	None	No

Table K-2

Summary of Transportation Impacts from Alternatives

IMPACT	IMPACT FINDING
LOCAL ACTIONS ALTERNATIVE	
Small, localized increases in construction traffic would be distributed over time.	Minor
Floods would continue to disrupt travel in and around the study area and could cause long-term damage to facilities and loss of access.	**Continued substantial flood risk**
Use of unofficial detour routes during floods could temporarily increase traffic and temporarily affect the level of service along non-arterial roadways.	**Continued substantial flood risk**
NO ACTION ALTERNATIVE	
Floods would continue to disrupt travel in and around the study area and could cause long-term damage to facilities and loss of access.	**Continued substantial flood risk**
Use of unofficial detour routes during floods could temporarily increase traffic and temporarily affect the level of service along non-arterial roadways.	**Continued substantial flood risk**

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 Resource Description

Transportation consists of a system of roadways, transit routes, railroads, and airport facilities that move people and goods. This discipline report describes the current transportation system in the study area and assesses the potential for impacts from the Proposed Action, a Local Actions Alternative, and the No Action Alternative. This report describes the regulatory setting and establishes the methods for assessing potential transportation impacts.

Geology and geomorphological impacts that could affect transportation are discussed in the *Earth Discipline Report* (Shannon & Wilson and Watershed Geodynamics 2020). Impacts to transportation affecting environmental justice communities are discussed in the *Environmental Justice Discipline Report* (Anchor QEA 2020a). Impacts to emergency services and critical facilities like hospitals that are affected by transportation closures from floods are in the *Public Services and Utilities Discipline Report* (ESA 2020a). Water modeling results, including flood heights and extents, are discussed in the *Water Discipline Report* (ESA 2020b).

1.2 Regulatory Context

Transportation facilities and functions are governed by state, regional, and local laws, plans, and policies. These documents typically identify infrastructure needs, priorities, and performance standards for the transportation system elements. Table K-3 identifies the regulations, statutes, and guidelines relevant to transportation in the study area.

Table K-3

Regulations, Statutes, and Guidelines for Transportation

REGULATION, STATUTE, GUIDELINE	DESCRIPTION
FEDERAL	
Fixing America's Surface Transportation Act	Established a new National Highway Freight Network, which requires states to improve the safety, security, efficiency, and resiliency of freight transportation in rural and urban areas.
Metropolitan Transportation Planning and Programming, 23 Code of Federal Regulations 450.306	Requires metropolitan planning process including projects, strategies, and services that will address productivity, safety, security, mobility, resiliency, and other environmental and mobility goals.
STATE	
Forest Practices Act Chapter 76.09 Revised Code of Washington (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.
Guidelines for Forest Roads, Section 3	Provides guidance related to forest practices and Forest Roads (DNR 2013).
Transportation System Policy Goals, RCW 47.04.280	Contains six transportation system policy goals, including the maintenance, preservation, and extension of the life and utility of prior investments in transportation systems and services and the predictable movement of goods and people throughout Washington State, including congestion relief and improved freight mobility.
Washington State System Plans: Highway, Freight, Aviation, and Public Transportation	Ensure that the transportation system in Washington supports and enhances the movement of people and goods; address federal and state policies and meet federal and state planning requirements (WSDOT 2007, 2016a, 2017a, and 2017b).
Water Quality Standards for Surface Water (WAC 173-201A)	Establishes water quality standards for surface waters, implementing RCW Title 90 law (Chapter 90.48 - Water Pollution Control Act). Freshwater designated uses and associated criteria are specifically identified in WAC 173-201A-200.
LOCAL	
2019–2022 Regional Transportation Improvement Program for the Thurston Region	Identifies and prioritizes transportation investments with secured funding in the upcoming year; the Regional Transportation Improvement Program is a short-range plan developed on an annual basis (Thurston Regional Planning Council 2018).
Grays Harbor County 2020-2025 Transportation Improvement Program	Represents Grays Harbor County's transportation priorities for a 6-year period and identifies road and bridge construction and other transportation improvement projects throughout the unincorporated county (Grays Harbor County 2019).
Lewis County *2019–2024 Transportation Improvement Program*	Represents Lewis County's transportation priorities for a 6-year period and identifies road and bridge construction and other transportation improvement projects throughout the unincorporated county (Lewis County 2018a).

REGULATION, STATUTE, GUIDELINE	DESCRIPTION
Lewis County Code Chapter 15.45 (Stormwater Management)	Provides requirements for including adequate stormwater quantity and quality controls for construction and development activities, and outlines associated County review/ permitting procedures. Ecology's Stormwater Management Manual is referenced in this chapter, for use as a guide in selecting appropriate stormwater best management practices

2 METHODOLOGY

2.1 Study Area

The study area for transportation consists of areas that could be directly or indirectly affected by the construction or operation of the Proposed Action. The study area includes the following:

- The area associated with the Flood Retention Expandable (FRE) facility site construction and operations
- The maximum inundation area of the temporary reservoir
- The area associated with construction and resulting changes to the airport levee
- The area along the mainstem Chehalis River from the FRE facility at river mile (RM) 108 to RM 9, just west of Montesano

A hydraulic model was used to identify the estimated limits of flooding along the mainstem of the Chehalis River. It modeled major and catastrophic floods in the mid- and late-century time frames from a storm originating in the Willapa Hills and includes climate change estimates. For the Skookumchuck River, South Fork Newaukum River, and South Fork Chehalis River, the study area extends an additional 1,500 feet upstream of the modeled limits.

Based on the hydraulic model results, the study area includes major roadways and transportation facilities (and services) within the Chehalis Basin in Lewis County, as well as parts of Thurston and Grays Harbor counties, and the Confederated Tribes of the Chehalis Reservation (Chehalis Tribe Reservation). Figures K-1a through K-1c present the general study area.

2.2 Affected Environment

Within the study area, past flooding had negative effects on local roads and major highways like Interstate 5 (I-5). Large floods significantly affected transportation systems in the local cities and towns and on major regional highways by closing roads, rail routes, and airports, reducing access to critical facilities, and causing damage. I-5 was closed for 4 days in 1996 and 2007, and 2 days in 2009 (WSDOT 2014).

Under current conditions, I-5 is predicted to be closed for 5 days during a catastrophic flood in the Chehalis-Centralia area. A closure of this length would result in prolonged adverse impacts on public health and safety due to limited or no access to critical medical facilities, and it would affect interstate commerce by preventing or reducing travel to and from areas outside of Chehalis-Centralia (Ecology 2017).

Routes into and out of local communities in Lewis County are generally blocked during floods (Ruckelshaus Center 2012). The area of Lewis County around the upper mainstem Chehalis River, which is highly vulnerable to flooding, includes Curtis, Adna, Dryad, and Doty along areas of State Route (SR) 6,

Leudinghaus Road, Boistfort Road, Curtis Hill Road, and Bunker Creek Road (Lewis County 2008a). In these communities, local roads, including access roads to area farms and dairies, have regularly flooded. SR 6 closes in multiple places during floods because the elevation of the roadway is low in several locations. Major roadways in Centralia and Chehalis have also experienced flooding-related roadway closures. The 2007 flood also damaged many forest roads and rail and air infrastructure.

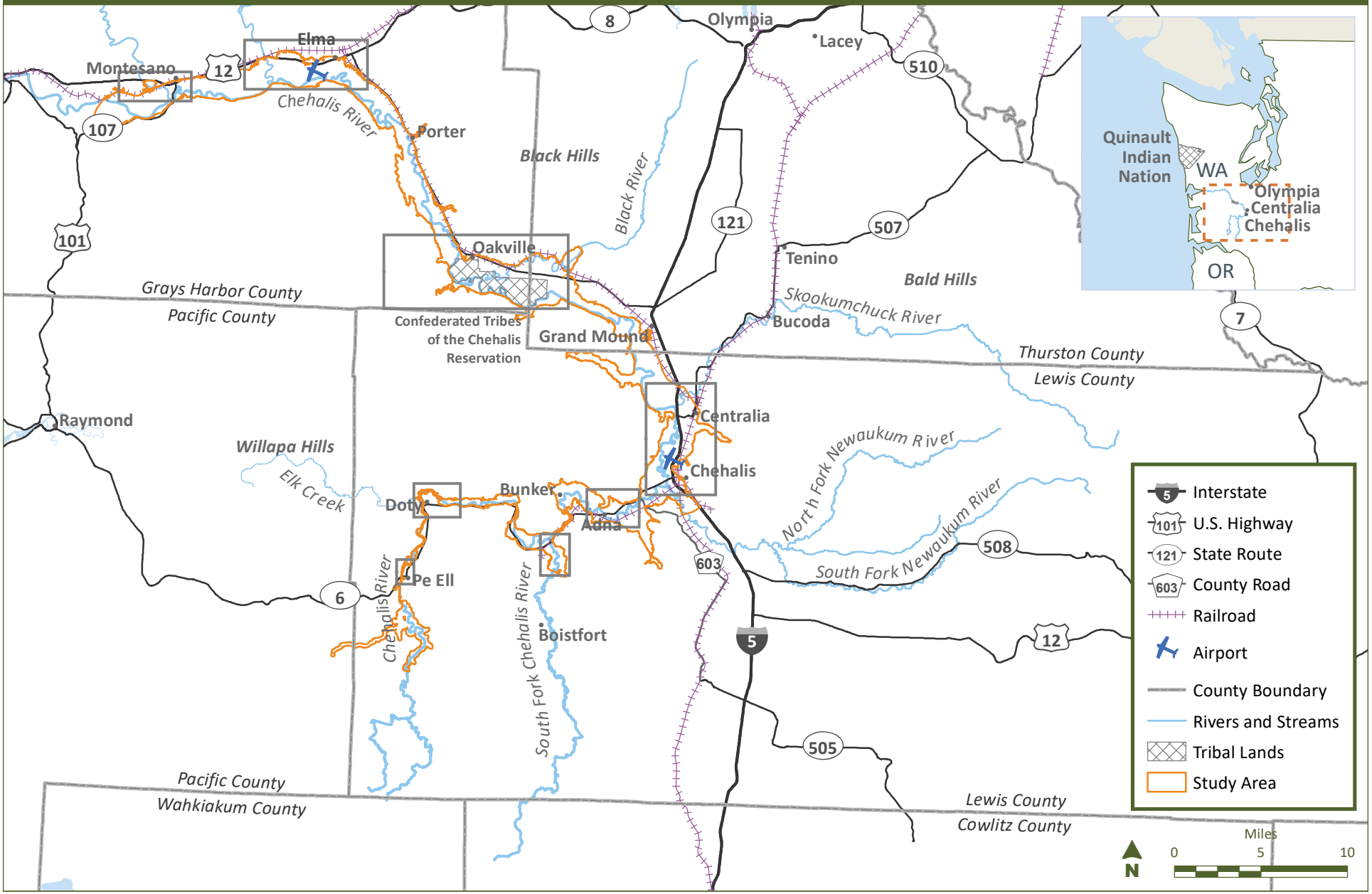
In Centralia and Chehalis, major roadways (in addition to I-5 and SR 6) that have experienced major flooding include SW Riverside Drive, SW Newaukum Avenue, N National Avenue, NE Kresky Avenue, NW Airport Road, and NW Louisiana Avenue (Sahlin 2019a, 2019b). The Chehalis-Centralia Twin City Town Center has been inundated by floodwaters. At the height of the December 2007 storm, 20 square blocks near downtown Centralia were flooded, which limited access in the area (Ecology 2017). In May 2019, to protect this area from floodwaters, the City of Centralia completed a project that reestablished the original shape and location of China Creek. A second phase of the project will include raising the Agnew Mill Pond near Gold Street. Phase 2 is scheduled to begin construction in early 2020 (Rubin 2019).

Current inundation modeling indicates that portions of U.S. Route 12 (US 12) in Thurston County, between Lewis and Grays Harbor counties, and US 12 through portions of Grays Harbor, could be affected by flooding. The community of Rochester is just north of US 12 and relies on this roadway for regional access.

Most of the developed communities and towns in Grays Harbor County are located along the lower mainstem Chehalis River. Oakville, Porter, Malone, Elma, Satsop, Brady, and Montesano have experienced flooding along US 12 and local roadways (Ruckelshaus Center 2012). Segments of US 12 east of the Black River Bridge were inundated with almost 2 feet of water in the 2007 and 2009 floods (Ecology 2017).

In the 1996 flood, 75% of the Chehalis Tribe Reservation, located in Grays Harbor County just south of Oakville, was inundated, with measured flood depths of up to 10 feet. Vital access routes, including Howanut Road, Anderson Road, and Moon Road, were under 1 to 4 feet of fast-moving water, and portions of US 12 through the reservation were flooded (Ecology 2017).

Figure K-1a
Transportation Study Area



Note: See insets on Figures K-1b and K-1c

Figure K-1b
Transportation Study Area Insets

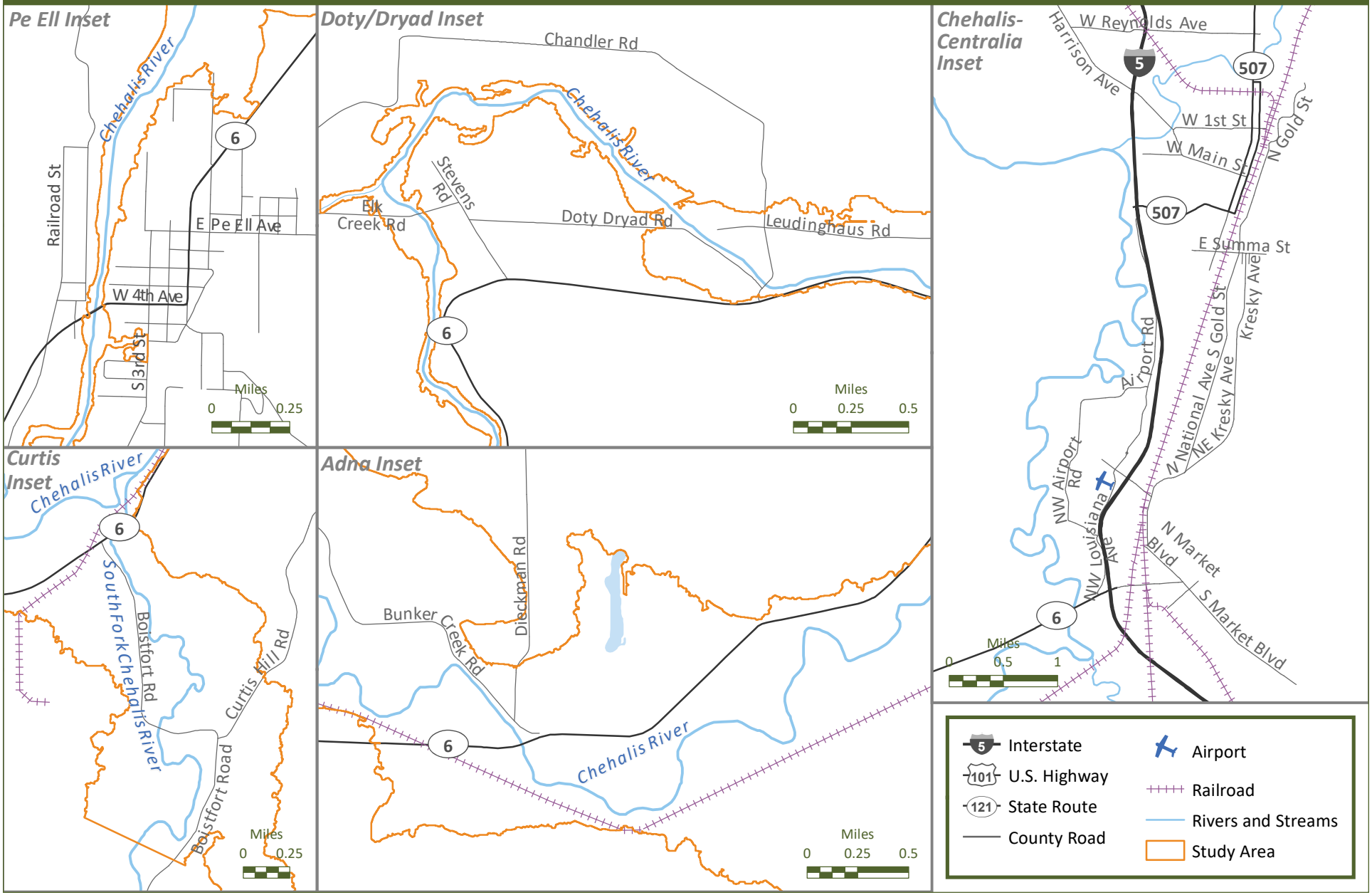
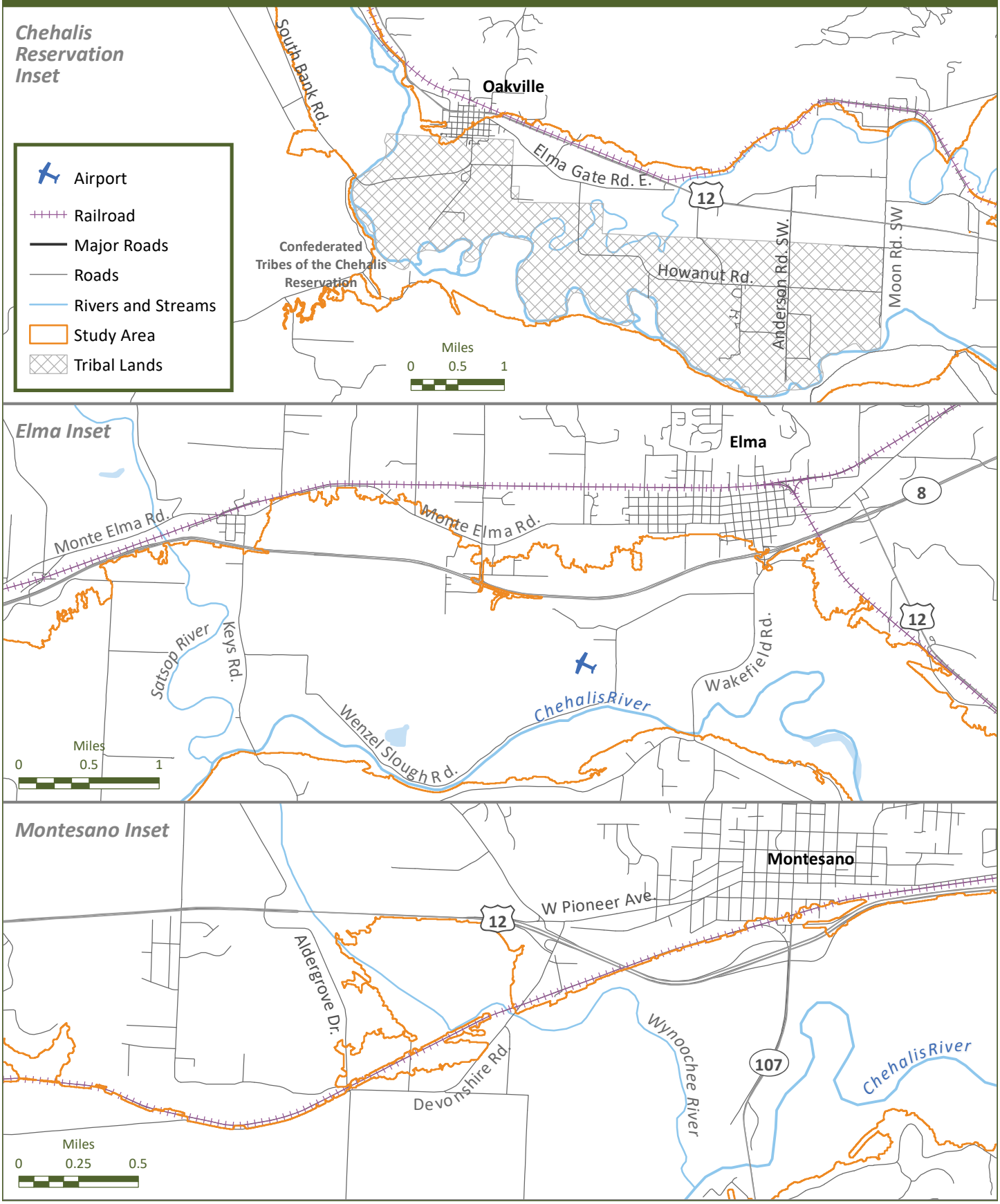


Figure K-1c
Transportation Study Area Insets



2.2.1 Transportation System and Facilities

The focus of this analysis is on major transportation facilities in the study area that move people and goods. These facilities are described in this section.

2.2.1.1 Roadways

Interstate 5

I-5 is the major north-south route along the West Coast, connecting most major cities from Canada to Mexico. The segment of I-5 through the study area is the primary transportation facility between the Puget Sound region and the Portland/Vancouver metropolitan area. The corridor is a principal freight arterial, moving regional and international cargo. The corridor is also a commuter and recreational route providing access to nearby cities and outdoor facilities, such as Mount St. Helens, the Cowlitz River, the Gifford Pinchot National Forest, and several other national and state parks that can be accessed from this corridor off of US 12. In Lewis County, the corridor intersects with SR 6, SR 508, SR 507, SR 505, SR 506, and US 12.

This segment of I-5 is a divided, unsignalized highway with a variable number of lanes. From the Thurston County/Lewis County line, I-5 has six lanes (three lanes in each direction) until it reaches Centralia. Through Centralia and Chehalis, I-5 becomes four lanes. It expands to six lanes south of Chehalis, with acceleration and deceleration lanes throughout the corridor. In 2016, the Annual Average Daily Traffic (AADT) on I-5 in the study area ranged from 61,000 to 68,000 (WSDOT 2019a).

Washington State's Connecting Washington multimodal investment program includes improvements to I-5 in the study area. Connecting Washington is a 16-year program that was fully phased in on July 1, 2016 (WSDOT 2019d). Projects in the study area include the following:

- **I-5/North Lewis County Interchange** will improve access to the Port of Centralia, including improvements to surrounding roadways.
- **I-5/Mellen Street to Blakeslee Junction** will improve this section of roadway by providing collector-distributor lanes between the existing Mellen Street and Harrison Avenue interchanges and will widen I-5 from two lanes to three lanes in each direction north of Harrison Avenue. A new overcrossing will be constructed south of Mellen Street, the Harrison Avenue interchange will be improved, a new bridge over the railroad tracks at Blakeslee Junction will be built, and the Skookumchuck River Bridges will be repaired. These improvements will reduce congestion, improve traffic flow, and improve safety.
- **I-5/Rebuild Chambers Way Interchange Improvements** will rebuild the Chambers Way interchange and construct auxiliary lanes between SR 6 and Chambers Way; pending practical design review and funding, auxiliary lanes between Chambers Way and Mellen Street may be constructed.

State Route 6

SR 6 is a 51-mile-long, east-west corridor between US 101 in Raymond and I-5 in Chehalis in Pacific and Lewis counties, respectively. The corridor also runs through Pe Ell, Menlo, Lebam, Frances, and Adna. The east portion of the corridor follows the Chehalis River until it reaches Chehalis.

The corridor serves as a main street for some small communities, like Pe Ell. SR 6 provides a connection to many coastal recreation areas and is designated a Scenic and Recreational Highway (WSDOT 2018a). The Willapa Hills State Park Trail, a Rail to Trails park, runs parallel to and, in some areas, immediately adjacent to SR 6. There are sidewalks within Pe Ell, and shoulders are available along most of the SR 6 corridor for pedestrian and cyclist use.

SR 6 is a two-lane, undivided highway that expands to include turn lanes at major intersections. The only signalized stop on the corridor is at the I-5 junction in Chehalis. The AADT on this corridor is highest at the I-5 interchange in Chehalis and lowest near Pe Ell. In 2016, AADT on SR 6 in the study area ranged from 1,600 (Pe Ell) to 11,000 (I-5 interchange; WSDOT 2019a).

U.S. Route 12

In the study area, US 12 extends from just west of Rochester, through the Chehalis Tribe Reservation, and the communities of Oakville, Malone, Porter, Elma, Satsop, Brady, and Montesano. The corridor mainly serves a mix of urban and rural commuters, as well as seasonal recreational traffic traveling to the Ocean Beaches and Olympic Peninsula. The corridor is also a regional freight route connecting the Port of Grays Harbor to I-5. The corridor is rural in character, dominated by state forestlands, agriculture, and single-family residences. The portion of US 12 from west of Rochester to Elma is a two-lane undivided highway, and from Elma to west of Montesano is a four-lane divided highway. The AADT on this corridor is highest near Montesano (near the US 101 junction in Aberdeen) and lowest between Elma and Oakville (WSDOT 2018c and 2018d). In 2016, AADT on US 12 in the study area ranged from 5,600 (Oakville) to 23,000 (Montesano; WSDOT 2019a).

Major Arterials in Lewis County

Major arterials in the study area that provide access and linkages to and within the communities of Pe Ell, Curtis, Doty, Dryad, Adna, Centralia, and Chehalis include the following:

- Chehalis-Centralia area:
  - NE Kresky Avenue
  - N National Avenue
  - NW Airport Road/ NW Louisiana Avenue
  - SW Riverside Drive
  - SW Newaukum Avenue
  - SW Chehalis Avenue
- Western Lewis County:
  - Bunker Creek Road
  - Dieckman Road
  - Leudinghaus Road East
  - Boistfort Road

Although there are many other arterial roadways in these communities, local authorities have identified these roads as the primary access roads in the study area that experience flooding (Hurley 2019a, 2019b; Sahlin 2019a, 2019b). The roadways listed previously, in western Lewis County, are paved two-lane roads, one way in each direction, with shoulders. Bunker Creek Road and Boistfort Road are designated by Lewis County as freight routes.

Roads in Centralia and Chehalis (Twin Cities) have experienced some of the most substantial flooding and flood damage in the Chehalis Basin. The Chehalis-Centralia Twin City Town Center has been inundated by floodwaters. At the height of the December 2007 flood, 20 square blocks near downtown Centralia were flooded, with resulting access limitations. The Centralia Business District is vulnerable to flooding from the Skookumchuck River and China Creek. Flooded roadways also resulted in access issues to critical facilities such as the hospital on Cooks Hill Road in Centralia (Ecology 2017). In 2016, the Washington State Department of Transportation (WSDOT) completed the I-5 to Blakeslee Junction project, which addresses access to critical facilities.

In Centralia and Chehalis, NE Kresky Avenue and N National Avenue provide the major north-south route between the two communities, forming a two-way couplet, each with two, one-way paved lanes with shoulders. The other roadways listed previously in these cities are predominately two-lane, two-way paved roadways. NW Louisiana Avenue also has a center-turn lane that runs the length of the roadway, which provides two lanes of travel in each direction in some areas.

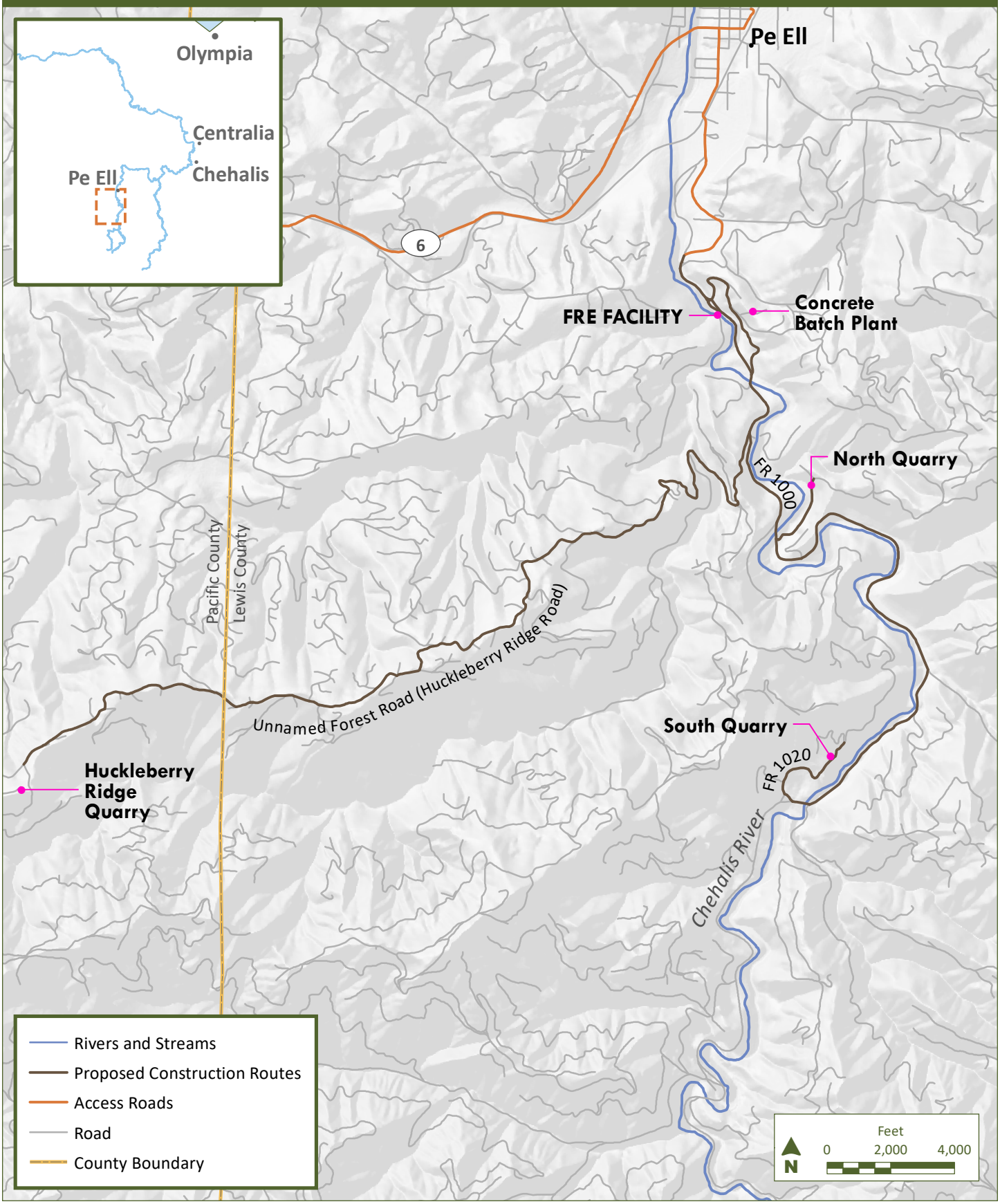
Major Arterials in Thurston and Grays Harbor Counties

Major arterials in Grays Harbor and Thurston counties, including the Chehalis Tribe Reservation, that provide access to the region include US 12, Elma Gate Road, Moon Road SW, South Bank Road, Wakefield Road, Keys Road, Monte Brady Road, and SR 107. Historically, many of these roadways have experienced flooding that has affected communities along these routes, including the Chehalis Tribe.

Forest Roads

Forest roads also provide access for private business operations as well as recreational activities. Forest roads in the study area that may provide access for the Proposed Action, including potential construction routes, include Forest Road (FR) 1000, FR 1020, and an unnamed forest road leading to the proposed Huckleberry Ridge Quarry site. Figure K-2 identifies the general location of these roadways.

Figure K-2
Proposed Project Construction Routes and Access Roads – FRE Facility



2.2.1.2 Detour Routes During Flooding

When I-5 is closed, WSDOT has designated SR 7 and US 12 as an emergency truck detour route (WSDOT 2014; Figure K-3). Northbound trucks would be detoured off I-5 at Exit 68 onto US 12 eastbound, then northbound on SR 7 through Morton and Elbe. At milepost 12.69 on SR 7, trucks would be detoured onto Alder Cutoff Road, to SR 161 in Eatonville. From that point, drivers could continue north on SR 161 and connect to SR 512, or connect to SR 7 using 304th Street East. Drivers would then find their own routes back to I-5. For southbound trucks, there is no defined route to reach the southbound detour because many options are available. Drivers would find their way to the intersection of SR 7 and SR 702. From there, drivers would be routed on SR 7 through La Grande, Elbe, and Morton to US 12. At US 12, drivers would continue westbound to I-5.

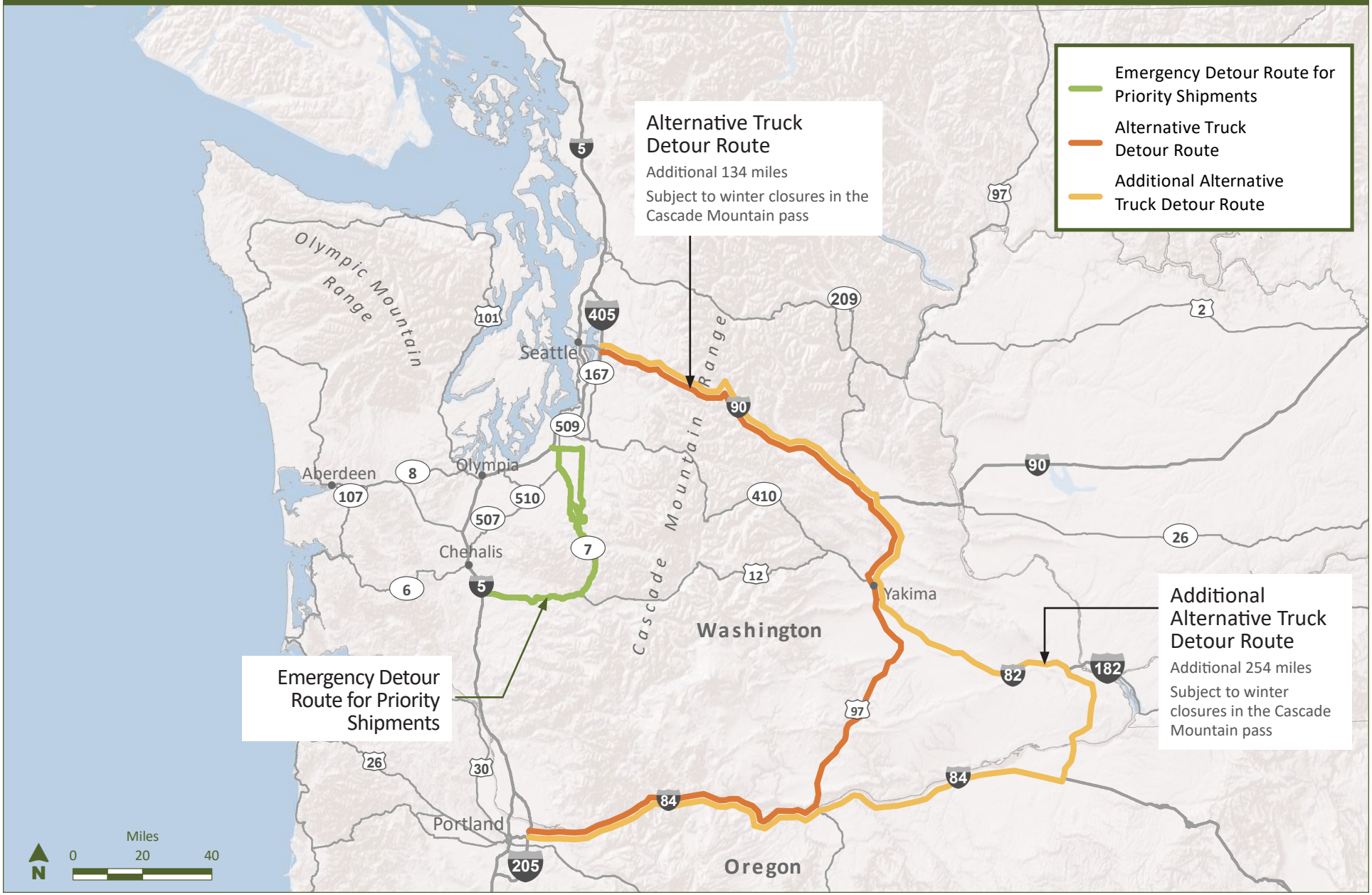
To control the volume of traffic on the detour and maintain access for emergency responders, WSDOT has developed a pass system for trucks. Trucking companies must apply for permits through the Commercial Vehicle Detour Pass System to access the detour route. The Commercial Vehicle Detour Pass System controls the types of goods that can be transported through the area and limits the number of trucks that can travel along the route to 50 per hour per direction. Criteria for activating the detour route are that I-5 has been closed for 24 hours, it is predicted to be closed for at least 3 days, and the National Guard has been activated. Checkpoints manned by the National Guard will be set up at SR 7 in Morton and at the intersection of SR 7 and SR 702 in Pierce County. The National Guard will check passes and divert trucks that are not permitted. Trucks with a valid permit will have a 3-hour window to enter the detour route. If permitted trucks miss their assigned windows, they must reapply for a new permit (Briggs 2019).

When the emergency detour route is not activated, or for trucks without a pass, two detour options are available. An available detour route uses I-84 in Oregon, US 97 in Eastern Washington, and I-90 over Snoqualmie Pass. This route adds 134 miles to the trip between Seattle and Portland, with an estimated additional travel time of 2.5 hours. A secondary detour route uses I-84, I-82 through the Tri-Cities in Eastern Washington, and I-90 over Snoqualmie Pass. The secondary detour adds 254 miles to the trip between Portland and Seattle, with an estimated additional travel time of 3.75 hours. Although longer, the secondary route could be preferable to trucks in bad winter weather. Since both routes use I-90, the detours are subject to winter closures of that highway in the Cascade Range pass due to snow and avalanches (Ecology 2017).

There are no official detour routes in Centralia and Chehalis (Sahlin 2019a, 2019b). However, if NE Kresky Avenue is closed due to flooding, traffic could be rerouted to N National Avenue to access I-5 (assuming I-5 is open). In addition, N National Avenue in Chehalis and S Gold Street in Centralia have been converted to two-way traffic during floods, even though they are one-way streets. This is a last resort option to open traffic up between the two cities.

There are no official detour routes for communities in western Lewis County. Depending on the location and extent of flooding, residents use backroads to access other areas of the county (Hurley 2019a, 2019b).

Figure K-3
WSDOT I-5 Detour Routes



2.2.1.3 Roadway Closure Process

Based on interviews and discussions with local agency representatives (Hurley 2019a, 2019b; Ashmore 2019; Sahlin 2019a, 2019b; Wilson 2019), there are no single criteria for closing local roadways due to flooding. Many factors are considered, including the depth of water and extent of roadway coverage. According to Lewis County Public Works, roadway closure is determined by the police department and usually occurs when the entire roadway is covered with water at a depth of 3 to 4 inches.

When flooding is projected to overtop I-5 within the Centralia-Chehalis area, WSDOT prioritizes the safety of the traveling public and closes approximately 20 miles of I-5 along US 12, from exit 68 to exit 88 (see Figure K-3 for detour route due to flooding). To determine whether or not to close the interstate, WSDOT surveys NOAA flood projections, gage data, and visual cues and times the closing of I-5 to promote the safest detour. Whenever I-5 is projected to flood, and as long as any point along the route continues to compromise the safety of the traveling public, WSDOT will keep I-5 closed. Since the 2007 floods, WSDOT has installed two culverts under Airport Road to facilitate drainage and reduce the duration of any future closure (Gernhart 2019).

In previous closures of I-5 due to flooding, the Centralia-Chehalis community has requested WSDOT seek a detour that does not impact their community. When I-5 floods, a number of the communities' local roads are already blocked by floodwater. Local emergency access is critical, and funneling I-5 traffic into the local community would further gridlock the already compromised local road system. The closure and detour remain in place for the duration of any flooding affecting I-5.

2.2.1.4 Airports

Two airports are located in the study area. The Chehalis-Centralia Airport, located in Chehalis, is a general aviation facility with one 5,000-foot runway that serves non-scheduled private and commercial flights. Although the Chehalis-Centralia Airport is protected by a dike system, those dikes were overtopped during the January 1990 flood, closing the airport. During the 2007 flood, the airport levee was overtopped and water covered most of the airport for approximately 4 days, damaging airport facilities. The 2007 flood caused the airport's automatic weather observation system to be down for 46 days, and closed the active day runway for 3 days. A levee-based improvement project was completed at the airport in July 2014, which involved expanding the width of the existing levee on the inside (airport side) by an additional 32 acre-feet of fill without increasing the levee elevation.

The Elma Municipal Airport, located in Grays Harbor County, is a privately-owned airport with one 2,280-foot runway and a parallel 1,700-foot turf runway that serves non-scheduled private flights. The airport has flooded and closed in the past during catastrophic floods.

2.2.1.5 Rail Lines

Two Class I railroads serve the area: BNSF Railway's main line through Lewis County and the Union Pacific Railroad, which operates on the BNSF main line. Amtrak Cascades and Amtrak Coast Starlight also

operate on the BNSF main line through the study area, with a station in Centralia. Two short-line railroads also run through various parts of the study area, including the Rainier Railroad (formerly the Tacoma Mountain Line) and the Puget Sound and Pacific Railroad (PSAP). The Rainier Railroad, owned by Frontier Rail, extends from Centralia north into Thurston County. The PSAP (owned by Genesee and Wyoming) extends from Centralia, through Lewis County, to the Port of Grays Harbor (WSDOT 2018e). It also has branches that extend from Chehalis to Centralia to Curtis. A spur line, the Curtis Industrial Park rail line, connects the Port of Chehalis to the Curtis Industrial Park near Pe Ell. This facility was damaged by flooding in 2007 and has been closed in the past during catastrophic floods.

2.2.1.6 Transit

Two transit operators currently provide bus services to residents of Lewis County, which operate on the major arterials in the study area, including I-5. LEWIS Mountain Highway Transit provides service from Centralia-Chehalis to eastern Lewis County, and travels on I-5 and US 12. Twin City Transit serves Centralia and Chehalis with four routes that operate along the major roadways in the two cities, including NE Kresky Avenue, N National Avenue, NW Louisiana Avenue, and SW Chehalis Avenue.

Grays Harbor Transit currently provides bus service to residents in eastern Grays Harbor County. Bus route 45 serves Oakville and the Chehalis Tribe Reservation. Bus route 40 serves Elma and Montesano, traveling primarily on US 12. Both routes travel primarily on US 12.

2.3 Studies and Reports Referenced/Used

Many information sources were used in this analysis, including local and regional planning documents and transportation inventories, upper Chehalis Basin flood plans, flood modeling, online mapping, and interviews with local and regional public works officials. Primary studies, reports, maps, and inventories used include the following:

- *1996 Modeled Inundation Area Map, Twin Cities* (Lewis County 2008a)
- *2007 Flood, Approximate Inundation Area Map, Twin Cities* (Lewis County 2008b)
- *2007 Flood, Approximate Inundation Area Map, Western Lewis County* (Lewis County 2008c)
- *Road Atlas Book* (Lewis County 2018b)
- *Lewis County Comprehensive Plan, Transportation Element 2018–2020* (Lewis County 2018c)
- *Chehalis Basin Strategy Programmatic Environmental Impact Statement* (Ecology 2017)
- *Guidelines for Forest Roads,* Section 3 (DNR 2013)
- *Chehalis Basin Flood Hazard Mitigation Alternatives Report* (Ruckelshaus Center 2012)
- *Corridor Sketch Studies: SR 6: US 101 Junction (Raymond) to I-5 Junction (Chehalis)* (WSDOT 2018a)
- *Corridor Sketch Studies: I-5: I-205 Junction (Salmon Creek) to Thurston County Line* (WSDOT 2018b)
- Community Planning Portal (WSDOT 2019a)
- Level of Service Database (WSDOT 2019b)
- Milepost Marker (WSDOT 2019c)

- *Travel Costs Associated with Flood Closures of State Highways near Centralia/Chehalis, Washington* (WSDOT 2014)

In addition, the following state and local transportation agencies were contacted for information on transportation facilities in the study area:

- City of Centralia (Ashmore 2019)
- City of Chehalis Public Works (Sahlin 2019a, 2019b)
- Grays Harbor County Public Works (Wilson 2019)
- Lewis County Public Works (Hurley 2019a, 2019b; Kroll 2019)
- Thurston Regional Planning Council (Grimes 2019)
- WSDOT (St. Charles 2019; Gernhart 2019)

2.4 Technical Approach

In general, impacts on the transportation system were qualitatively assessed based on an evaluation of how construction and routine operations could disrupt mobility and access. Potential transportation impacts on emergency responders and access for critical facilities are addressed in the *Public Services and Utilities Discipline Report* (ESA 2020a).

2.4.1 Construction Impacts Methodology

Construction impacts were analyzed based on anticipated truck, equipment, and employee trips to and from the FRE facility and the proposed quarry sites (that would be used to support FRE facility construction), as well as construction trips and routes to and from the Airport Levee Changes site. For the FRE facility, construction traffic would primarily travel on forest roads and along roadways in the Pe Ell area (SR 6, S 3rd Street/Muller Road). For the FRE facility, the construction impacts analysis focuses on these locations and facilities. For the Airport Levee Changes, construction traffic would travel primarily on NW Airport Road and NW Louisiana Avenue as well as I-5 and other surrounding arterials.

For construction, the estimated number of truck and vehicle trips along affected roadways was used to identify potential impacts on traffic circulation. The construction impacts were developed by estimating changes to the level of service (LOS) for the affected roadways. LOS is a qualitative tool used to measure the quality of vehicular traffic flow and categorizes the flow of roadways and intersections based measures like vehicle speed, congestion, and delay. LOS ranges from LOS A, which indicates free flow, low volumes and densities, to LOS F, which indicates a breakdown in flow, with speeds dropping to zero. More information about LOS and its definitions can be found in Attachment K-1. The purpose of determining LOS was to assess general traffic flow in the area. Per Lewis County's Comprehensive Plan Transportation Element (Lewis County 2018c), the LOS goal for local roadways and intersections in Lewis County is LOS D. For state highways, the LOS goal is LOS C.

To determine order of magnitude impacts on affected roadways during construction, the following method was used:

- For key locations used by construction vehicles and equipment, AADT was projected for the No Action Alternative for construction years 2025 and 2030. The AADT for years 2017 (data provided by WSDOT) and 2018 (data provided by Lewis County) was used as the baseline for future projections. These figures represent the most recent data available from each agency. Projections were calculated using Lewis County's Traffic Projection Spreadsheet (see Attachment K-1).
- Once AADT was determined for future years, the LOS for 2025 and 2030 for the No Action Alternative was identified. This LOS was based on the Florida Department of Transportation's (FDOT) *Quality/Level of Service Handbook* Tables 1 and 6 (see Attachment K-1; FDOT 2013). The FDOT simplified technique is a recognized tool for determining LOS by the National Cooperative Highway Research Program (NCHRP) (NCHRP 2016). NCHRP is administered by the Transportation Research Board, part of the National Academy of Sciences, and sponsored by the individual state departments of transportation of the American Association of State Highway and Transportation in cooperation with the Federal Highway Administration. Therefore, this technique applies throughout the United States and is used here for the analysis.
- Once the baseline LOS was established for years 2025 and 2030, estimated construction trips from the Proposed Action were added to the projected No Action Alternative AADT to determine if the LOS would change, thus affecting traffic flow and delay along selected routes.

For road construction in managed forests, the general condition and maintenance needs, as well as the process required by the Washington Department of Natural Resources (DNR) to establish and maintain forest roads, are included under the Forest Practices Act.

2.4.2 Operations Impacts Methodology

Operations impacts were analyzed based on anticipated truck and employee trips related to operation of the FRE facility, including trips for maintenance activities at the FRE facility and temporary reservoir, and maintenance activities at the airport levee. In addition, impacts related to changes in flood inundation throughout the study area were analyzed.

Two approaches were taken for the operations impact assessment of the Proposed Action for the transportation system in the study area. First, operational impacts were qualitatively assessed by considering the potential for increased vehicle trips to the general area. In addition, the potential to change existing traffic patterns, due to increased use of the roadways and other transportation facilities resulting from the operation of the FRE facility and the Airport Levee Changes, is described. The general methodology used for the operations impact assessment is consistent with WSDOT's *Development Services Manual*, Chapter 4, impacts threshold approach (WSDOT 2016b).

The closure of major roadways and other transportation facilities was also assessed based on the level of inundation during a major flood and the duration of closure. To identify changes in flood and duration impacts, a geographic information system (GIS) map of flood inundation levels, modeled under various scenarios, was reviewed. Major roadways included in the analysis were identified using the inundation mapping and interviews with local officials. Based on model projections, the timeframe for closure for each of these routes and the projected traffic along affected routes were reviewed. Impacts were identified based on the estimated length of closure and the number of vehicles that would be affected. For rail and airport facilities as well as transit service, impacts were qualitatively assessed based on an evaluation of potential delays to service due to flood inundation.

3 TECHNICAL ANALYSIS AND RESULTS

3.1 Overview

This section describes the probable transportation impacts from the Proposed Action (Section 3.2), Local Actions Alternative (Section 3.3), and No Action Alternative (Section 3.4). The 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

Construction of the Proposed Action would require truck, equipment, and employee vehicle trips to and from the FRE facility and the proposed quarry sites, and along routes to and from the airport levee. Most of the truck trips would be associated with FRE facility construction (suppliers for the concrete batch plant), and to a lesser extent, construction of FR 1000 detour or bypass, quarry roads, and the temporary reservoir (including tree removal). Because temporary fish trap-and-transport activities would result in minimal truck trips during construction, a quantitative analysis for these additional trips was not performed. In addition to construction-related vehicle trips to and from the airport levee, construction for the levee includes temporary impacts related to extending the levee and raising and removing nearby roads and approaches.

Construction of the FRE facility is estimated to last for 5 years, from 2025 to 2030, and 1 year for the Airport Levee Changes within this time frame.

3.2.1.1 Direct

3.2.1.1.1 Flood Retention Expandable Facility

The FRE facility would be constructed on property currently owned by Weyerhaeuser and Panesko Tree Farm, south of SR 6. It would be accessed via S 3rd Street/Muller Road in Pe Ell to FR 1000 and then via local streets to the FRE facility site. No access permit would be required from WSDOT. Concrete aggregate for use in construction of the FRE facility would be mined at one or more proposed quarries near the site. As a result, most of the construction vehicle trips would occur on site and on forest roads, between the quarries to the batch plant and from the batch plant to the FRE facility site (Figure K-2). Construction would also generate some truck trips from off-site suppliers to the batch plant and removal of trees in the temporary reservoir area. Truck trips associated with the temporary fish trap-and-transport facility would be minimal (an estimated one trip per day) to a release site approximately 7 miles

upstream from the construction site. The primary roadways that off-site suppliers would use are SR 6 and Muller Road, both of which are far below capacity per Lewis County goals (Lewis County 2018c).

Based on information from the Applicant, Table K-4 presents the estimated number of on-site construction vehicle trips and the number of off-site vehicle trips. Road access to the FRE facility site is limited; therefore, at the beginning of construction, equipment and trucks would be brought to the site along SR 6 to Pe Ell and S 3rd Street/Muller Road.

Table K-4
Estimated Construction Trips for the FRE Facility, 2025–2030

TRIP TYPE	DAILY[1]	ANNUAL[2]	TOTAL
VEHICLES ALONG FOREST ROADS			
Quarry to Batch Plant/Staging Area	30 to 42	8,000 to 11,000	40,000 to 55,000
Batch Plant to FRE Facility	69 to 92	18,000 to 24,000	90,000 to 120,000
VEHICLES ALONG SR 6 AND S 3RD STREET/MULLER ROAD			
Removal of Logs for Temporary Reservoir	3	640	3,200
Suppliers to Batch Plant	3 to 5	800 to 1,200	4,000 to 6,000
Worker Trips	80	20,800	104,000

Notes:
1. Assumes 52 weeks, 5 days per week.
2. Assumes a 5-year construction window.

It is assumed that once haul trucks and equipment are brought to the batch plant via SR 6, they would remain on site in the FRE facility area and would not use SR 6 or S 3rd Street/Muller Road on a daily basis. Trucks and equipment may periodically leave the on-site area for servicing, thus requiring travel off site via SR 6; however, these additional trips were not part of the calculations presented here because they would be periodic and of short duration. Daily workers would continue to use SR 6 and S 3rd Street/Muller Road. Also, daily supply trucks would travel along SR 6 to S 3rd Street/Muller Road to access FR 1000.

Construction of the FRE facility would occur over 5 years. Total daily trips in the Pe Ell area along SR 6 to S 3rd Street/Muller Road would be limited to worker vehicles, supply trucks, and trucks carrying logs, estimated to total less than 88 trips per day during the 5-year construction period. Table K-5 presents AADT along S 3rd Street/Muller Road from Pe Ell to FR 1000, and along SR 6 (from the Centralia/Chehalis area) to S 3rd Street/Muller Road. Based on projections, it is estimated that traffic along SR 6 to S 3rd Street/Muller Road would increase by less than 5% over the 5-year period. However, the increase in traffic on S 3rd Street/Muller Road would increase by just under 20%. Although traffic would increase during construction, as indicated in Table K-5, the LOS would remain the same and not exceed Lewis County's goal of LOS C (Lewis County 2018c). Therefore, there would be a **moderate** adverse impact on roadways during construction of the FRE facility due to increased temporary traffic.

Table K-5
Average Annual Daily Traffic and Level of Service Comparison for SR 6 and Muller Road

BEGIN	END	2018 AADT	2025 AADT/ LOS	2025 AADT/ LOS WITH CONSTRUCTION	2030 AADT/ LOS	2030 AADT/ LOS WITH CONSTRUCTION
S 3rd Street/Muller Road at SR 6	Muller Road at end of maintenance (start of FR 1000)	370	425/ A	513 B	469/ B	557/ B
SR 6 at S 3rd Street/Muller Road (MP 28.21)	SR 6 to MP 28.31	1,600[a]	1,875/ C	1,963/ C	2,070/ C	2,158/ C

Notes:
a. AADT for MP 28.21 to 27.83 (1,300) and MP 28.731 (1,900).
AADT calculated using Lewis County Public Works AADT Forecast Methodology, April 1, 2019.
LOS estimated using Table 6, FDOT 2013.
Sources for 2017 and 2018 AADT: Kroll 2019; St. Charles 2019
MP: mile post

Due to current at-grade rail crossing regulations, rail operations would not be affected by construction traffic. Therefore, **no adverse impacts** on rail or transit are anticipated.

The FRE facility site is in a remote area, accessible only by FR 1000 (a private forest road). Construction (and operation) activities would require use of existing roads as a permanent bypass or detour for FR 1000, which is a main access road for Weyerhaeuser forestry operations. The FR 1000 bypass or detour would also provide access to the temporary reservoir area on a permanent basis when the FRE facility is in operation and FR 1000 is inundated (see operations impacts in Section 3.2.2).

In addition, several miles of upgrades and widening of existing forest roads, and potentially some new temporary road segments, would be constructed to access the FRE facility and quarry sites. As proposed, the FRE facility construction would require developing a quarry to provide aggregate for the FRE facility structure. This would also include constructing or upgrading roads to the quarry, identifying material storage and processing sites, and constructing areas for offices and storing equipment. Concrete aggregate could be mined within the FRE facility site or nearby, depending on aggregate availability. The proposed quarry sites are the North Quarry, South Quarry, and Huckleberry Ridge (Figure K-2). The North Quarry option would require widening 1.9 miles of 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.

Specific locations and the extent of improvements to the bypass road for FR 1000 and other road segments in the temporary reservoir and for quarries would be defined during the detailed design and permitting phase. Approximately 13.5 miles of unpaved access roads would be widened for quarry and construction access, resulting in up to about 21 acres of clearing to widen roads.

For roads in managed forests, the owner of the managed forestland would be required to comply with all DNR regulations regarding the construction of new forest roads, upgrades and widening of existing forest roads, and maintenance and decommissioning of forest roads. A Forest Practices Application/Notification (FPA/N) would be required for roads in managed forests. Under Washington Administrative Code (WAC) 222-24, all new forest roads are required to be constructed to state Forest Practice Standards, and all existing forest roads that are used are to be maintained to Forest Practice Standards. DNR requirements are specifically designed to ensure that forest roads are constructed and maintained for the safe passage of heavy equipment and vehicles, while ensuring the preservation of the natural environment. With these requirements, impacts of road construction for bypass and access in managed forests would be **minor adverse impacts.**

The FRE facility and the temporary reservoir area would not be managed forestland. For the conversion of the land from managed forest to non-managed forest at the FRE facility site and temporary reservoir areas, the Applicant would need a Class IV-General Forest Practices Application for the harvest of trees from DNR. Under this application, the roads constructed for the harvest of trees would be required to meet Forest Practices standards. With this application, impacts to roads used for bypass or access that are not in managed forestland would have **minor adverse impacts**.

Once the land in the temporary reservoir area is converted, and for any roads used for construction of the FRE facility not covered under the Class IV-General Forest Practices Application, local and state permits would apply for construction activities in this area. The creation and use of temporary construction access roads would increase the potential for sediment entry into surface waters and could increase turbidity in surface waters. The introduction of construction vehicles, equipment, and materials would also increase the potential for pollutants (e.g., oil and grease, hydraulic fluids, metals) to enter surface waters through stormwater runoff. As described in the *Water Discipline Report,* construction activities for the FRE facility and temporary reservoir area would be regulated by a Washington Department of Ecology (Ecology) National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permit and local land use and development permits issued by Lewis County. The NPDES Construction Stormwater Permit includes conditions requiring the permittee to control flow rates to protect waterways downstream, as required by the local plan approval authority. Roads constructed, upgraded, or used for the Proposed Action that are not in managed forests would result in **moderate to minor adverse impacts.** A mitigation measure is proposed for the Applicant to meet all Forest Practices requirements for road building, maintenance, and abandonment for roads not in managed forestland. The Applicant will ensure that road construction (and equipment on the roadway) and maintenance are

in accordance with state requirements for protection of streams, wetlands, unstable slopes, or other sensitive sites.

See also the *Wetlands Discipline Report* (Anchor QEA 2020b), W*ildlife Species and Habitats Discipline Report* (Anchor QEA 2020c), and *Earth Discipline Report* (Shannon & Wilson and Watershed Geodynamics 2020) for additional information on impacts related to forest road construction.

3.2.1.1.2 Airport Levee Changes

The Airport Levee Changes include raising the existing levee around the Chehalis-Centralia Airport and a portion of NW Louisiana Road. The purpose of these changes is to provide protection from catastrophic flood levels for the Chehalis-Centralia Airport, local businesses, and a portion of I-5. Approximately 810 feet of NW Louisiana Road, along the southern extent of the airport, would be raised to meet the airport levee height.

Per the Applicant, during construction, traffic would be rerouted to NW Airport Road, NW West Street, NW Chamber of Commerce Way, and NW Louisiana Avenue. Based on information provided by the Applicant, it is estimated that on average, approximately 88 truck trips per day during the 1-year construction period would travel to/from the construction areas (see Table K-6). Vehicles traveling on the surrounding roadways, including I-5 and its on-ramps and off-ramps, would likely encounter moderate congestion and delays due to truck activity, which could affect travel to commercial development near the airport or airport operations. Truck haul routes for the Airport Levee Changes are illustrated in Figure K-4. The City of Chehalis's LOS goal for the locations identified in Table K-7 is LOS D (City of Chehalis 2017). Based on estimates of LOS during construction using the FDOT simplified method, the City's LOS goals would still be met.

Table K-6
Estimated Construction Trips for the Airport Levee Changes, 2025–2026

TRIP TYPE	DAILY*	TOTAL
Vehicles, Trucks, and Equipment	88	22,900

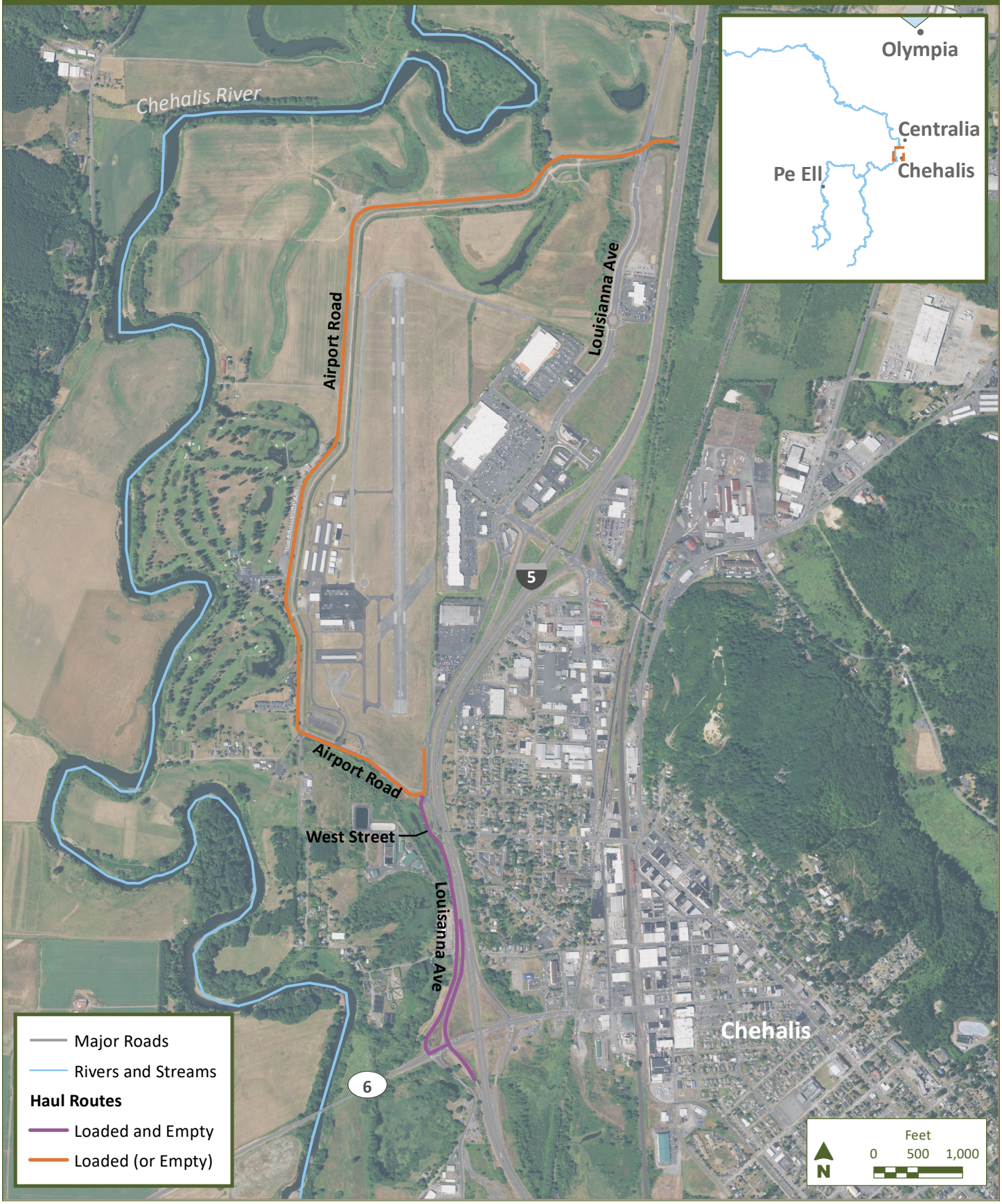
Note:
*Assumes 52 weeks, 5 days per week.

Table K-7
Average Annual Daily Traffic and Level of Service Comparison for NW Airport Road

BEGIN	END	2018 AADT	2025 AADT/ LOS	2025 AADT/ LOS WITH CONSTRUCTION	2030 AADT/ LOS	2030 AADT/LOS WITH CONSTRUCTION COMPLETED
NW Airport Road at Mellen Street	NW Airport Road at NW Louisiana Avenue	6,560	7,537/ C	7,546/ C	8,321/ C	8,330/ C

Notes:
AADT calculated using Lewis County Public Works AADT Forecast Methodology, April 1, 2019.
LOS estimated using Table 1, FDOT 2013.
Source for 2018 AADT: Kroll 2019

Figure K-4
Haul Routes Associated with Airport Levee Changes



Potential impacts on traffic flow (congestion and delays) would be minimized through implementation of a Traffic Control Plan in coordination with the City of Chehalis and in accordance with the *Manual on Uniform Traffic Control Devices* (FHWA 2009). A Traffic Control Plan is required for any project that includes construction on or along traveled roadways in the City of Chehalis. While there would be typical construction delays, adverse impacts would be **moderate to minor** because a Traffic Control Plan, which includes flagging, detours, and other traffic management methods, would be required during construction.

3.2.1.2 Indirect

No indirect impacts on the transportation system from the construction of the Airport Levee Changes as part of the Proposed Action are anticipated.

3.2.2 Impacts from Operation

This section describes the impacts from operation of the FRE facility, including transportation impacts resulting from maintenance activities at the FRE facility and temporary reservoir, maintenance activities at the airport levee, and changes in flood inundation throughout the study area.

3.2.2.1 Direct

3.2.2.1.1 Flood Retention Expandable Facility

Operation of the Proposed Action would include transportation for maintenance of the FRE facility and temporary reservoir vegetation, disposal of large woody material from the temporary reservoir after a major or larger flood, transportation of fish from the FRE facility to upstream locations when the reservoir is temporarily holding water, and maintenance of the bypass road. It would also include transportation for FRE facility workers in and around the area before, during, and after a major or larger flood.

On a regular basis, operation of the FRE facility would generate few vehicle trips, limited to travel for periodic maintenance. Vehicle and equipment trips would increase before, during, and after a major flood or larger with operation of the FRE facility, trap-and-transport facility, and during debris removal. During and after a major or larger flood, large woody material would be moved from the temporary reservoir area to an existing log sorting yard previously operated by Weyerhaeuser. The log sorting yard is on the west bank of the Chehalis River between RM 109.6 and RM 109.9. The site is expected to be accessed using the FR 1000 detour route (Figure K-5). The Applicant stated this site was selected because of the relatively flat topography, ground elevation, and proximity to existing roadways. Woody material would be transported away from the log sorting yard by truck. The woody material would be removed after the temporary reservoir is drained and once the ground dries out enough to allow heavy equipment onto the sorting yard. A trap-and-transport facility utilizing trucks would be used to provide upstream fish passage during major or larger floods, but would result in minimal truck trips during periodic flood recurrences (approximately every 7 years). Based on the limited operations and

maintenance trips, the completed FRE facility would cause a **negligible** increase in traffic on local roadways.

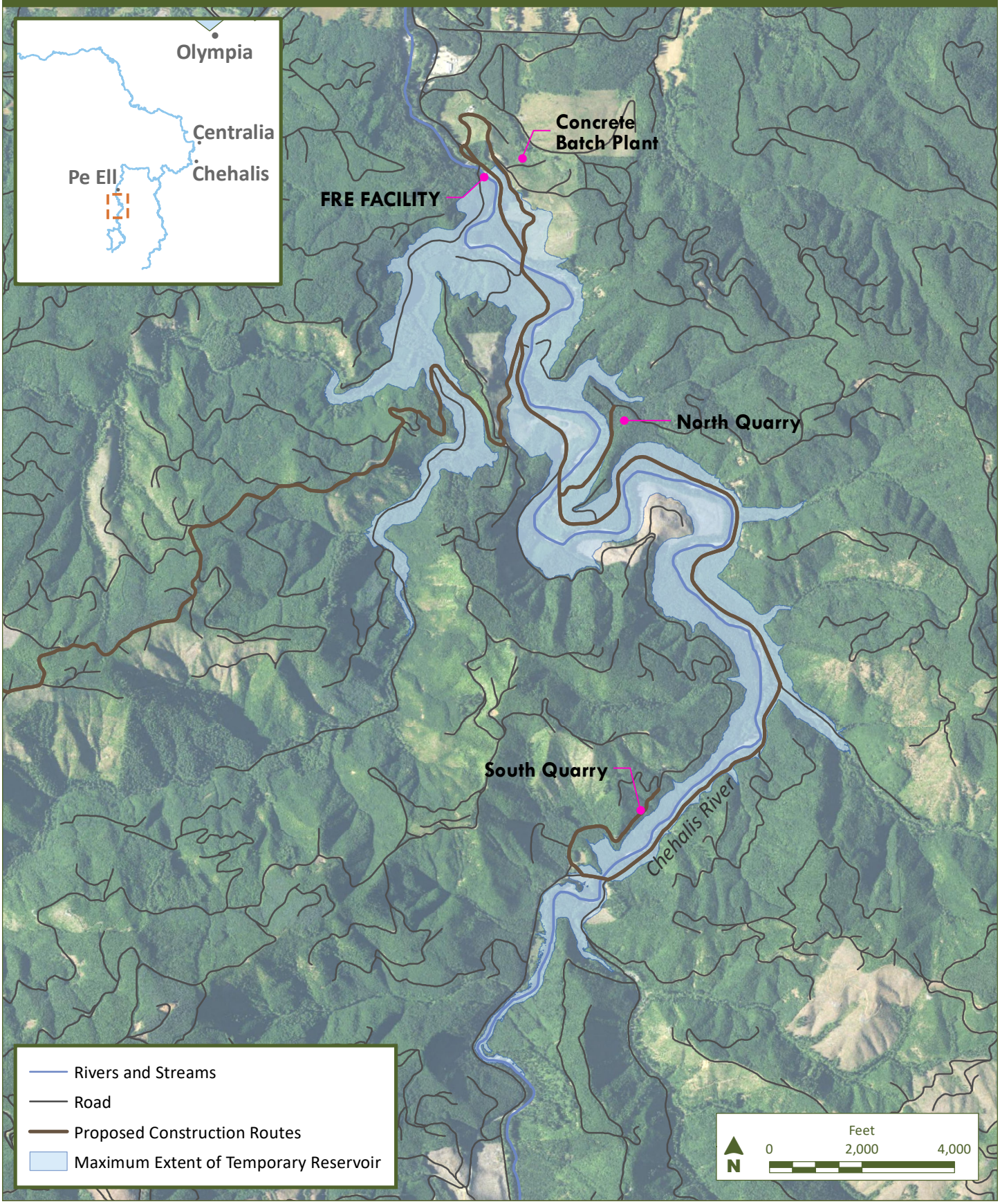
For the FRE facility, a bypass road for FR 1000 would provide access when the FRE facility is in operation and when FR 1000 is inundated. There may be times when the bypass is also temporarily inundated. Per the Applicant, up to 6 miles of FR 1000 would be inundated and unavailable during major peak flood retention, at which time a detour could be used consisting of existing roads to rejoin FR 1000 upstream of the temporary reservoir (Figure K-5). Roads in managed forests are subject to DNR Forest Practices requirements. These requirements ensure that road use and maintenance do not affect streams, wetlands, unstable slopes, or other sensitive sites. Use of these forest roads during FRE facility operations would not result in any significant impacts on forest roads because DNR requirements are specifically designed to ensure that forest roads are constructed and maintained for the safe passage of vehicles and equipment, while preserving the natural environment.

As described in the *Earth Discipline Report*, there are several potential deep- and shallow-rapid landslide areas in the temporary reservoir area. When the reservoir impounds water, the soil in areas that are underwater will become saturated. As the reservoir drains, these saturated soils will no longer be supported by the reservoir water and could be susceptible to shallow-rapid landslides which could affect roads. Erosion could also occur when the reservoir drains, potentially affecting roads in the reservoir area. Road stability may also be affected by inundation.

For roads used for the Proposed Action in the temporary reservoir area where the Forest Practices requirements do not apply, a mitigation measure in included in Section 3.2.4 to reduce impacts to the environment by having the Applicant meet all Forest Practices requirements for road maintenance. The Applicant will ensure that road maintenance is in accordance with state requirements for protection of streams, wetlands, unstable slopes, or other sensitive sites. An additional mitigation measure for the roads in the temporary reservoir is to meet all Forest Practices requirements for road building, maintenance, and abandonment for protection of streams, wetlands, unstable slopes, or other sensitive sites.

With the implementation of the requirements in the Forest Practices Application for roads in managed forests, and mitigation measures for roads in the temporary reservoir area, impacts related to road maintenance and use would be **minor**.

Figure K-5
Inundation of Forest Roads Within the Temporary Reservoir



3.2.2.1.2 Airport Levee Changes

Operation and maintenance of the Airport Levee Changes and raising of NW Louisiana Avenue would not result in long-term impacts on the transportation system because there would be no change in roadway capacity or travel patterns. Once completed, the roadway would have the same geometric and operational characteristics as the original roadway. **No adverse impacts** on rail or transit are anticipated from operation of the airport levee.

3.2.2.1.3 Changes in Flood Inundation

Based on modeling, the FRE facility would reduce flooding at key transportation locations that were identified by local public works officials and historical data, and would decrease the duration of roadway closures at most locations. The following discussion presents findings for both a major flood and a catastrophic flood, as identified in Tables K-8 and K-9.

The Applicant's project description (included in Anchor QEA 2020d) identifies metrics to measure the objective of reducing flood damage through the Proposed Action, including the following:

- "Reducing the disruption of access via main transportation routes, specifically ensuring access along State Route (SR) 6 and Interstate 5 (I-5) is open within 24 hours of a 100-year flood"
- "Minimizing flood-related impacts (e.g., closure) at the Chehalis-Centralia Airport"

I-5 Main Line and Interchanges

Seven locations along I-5 or on its interchanges were reviewed as part of this analysis (Figure K-6). As presented in Table K-8, flooding would not occur during a major mid-century or late-century flood under the No Action Alternative. However, during a catastrophic event (mid- or late-century), six of the seven locations would experience flooding under the No Action Alternative.

No Action Alternative flooding levels during a mid-century catastrophic flood would range from 0.2 foot at I-5 at the 13th Street interchange to 7 feet at the I-5 interchange at NW Chamber of Commerce Way. At one location, 1,700 feet north of the 13th Street interchange on I-5, 1.8 feet of flooding would be expected under the No Action Alternative. Under the Proposed Action, flooding would be eliminated in four of the six locations. In other locations, flood depths would be reduced but may still result in road closures. At the I-5 interchange at Chamber of Commerce Way, floodwaters would be reduced to just under 0.42 foot. At I-5, 1,700 feet north of the 13th Street interchange, the roadway would be flooded by almost 0.75 foot. Although there are no formal criteria for road closures, local officials stated that the rule of thumb is typically to close roads when inundated by 0.25 to 0.33 foot (Hurley 2019a, 2019b; Ashmore 2019; Sahlin 2019a, 2019b). However, WSDOT monitors this section of I-5 and will proactively close I-5 if the levee is predicted to overtop (Gernhart 2019). Therefore, these roads are expected to be closed if flooded.

Figure K-6
Locations Evaluated for Flooding at I-5 and Interchanges

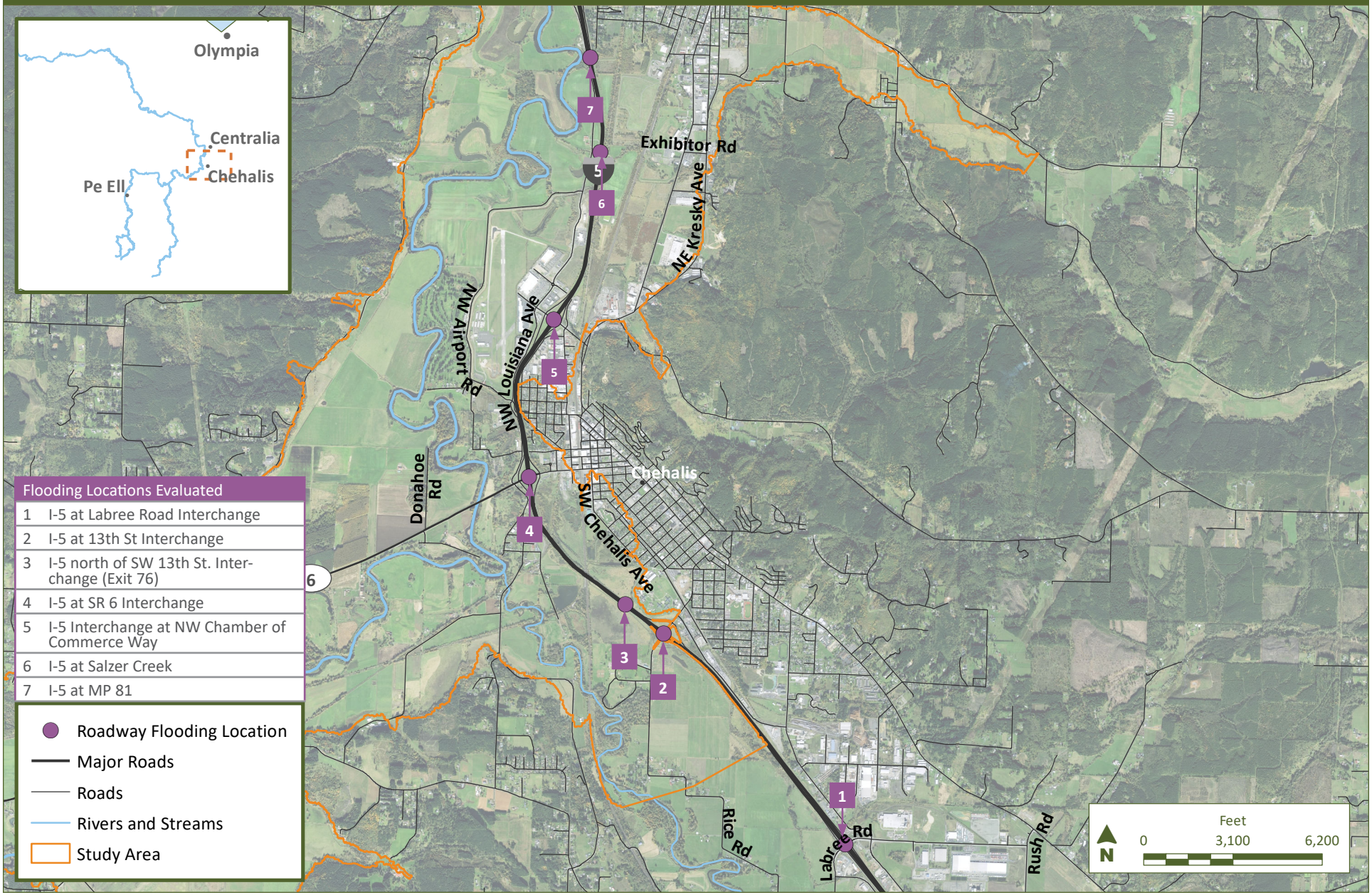


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Table K-8
Maximum Simulated Flood Depth for Transportation Facilities with Proposed Action and No Action Alternative (Feet)

LOCATION	MAJOR FLOOD						CATASTROPHIC FLOOD					
	MID-CENTURY			LATE-CENTURY			MID-CENTURY			LATE-CENTURY		
	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE
DRYAD												
Leudinghaus Road east of Chandler Road	0.0	0.0	0.0	0.0	0.0	0.0	5.0	**0.0**	-5.0	6.0	**0.0**	-6.0
CURTIS												
Boistfort Road at Curtis Hill Road	0.1	0.1	0.0	0.2	0.2	0.0	2.4	0.7	-1.7	4.0	1.2	-2.8
BUNKER HILL												
Bunker Creek Road at Deep Creek Road	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.1	-1.1	1.8	0.4	-1.5
ADNA												
Dieckman Road north of Bunker Creek Road	0.0	0.0	0.0	0.0	0.0	0.0	3.6	1.6	-2.0	4.2	2.4	-1.9
CHEHALIS-CENTRALIA												
SW Chehalis Avenue/SW John Street[1]	2.3	**0.0**	-2.3	3.3	2.6	-0.7	6.4	5.3	-1.1	6.9	6.0	-0.9
SW Riverside Drive/ SW Newaukum Avenue	0.6	**0.0**	-0.6	0.9	0.4	-0.5	2.6	1.4	-1.2	3.2	2.2	-0.9
NW Airport Road west of NW Louisiana Avenue[2]	0.0	0.0	0.0	0.1	**0.0**	-0.1	2.8	1.7	-1.0	3.6	2.9	-0.6
National Avenue north of NE Kresky Avenue	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.3	-2.7	4.3	1.1	-3.2
NE Kresky Avenue/Exhibitor Road	0.0	0.0	0.0	1.1	**0.0**	-1.1	5.8	3.1	-2.6	7.1	4.0	-3.1
Mellen Street at I-5 Interchange[3]	0.0	0.0	0.0	0.0	0.0	0.0	1.0	**0.0**	-1.0	2.4	0.8	-1.6
Harrison Avenue at I-5 Interchange[4]	0.2	0.2	0.0	1.5	1.5	0.0	3.7	3.6	-0.1	4.1	4.0	-0.1
NAPAVINE												
Rush Road at I-5 Interchange[5]	3.4	3.4	0	3.6	3.6	0.0	5.3	5.3	0.0	6.5	6.5	0.0
INTERSTATE 5												
I-5 at Labree Road Interchange	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-5 at 13th Street Interchange	0.0	0.0	0.0	0.0	0.0	0.0	0.2	**0.0**	-0.2	0.5	**0.0**	-0.5
I-5 north of SW 13th Street Interchange (Exit 76)	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.7	-1.1	2.3	1.4	-0.9
I-5 at SR 6 Interchange	0.0	0.0	0.0	0.0	0.0	0.0	0.8	**0.0**	-0.8	1.2	0.5	-0.8
I-5 Interchange at NW Chamber of Commerce Way [6]	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.4	-6.6	8.4	4.7	-3.8
I-5 at Salzer Creek	0.0	0.0	0.0	0.0	0.0	0.0	1.1	**0.0**	-1.1	2.6	0.1	-2.4
I-5 at Mile Post 81	0.0	0.0	0.0	0.0	0.0	0.0	1.9	**0.0**	-1.9	3.2	0.3	-2.9
STATE ROUTE 6												
SR 6 and River Road	0.0	0.0	0.0	0.0	0.0	0.0	0.9	**0.0**	-0.9	2.2	**0.0**	-2.2
SR 6 and Boistfort Road	0.0	0.0	0.0	0.0	0.0	0.0	5.7	0.8	-4.8	7.5	1.8	-5.7
SR 6 and Spooner Road	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR 6 near Twin Oaks Road (600 feet west of intersection)	1.1	**0.0**	-1.1	2.7	0.4	-2.4	5.5	3.8	-1.6	6.0	4.5	-1.4
SR 6 and Heden Road	0.4	**0.0**	-0.4	0.5	0.2	-0.3	2.1	1.1	-1.0	2.6	1.5	-1.0
SR 6 and Donahoe Road	0.0	0.0	0.0	0.0	0.0	0.0	0.3	**0.0**	-0.3	0.5	0.1	-0.4
GRAND MOUND TO WEST OF MONTESANO												
188th Avenue and Moon Road	2.6	2.2	-0.5	3.0	2.5	-0.5	4.4	3.8	-0.6	4.9	4.1	-0.8
US 12 and Blockhouse Road	0.0	0.0	0.0	0.0	0.0	0.0	0.7	**0.0**	-0.7	1.8	0.4	-1.4
Slate Street and Harris Avenue	0.0	0.0	0.0	0.0	0.0	0.0	0.9	**0.0**	-0.9	1.8	0.4	-1.4
Elma Gate Road and Shelton Road	0.6	**0.0**	-0.6	1.1	0.5	-0.5	3.5	2.4	-1.1	4.5	3.3	-1.3
US 12 west of Wakefield Road	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.1	-1.2	2.4	1.2	-1.2
SR 107, just south of US 12	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.5	-0.6	2.1	1.3	-0.8

Notes:

1. The intersection of SW John Street and SW Chehalis Avenue is a low-lying area that does not drain in the model after floodwater reaches it.
2. Flood depths for NW Airport Road / Louisiana Avenue are based on the existing ground level of the road; if this road is raised as part of the Airport Levee Changes, the Proposed Action flood depths would be zero.
3. Mellen Street passes under I-5; I-5 is not inundated at this location.
4. Harrison Avenue passes under I-5; flooding at this location is primarily influenced by the Skookumchuck River; I-5 is not inundated at this location.
5. The Rush Road underpass under I-5 is flooded by the Newaukum River. Flooding at this location is not influenced by the Proposed Action; I-5 is not inundated at this location.
6. Maximum simulated flood depths at I-5 near NW Chamber of Commerce Way are not thought to be affected by the fact that the culverts and pump station that drain this area are not included in the main stem RiverFlow2D model.

Bold and shading indicates locations where the flood depth is reduced to zero under the Proposed Action.

Table K-9
Estimated Flood Duration at Transportation Facilities with Proposed Action and No Action Alternative (Hours)

	MAJOR FLOOD						CATASTROPHIC FLOOD					
	MID-CENTURY			LATE-CENTURY			MID-CENTURY			LATE-CENTURY		
LOCATION	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE
DRYAD												
Leudinghaus Road east of Chandler Road	0	0	0	0	0	0	11	**0**	-11	14	**0**	-14
CURTIS												
Boistfort Road at Curtis Hill Road	0	0	0	0	0	0	15	14	-1	18	17	-1
BUNKER HILL												
Bunker Creek Road at Deep Creek Road	0	0	0	0	0	0	12	**0**	-12	15	4	-11
ADNA												
Dieckman Road north of Bunker Creek Road	0	0	0	0	0	0	16	7	-9	18	11	-7
CHEHALIS-CENTRALIA												
SW Chehalis Avenue/SW John Street[1]	18	0	-18	29	18	-11	49	44	-5	57	50	-7
SW Riverside Drive/ SW Newaukum Avenue	10	**0**	-10	18	4	-14	39	31	-8	45	36	-9
NW Airport Road west of NW Louisiana Avenue[2]	0	0	0	0	0	0	30	20	-10	35	27	-8
National Avenue north of NE Kresky Avenue	0	0	0	0	0	0	22	3	-19	29	16	-13
NE Kresky Avenue/Exhibitor Road	0	0	0	15	**0**	-15	42	34	-8	48	41	-7
Mellen Street at I-5 Interchange[3]	0	0	0	0	0	0	17	**0**	-17	27	8	-19
Harrison Avenue at I-5 Interchange[4]	0	0	0	10	10	0	28	25	-3	35	31	-4
NAPAVINE												
Rush Road at I-5 Interchange[5]	10	10	0	12	12	0	17	17	0	23	23	0
INTERSTATE 5												
I-5 at Labree Road Interchange	0	0	0	0	0	0	0	0	0	0	0	0
I-5 at 13th Street Interchange	0	0	0	0	0	0	0	0	0	10	**0**	-10
I-5 north of SW 13th Street Interchange (Exit 76)	0	0	0	0	0	0	20	12	-8	25	20	-5
I-5 at SR 6 Interchange	0	0	0	0	0	0	9	**0**	-9	15	6	-9
I-5 Interchange at NW Chamber of Commerce Way[6,7]	0	0	0	0	0	0	52	13	-39	59	48	-11
I-5 at Salzer Creek	0	0	0	0	0	0	10	**0**	-10	18	**0**	-18
I-5 at Mile Post 81	0	0	0	0	0	0	14	**0**	-14	22	2	-20
STATE ROUTE 6												
SR 6 and River Road	0	0	0	0	0	0	4	**0**	-4	7	**0**	-7
SR 6 and Boistfort Road	0	0	0	0	0	0	15	6	-9	17	9	-8
SR 6 and Spooner Road	0	0	0	0	0	0	0	0	0	0	0	0
SR 6 near Twin Oaks Road (600 feet west of intersection)	15	**0**	-15	19	3	-16	31	22	-9	35	25	-10
SR 6 and Heden Road	9	**0**	-9	16	**0**	-16	34	24	-10	40	29	-11
SR 6 and Donahoe Road	0	0	0	0	0	0	5	**0**	-5	11	0	-11
GRAND MOUND TO WEST OF MONTESANO												
188th Avenue and Moon Road	73	72	-1	86	83	-3	102	103	1	115	118	3
US 12 and Blockhouse Road	0	0	0	0	0	0	14	**0**	-14	24	9	-15
Slate Street and Harris Avenue	0	0	0	0	0	0	14	**0**	-14	23	9	-14
Elma Gate Road and Shelton Road	19	**0**	-19	33	21	-12	53	48	-5	61	55	-6
US 12 west of Wakefield Road	0	0	0	0	0	0	15	**0**	-15	26	14	-12
SR 107, just south of US 12	0	0	0	0	0	0	23	13	-10	33	27	-6

Notes:

1. The intersection of SW John Street and SW Chehalis Avenue is a low-lying area that does not drain in the model after floodwater reaches it.
2. Flood durations for NW Airport Road are based on the existing ground level of the road; if this road is raised as part of the Airport Levee Changes, the Proposed Action flood durations would be zero.
3. Mellen Street passes under I-5; I-5 is not inundated at this location.
4. Harrison Avenue passes under I-5; flooding at this location is primarily influenced by the Skookumchuck River; I-5 is not inundated at this location.
5. Rush Road passes under I-5. It is flooded by the Newaukum River, and flooding at this location is not influenced by the Proposed Action; I-5 is not inundated at this location model, which only considers drawdown after the peak of the flood. The model includes four culverts (two 84-inch, one 48-inch, one 36-inch) and a 25 cfs pump station draining the airport area.
6. Flood durations at I-5 near NW Chamber of Commerce Way are affected by ponding within the airport levee. Flood duration results for this area were estimated using a modified version of the RiverFlow2D model that includes the pumps and culverts. The analysis does not, however, include small-scale drainage features such as storm drains and ditches.
7. The flood duration for the late-century catastrophic flood with the Proposed Action at I-5 near NW Chamber of Commerce Way was simulated using a test version of the model that attempts to simulate the drawdown after the peak of the flood. The level of accuracy of this duration analysis is uncertain.

Bold and shading indicates locations where the flood depth is reduced to zero under the Proposed Action. Note that model constraints means that a depth of zero feet could range from zero to 3 inches.

Under a late-century catastrophic flood, No Action Alternative flooding levels would range from 0.5 foot at I-5 at the 13th Street interchange to 8.4 feet at the I-5 interchange at NW Chamber of Commerce Way. Five of the six locations would continue to flood under the Proposed Action, as shown in Table K-8. Of these five locations, only one, I-5 at Salzer Creek, would be inundated by flood levels lower than 0.25 foot.

Table K-9 presents the durations that roadways would be inundated. Under the mid-century catastrophic flood scenario with the Proposed Action, two I-5 locations would no longer be inundated (I-5 at SR-6, I-5 at Salzer Creek, and I-5 at Mile Post 81) and two I-5 locations would be inundated at substantially shorter durations as compared to the No Action Alternative. The location 1,700 feet north of the 13th Street interchange on I-5 would be inundated for 12 hours under the Proposed Action (versus 20 hours under the No Action Alternative), while the I-5 interchange at NW Chamber of Commerce Way would be inundated for 13 hours under the Proposed Action (compared to 52 hours under the No Action Alternative).

Under the late-century catastrophic flood scenario with the Proposed Action, four locations on I-5 would continue to be inundated, although durations would be reduced by up to 20 hours as compared to No Action, depending on the location. At the I-5 interchange at NW Chamber of Commerce Way, under the late-century catastrophic flood scenario, the Proposed Action would reduce the flood duration by 11 hours. However, the flood duration at this location would be 48 hours, thereby not meeting the Applicant's objective to reduce the closure of I-5 to less than 24 hours. Although flood duration would be reduced, this location would continue to experience significant impacts. Planning is underway by WSDOT to implement culvert changes at the I-5 / NW Chamber of Commerce Way intersection that are expected to reduce flooding at this location. It is expected that the Applicant will work with WSDOT to consider if further actions are needed to reduce flooding at this intersection.

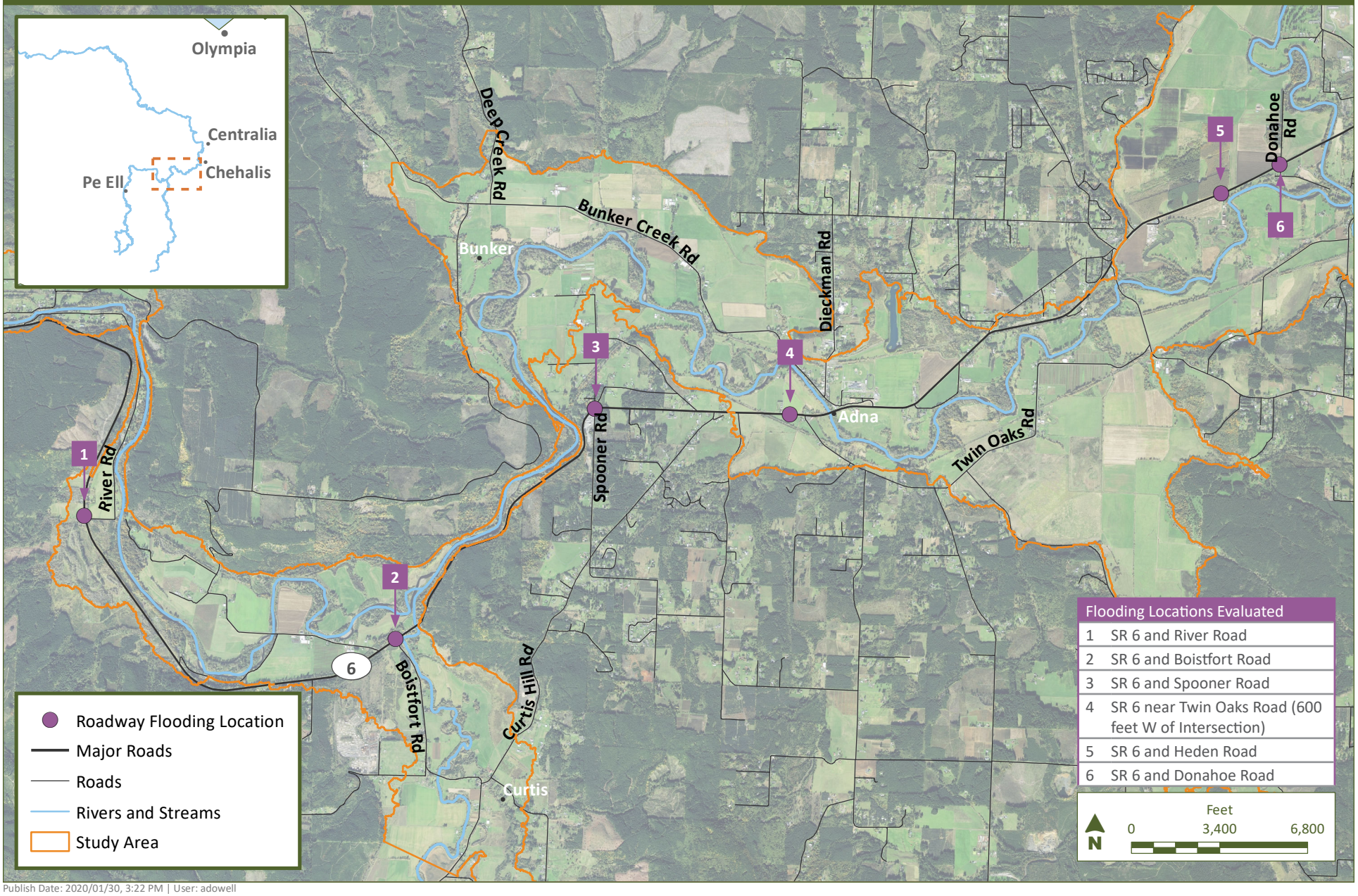
State Route 6

Six locations along SR 6 were reviewed as part of this analysis (Figure K-7). The following discussion compares various locations under the No Action Alternative and the Proposed Action for the major and catastrophic flood scenarios.

Major Flood Scenario

As presented in Table K-8, limited flooding of SR 6 would occur under the No Action Alternative during a mid-century major flood and a late-century major flood at Twin Oaks Road (1.1 feet and 2.7 feet) and Heden Road (0.4 foot and 0.5 foot). Neither location would flood in a mid-century major flood under the Proposed Action. Under the late-century major flood scenario with the Proposed Action, both locations would experience reduced flooding (0.4 foot at Twin Oaks Road and 0.2 foot at Heden Road). SR 6 at Twin Oaks Road would be inundated for 3 hours compared to 19 hours under the No Action Alternative.

Figure K-7
Locations Evaluated for Flooding at State Route 6



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Catastrophic Flood Scenario

Five of the six locations along SR 6 would flood during a mid-century catastrophic flood under the No Action Alternative. Flood depths would range from just under 0.33 foot (SR 6 at Donahoe Road) to just under 6 feet (SR 6 at Boistfort Road). Under the Proposed Action, this flooding would be reduced considerably, as shown in Table K-8. Although durations would be reduced under the Proposed Action at all locations (Table K-9), SR 6 near Twin Oaks Road and SR 6 and Heden Road would both experience inundation durations of up to 24 hours.

Five of the six locations along SR 6 would also flood during a late-century catastrophic flood under the No Action Alternative. Flood depths would range from 0.5 foot (SR 6 at Donahoe Road) to 7.5 feet (SR 6 at Boistfort Road). Under the Proposed Action, this flooding would be reduced considerably, with the greatest depth being at SR 6 near Twin Oaks Road (4.5 feet). Although durations would be reduced under the Proposed Action at all locations (Table K-9), SR 6 near Twin Oaks Road would be inundated for 25 hours and SR 6 and Heden Road would be inundated for up to 29 hours. SR 6 at Boistfort Road would be inundated for up to 9 hours, with a modeled depth of 1.8 feet under the Proposed Action.

At SR 6 near Twin Oaks Road and SR 6 and Heden Road, flood duration, although reduced by up to 11 hours under the Proposed Action, would still last for up to 25 and 29 hours respectively. Therefore, under the late-century catastrophic flood, the Applicant's objective to reduce the closure of roadways to less than 24 hours would not be met at these locations. Although flood duration would be reduced, this location would continue to experience significant impacts.

Chehalis, Centralia, and Napavine Roadways

Eight locations along select major arterials in Chehalis, Centralia, and Napavine (Figure K-8) were reviewed as part of this analysis. Locations were chosen based on interviews with local officials and historical data. The following discussion compares various locations under the No Action Alternative and the Proposed Action for major and catastrophic floods.

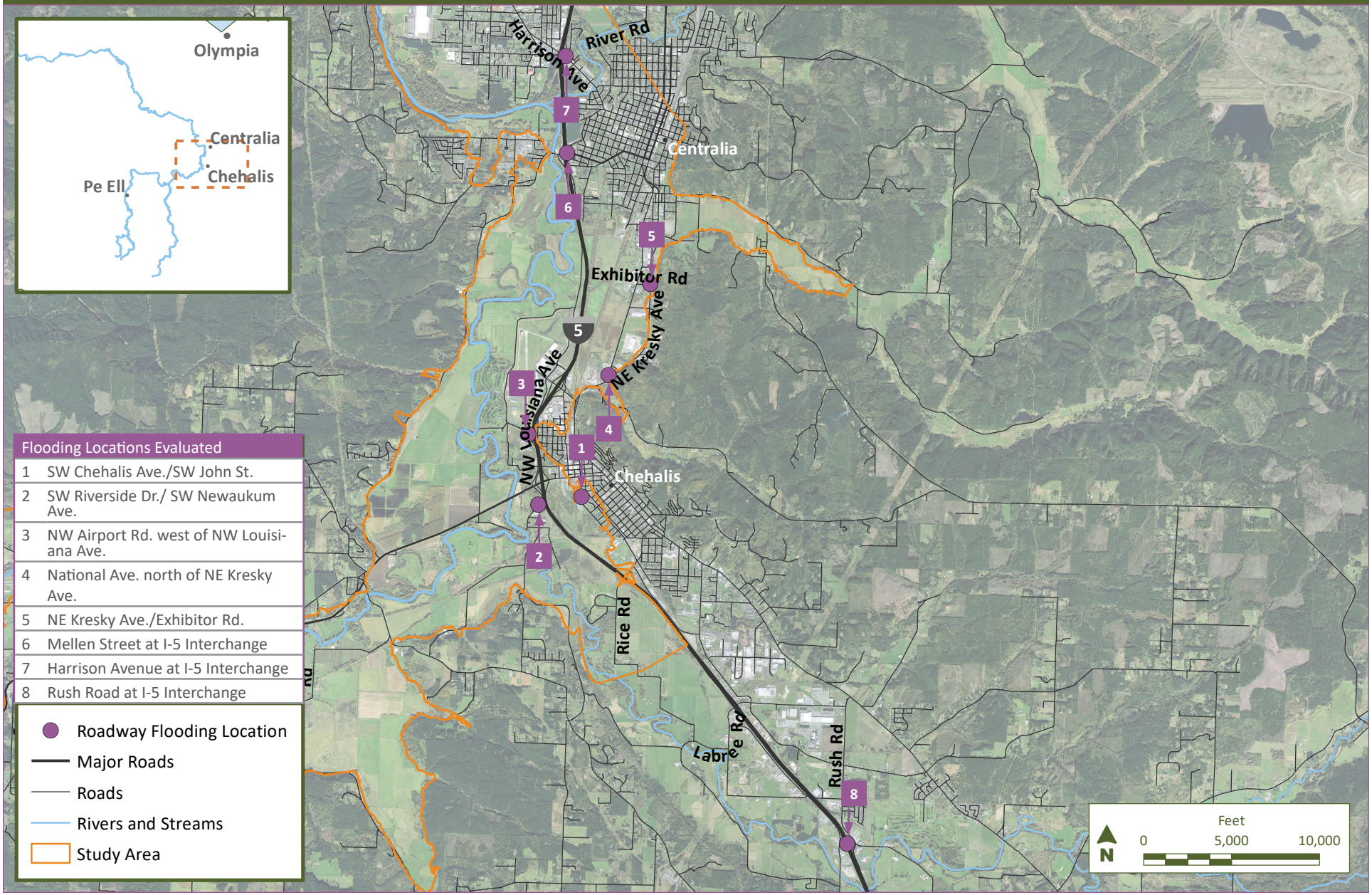
Major Flood Scenario

As presented in Table K-8, limited or no flooding would occur under the No Action Alternative during the mid-century major flooding scenario, except at the following locations:

- SW Riverside Drive and SW Newaukum Avenue: 0.6 foot
- SW Chehalis Avenue and SW John Street: 2.3 feet
- Harrison Avenue at I-5 interchange: 0.2 foot
- Rush Road under I-5 interchange: 3.4 feet

Under the Proposed Action, flooding would be reduced to zero in all of these locations except the Harrison Avenue and Rush Road locations, where flood levels would not change.

Figure K-8
Locations Evaluated for Flooding in Chehalis/Centralia/Napavine



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For the late-century major flooding scenario, under the No Action Alternative, the following five of the eight locations analyzed would experience flooding deep enough to likely result in a roadway closure:

- SW Chehalis Avenue and SW John Street: 3.3 feet
- SW Riverside Drive and SW Newaukum Avenue: 0.9 foot
- NE Kresky Avenue and Exhibitor Road: 1.1 feet
- Harrison Avenue at I-5 interchange: 1.5 feet
- Rush Road under I-5 interchange: 3.6 feet

Flooding would continue at the Rush Road and Harrison Avenue locations, at the same depth, under the Proposed Action. Depths at the other locations would be reduced considerably, as presented in Table K-8.

Flood inundation durations under the Proposed Action, as presented in Table K-9, would likely occur at four locations, ranging from 4 hours to 18 hours.

Catastrophic Flood Scenario

Flooding levels during a mid-century catastrophic flood under the No Action Alternative would occur at all eight locations reviewed. Flood depths would range from 1 foot (Mellen Street at I-5 interchange) to just over 6 feet (SW Chehalis Avenue and SW John Street). Under the Proposed Action, flooding would continue at seven of the eight locations. In some locations, as presented in Table K-8, flooding would be reduced by more than 2.5 feet. However, floodwaters are still expected to be more than 3 feet in the following three locations:

- SW Chehalis Avenue and SW John Street: 5.3 feet
- NE Kresky Avenue and Exhibitor Road: 3.1 feet
- Harrison Avenue at I-5 interchange: 3.6 feet.

Flooding levels would not be reduced at the Rush Road location under the Proposed Action.

Flood durations would be reduced under the Proposed Action at seven of the eight locations analyzed (Rush Road would still experience flooding for 17 hours under either alternative). However, as presented in Table K-9, road closures could extend beyond 24 hours in the following four locations:

- SW Chehalis Avenue and SW John Street: 44 hours
- SE Riverside Drive and SW Newaukum Avenue: 31 hours
- NE Kresky Avenue and Exhibitor Road: 34 hours
- Harrison Avenue at I-5 interchange: 25 hours

Flooding during a late-century catastrophic flood under the No Action Alternative would occur at all eight locations. Flood depths would range from 2.4 feet (Mellen Street at I-5 interchange) to around 7 feet (SW Chehalis Avenue and SW John Street). Under the Proposed Action, flooding would continue

at all eight locations. In some locations, as presented in Table K-8, flooding would be reduced by more than 3 feet. However, floodwaters are still expected to be more than 2 feet in the following five locations:

- SW Chehalis Avenue and SW John Street: 6.0 feet
- SE Riverside Drive and SW Newaukum Avenue: 2.2 feet
- NW Airport Road west of NW Louisiana Avenue: 2.9 feet
- NE Kresky Avenue and Exhibitor Road: 4.0 feet
- Harrison Avenue at I-5 interchange: 4.0 feet

Flooding levels would not be reduced at the Rush Road location under the Proposed Action.

Flood durations for the late-century catastrophic flood would be reduced under the Proposed Action at seven of the eight locations (Rush Road would still experience flooding for 23 hours under either alternative). However, as presented in Table K-9, road closures could extend beyond 24 hours in the following five locations:

- SW Chehalis Avenue and SW John Street: 50 hours
- SE Riverside Drive and SW Newaukum Avenue: 36 hours
- NW Airport Road west of NW Louisiana Avenue: 27 hours
- NE Kresky Avenue and Exhibitor Road: 41 hours
- Harrison Avenue at I-5 interchange: 31 hours

Western Lewis County

Four western Lewis County locations (in Dryad, Curtis, Bunker Hill, and Adna; Figure K-9) were analyzed based on inundation modeling and interviews with local agency representatives. The following discussion compares these locations under the No Action Alternative and the Proposed Action for major and catastrophic floods.

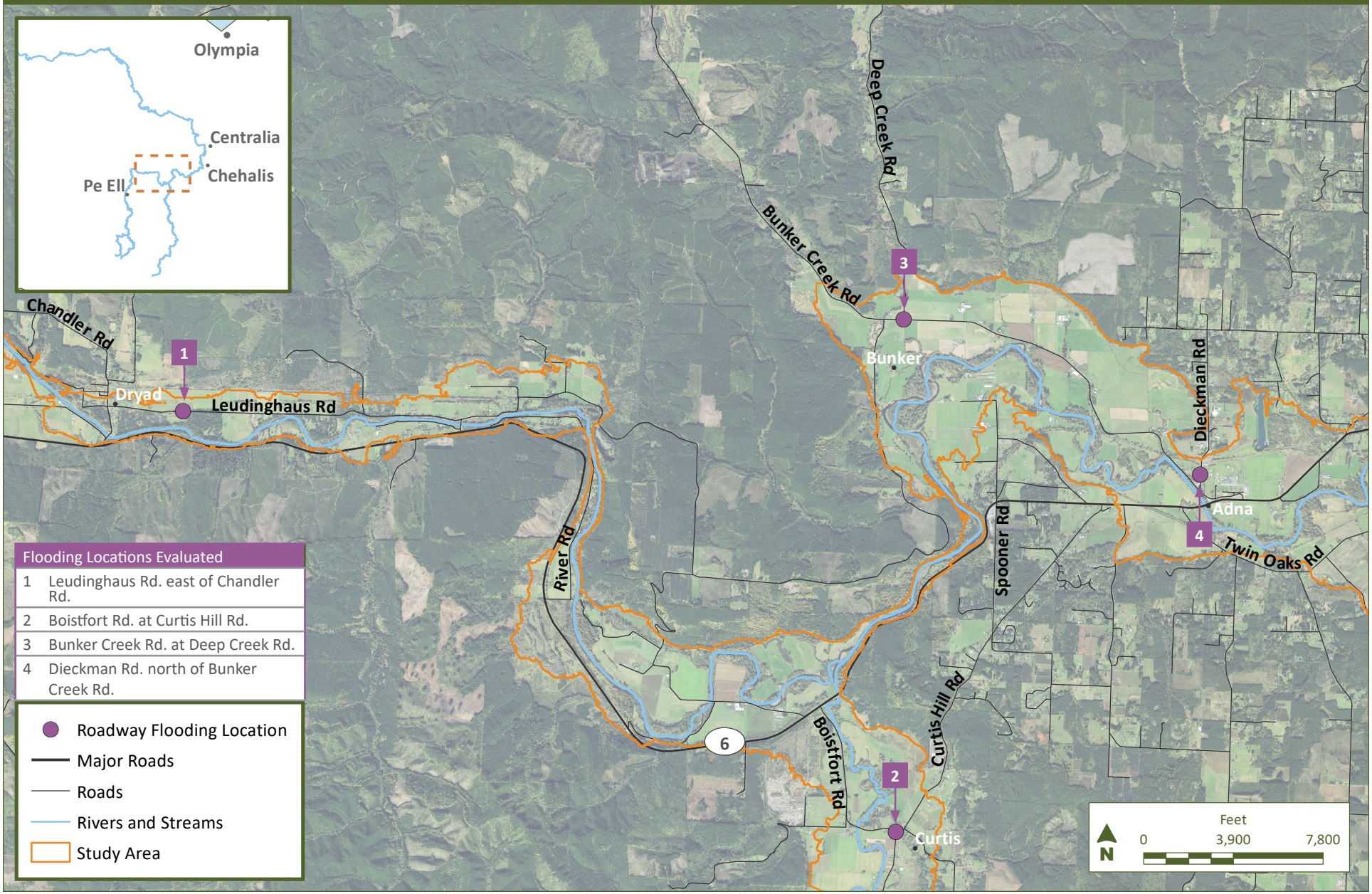
Major Flood

As presented in Table K-8, limited flooding (just over 0.17 foot) or no flooding would occur under the No Action Alternative or Proposed Action for either the mid-century or late-century major flood scenarios. Therefore, roadway closures under either alternative, as presented in Table K-9, are not anticipated.

Catastrophic Flood

Flooding levels during a mid-century catastrophic flood under the No Action Alternative would occur at all four locations. Flood depths would range from 1.3 feet (Bunker Creek Road at Deep Creek Road) to 5 feet (Leudinghaus Road East of Chandler Road). Under the Proposed Action, flooding would continue at three of the four locations analyzed.

Figure K-9
Locations Evaluated for Flooding in Western Lewis County



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At Leudinghaus Road, as presented in Table K-8, flooding would be eliminated. However, floodwaters of more than 0.25 to 0.33 foot (which would likely trigger a roadway closure) are still expected at the following locations:

- Boistfort Road at Curtis Hill Road: 0.7 foot
- Dieckman Road north of Bunker Creek Road: 1.6 feet

Although flood durations would be reduced under the Proposed Action at all locations, as presented in Table K-9, both of the above locations would still experience road closures of the following durations:

- Boistfort Road at Curtis Hill Road: 14 hours
- Dieckman Road north of Bunker Creek Road: 7 hours

Flooding levels during a late-century catastrophic flood under the No Action Alternative would occur at all four locations analyzed. Flood depths would range from 1.8 feet (Bunker Creek Road at Deep Creek Road) to 6 feet (Leudinghaus Road East of Chandler Road). Under the Proposed Action, flooding would continue at three of the four locations. At Leudinghaus Road, as presented in Table K-8, flooding would be eliminated. However, flood inundation over 0.25 to 0.33 foot (which would likely trigger a roadway closure) is still expected at the following locations:

- Bunker Creek Road at Deep Creek Road: 0.4 foot
- Boistfort Road at Curtis Hill Road: 1.2 feet
- Dieckman Road north of Bunker Creek Road: 2.4 feet

Although flood durations would be reduced under the Proposed Action at all locations, as presented in Table K-9, all locations listed above would still experience road closures of the following durations:

- Bunker Creek Road at Deep Creek Road: 4 hours
- Boistfort Road at Curtis Hill Road: 17 hours
- Dieckman Road north of Bunker Creek Road: 11 hours

Grand Mound to Montesano Roadways

Grays Harbor and Thurston County locations were analyzed based on inundation modeling and historical data (Figures K-10 and K-11). The following discussion compares these locations under the No Action Alternative and the Proposed Action for major and catastrophic flood scenarios.

Figure K-10
Locations Evaluated for Flooding from Grand Mound to Porter

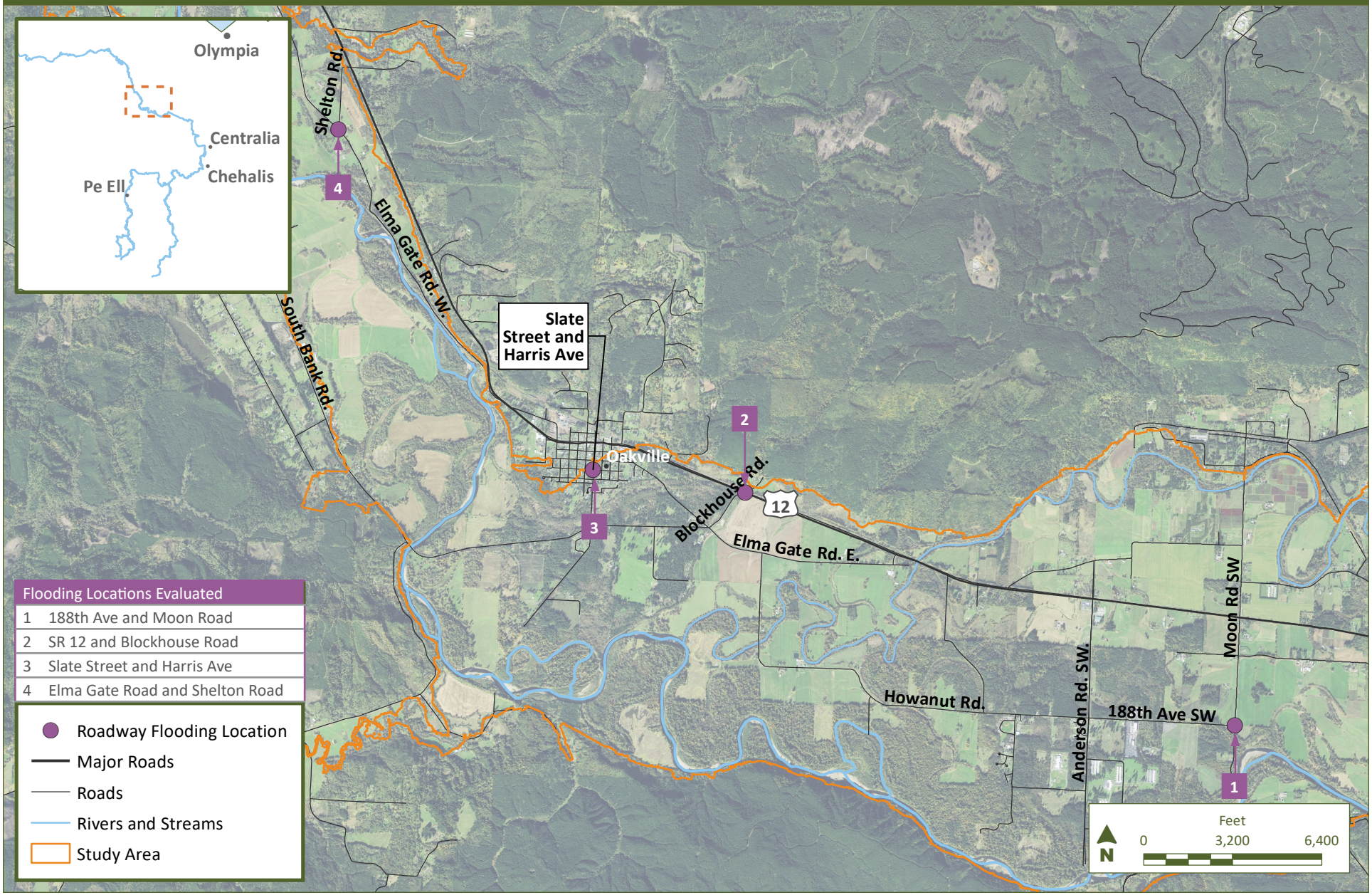

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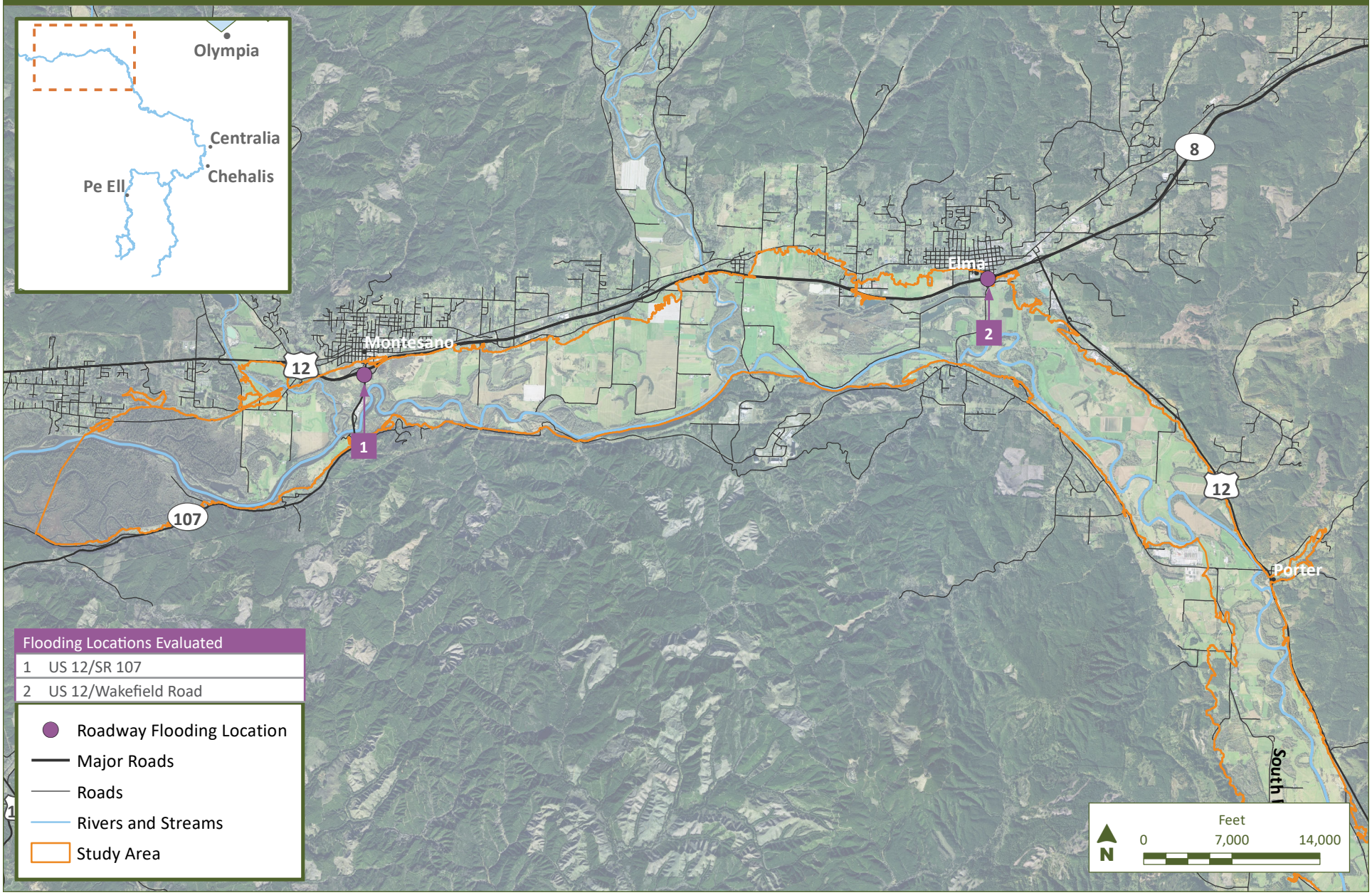
Figure K-11
Locations Evaluated for Flooding from Porter to West of Montesano



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Major Flood Scenarios

As presented in Table K-8, two of the six locations analyzed would experience flooding under the No Action Alternative during both the mid-century and late-century major flood scenarios. During the mid-century scenario, 188th Avenue and Moon Road would experience 2.6 feet of inundation under the No Action Alternative. The Proposed Action would reduce this flooding by 0.5 foot, still resulting in over 2 feet of flooding. As presented in Table K-9, it is anticipated this intersection would be closed for 72 hours under the Proposed Action (1 hour less than the No Action Alternative). At Elma Gate Road and Shelton Road, under the No Action Alternative, there would be 0.58 foot of flooding. However, this flooding would be eliminated under the Proposed Action, and the inundation duration would be reduced from 19 hours to zero hours.

Under the late-century major flood scenario, both roadways would experience flooding under both the No Action Alternative and Proposed Action. 188th Avenue and Moon Road would experience 3.0 feet of inundation under the No Action Alternative. The Proposed Action would reduce flood levels at this location by 0.5 foot, resulting in flood levels of 2.5 feet. As presented in Table K-9, it is anticipated that this intersection would be closed for 83 hours under the Proposed Action (3 hours less than the No Action Alternative). At Elma Gate Road and Shelton Road, under the No Action Alternative, there would be 1.1 feet of flooding. However, this flooding would be reduced by 0.5 foot under the Proposed Action. The roadways at this location would still be closed for 21 hours under the Proposed Action, 12 hours less than the No Action Alternative.

Catastrophic Flood Scenario

Flooding would occur at all six locations analyzed during a mid-century catastrophic flood under the No Action Alternative. Flood depths would range from 0.7 foot (US 12 and Blockhouse Road) to 4.4 feet (188th Avenue and Moon Road). Under the Proposed Action, flooding would continue at the following three locations:

- 188th Avenue and Moon Road: 3.8 feet
- Elma Gate Road and Shelton Road: 2.4 feet
- SR 107, south of US 12: 0.5 foot

All three locations would also continue to experience flooded roadways for extended periods. Flooding at 188th Avenue and Moon Road would increase from 102 hours under the No Action Alternative to 103 hours under the Proposed Action. Flooding duration at Elma Gate Road and Shelton Road would be reduced by 5 hours under the Proposed Action, from 53 hours to 48 hours. Flooding duration on SR 107, just south of US 12, would be reduced by 10 hours under the Proposed Action, from 23 hours to 13 hours.

Flooding would occur at all six locations during a late-century catastrophic flood under the No Action Alternative. Flood depths would range from 1.8 feet (US 12 and Blockhouse Road) to 4.9 feet (188th Avenue and Moon Road). Under the Proposed Action, flood depths would range from 0.42 foot (US 12 and Slate Street locations) to 4.1 feet (188th Avenue and Moon Road).

Flood durations would be reduced at the following five of the six locations under the Proposed Action:

- Elma Gate Road and Shelton Road: reduced by 6 hours, from 61 hours to 55 hours
- US 12 and Blockhouse Road: reduced by 15 hours, from 24 hours to 9 hours
- Slate Street and Harris Street: reduced by 14 hours, from 23 hours to 9 hours
- US 12 and Wakefield Road: reduced by 12 hours, from 26 hours to 14 hours
- SR 107, south of US 12: reduced by 6 hours, from 33 hours to 27 hours

However, flooding duration at the 188th Avenue and Moon Road location would increase from 115 hours to 118 hours. While the Proposed Action would contribute to a longer duration of flooding at 188th Avenue and Moon Road, the increase in duration would be small (around 1% to 2.5%, depending on the scenario) and there is no increase in the flood level. Therefore, the impact would be **minor** as a result of the Proposed Action but the overall area would experience significant impacts from flooding.

Emergency Services and Critical Facility Access

The *Public Services and Utilities Discipline Report* (ESA 2020a) describes impacts to emergency services and critical facilities access from the Proposed Action. Most of the flood level reduction would occur in the Chehalis-Centralia area where public services and utilities are concentrated. Lowering the depth and duration of floodwater would also reduce the amount of time emergency responder access would be limited by floodwaters. There would be **no impacts** as a result of the Proposed Action but the overall area would experience significant impacts from flooding.

Rail and Transit

Changes in the depth and duration of flooding under the Proposed Action would also likely decrease the delay or cancellation of rail and transit service. Various rail and transit locations in the study area were selected to determine potential inundation during floods. Locations were chosen based on their locations within the study area, proximity to areas identified by local agency staff, and locations near creeks and other waterbodies. The following discussion presents findings for both a major flood and a catastrophic flood, as identified in Tables K-10 and K-11 and shown in Figure K-12.

For the selected sites within the study area, flooding along the BNSF rail line for Amtrak and freight operations would be reduced or would be the same as the No Action Alternative. As presented in Table K-10, most of the Rainier Railroad and PSAP short-lines are outside the modeled study area and would experience no flooding. Under the No Action Alternative, flooding would occur at the BNSF lines south of I-5 at Dillenbaugh Creek under the mid- and late-century major and catastrophic flood scenarios. The Proposed Action would result in no flooding at this location under the mid- and late-century major flood scenarios and would reduce flood levels under the mid- and late-century catastrophic flood scenarios. Under the No Action Alternative, the BNSF lines at E Floral Street would experience flooding during the late-century catastrophic flood. The Proposed Action would result in no flooding at that location. The Blakeslee Junction location would also experience flooding under the No Action Alternative catastrophic flood scenario, but flood levels at this location would not be reduced by the Proposed Action. There would be **no impacts** as a result of the Proposed Action but the overall area would experience significant impacts from flooding.

Figure K-12
Railway Locations Evaluated for Flooding

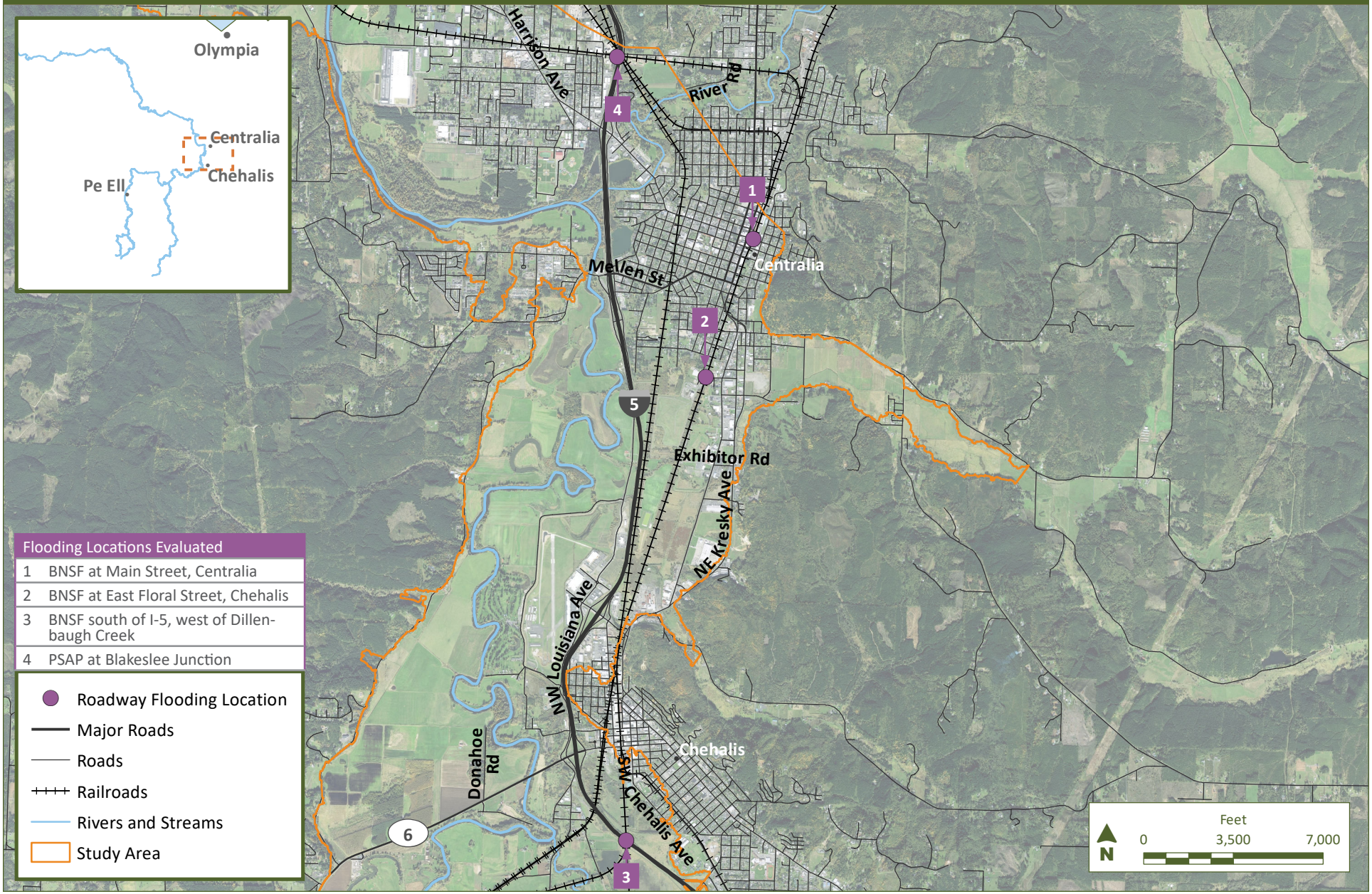

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Table K-10
Predicted Inundation Depths (in Feet) from a Major Flood at Selected Railroad Locations

SITE	MID-CENTURY			LATE-CENTURY		
	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE
BNSF at Main Street, Centralia	0.0	0.0	0.0	0.0	0.0	0.0
BNSF at East Floral Street, Chehalis	0.0	0.0	0.0	0.0	0.0	0.0
BNSF south of I-5, west of Dillenbaugh Creek	0.1	0.0	-0.1	0.4	0.0	-0.4
PSAP at Blakeslee Junction	0.0	0.0	0.0	0.0	0.0	0.0

Table K-11
Predicted Inundation Depths (in Feet) from a Catastrophic Flood at Selected Railroad Locations

SITE	MID-CENTURY			LATE-CENTURY		
	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE
BNSF at Main Street, Centralia	0.0	0.0	0.0	0.0	0.0	0.0
BNSF at East Floral Street, Chehalis	0.0	0.0	0.0	0.5	0.0	-0.5
BNSF south of I-5, west of Dillenbaugh Creek	2.2	1.7	-0.6	3.3	2.4	-0.9
PSAP at Blakeslee Junction	0.4	0.4	0.0	0.5	0.5	0.0

Airports

Inundation depths and durations modeled for the Chehalis-Centralia Airport and Elma Municipal Airport are included in Tables K-12 through K-15.

For the Elma Municipal Airport, the flood inundation model indicates that under the No Action Alternative, the airport could be inundated by 4.2 feet during a mid-century catastrophic flood, and by as much as 5.5 feet during a late-century catastrophic flood. Under the Proposed Action, depth of flooding would be reduced by approximately 1 foot under both flood scenarios.

For the Chehalis-Centralia Airport, the flood inundation model indicates that under the No Action Alternative and the Proposed Action, the airport would not be inundated during a major flood, and therefore would continue to operate. Under the No Action Alternative, the airport could be inundated by 6.8 feet during a mid-century catastrophic flood, and by as much as 8.2 feet along the runway during a late-century catastrophic flood (Table K-12). Similar levels of flooding are expected in the area of the airport operations center. With the Proposed Action, flood inundation depths would be reduced by

approximately 50% under both scenarios. Figures K-13 and K-14 illustrate the changes in flood inundation for a major and a catastrophic flood, respectively, at the Chehalis-Centralia Airport area.

The Proposed Action would meet the Applicant's objective to reduce closure at the Chehalis-Centralia Airport during a catastrophic flood. Under the Proposed Action, depth of flooding would be reduced in a late-century catastrophic flood from 8.2 feet to 4.3 feet at the airport runway. Duration of flooding would also be reduced in a late-century catastrophic flood from 61 hours to 43 hours along the runway. Similar levels of flood depth and duration reductions are expected in the area of the airport operations center. There would be **no impacts** as a result of the Proposed Action but the overall area would experience impacts from flooding.

Table K-12
Predicted Inundation Depths (in Feet) from a Major Flood at Airports

AIRPORT	MID-CENTURY			LATE-CENTURY		
	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE
CHEHALIS-CENTRALIA						
Runway (Mid-Point)	0.0	0.0	0.0	0.0	0.0	0.0
Airport (Operations Building)	0.0	0.0	0.0	0.0	0.0	0.0
ELMA MUNICIPAL						
Runway (Mid-Point)	0.0	0.0	0.0	0.1	0.0	-0.1
Airport (Operations Building)	0.4	0.0	-0.4	1.2	0.6	-0.6

Table K-13
Predicted Inundation Durations (in Hours) from a Major Flood at Airports

AIRPORT	MID-CENTURY			LATE-CENTURY		
	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE
CHEHALIS-CENTRALIA						
Runway (Mid-Point)	0	0	0	0	0	0
Airport (Operations Building)	0	0	0	0	0	0
ELMA MUNICIPAL						
Runway (Mid-Point)	0	0	0	0	0	0
Airport (Operations Building)	9	0	-9	26	14	-12

Table K-14

Inundation Depths (in Feet) from a Catastrophic Flood at Airports

AIRPORT	MID-CENTURY			LATE-CENTURY		
	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE
CHEHALIS-CENTRALIA						
Runway (Mid-Point)	6.8	0.0	-6.8	8.2	4.3	-3.9
Airport (Operations Building)	6.3	0.0	-6.3	7.8	3.5	-4.3
ELMA MUNICIPAL						
Runway (Mid-Point)	3.1	2.0	-1.0	4.3	3.0	-1.3
Airport (Operations Building)	4.2	3.2	-1.1	5.5	4.1	-1.3

Table K-15

Inundation Durations (in Hours) from a Catastrophic Flood at Airports

AIRPORT	MID-CENTURY			LATE-CENTURY		
	NO ACTION	PROPOSED ACTION	DIFFERENCE	NO ACTION	PROPOSED ACTION	DIFFERENCE
CHEHALIS-CENTRALIA						
Runway (Mid-Point)	54	0	-54	61	43	-18
Airport (Operations Building)	52	0	-52	58	39	-19
ELMA MUNICIPAL						
Runway (Mid-Point)	37	31	-6	46	40	-6
Airport (Operations Building)	52	47	-5	60	56	-4

Figure K-13
Predicted Changes in Flood Inundation Depths from a Major Flood in the Chehalis-Centralia Airport Area

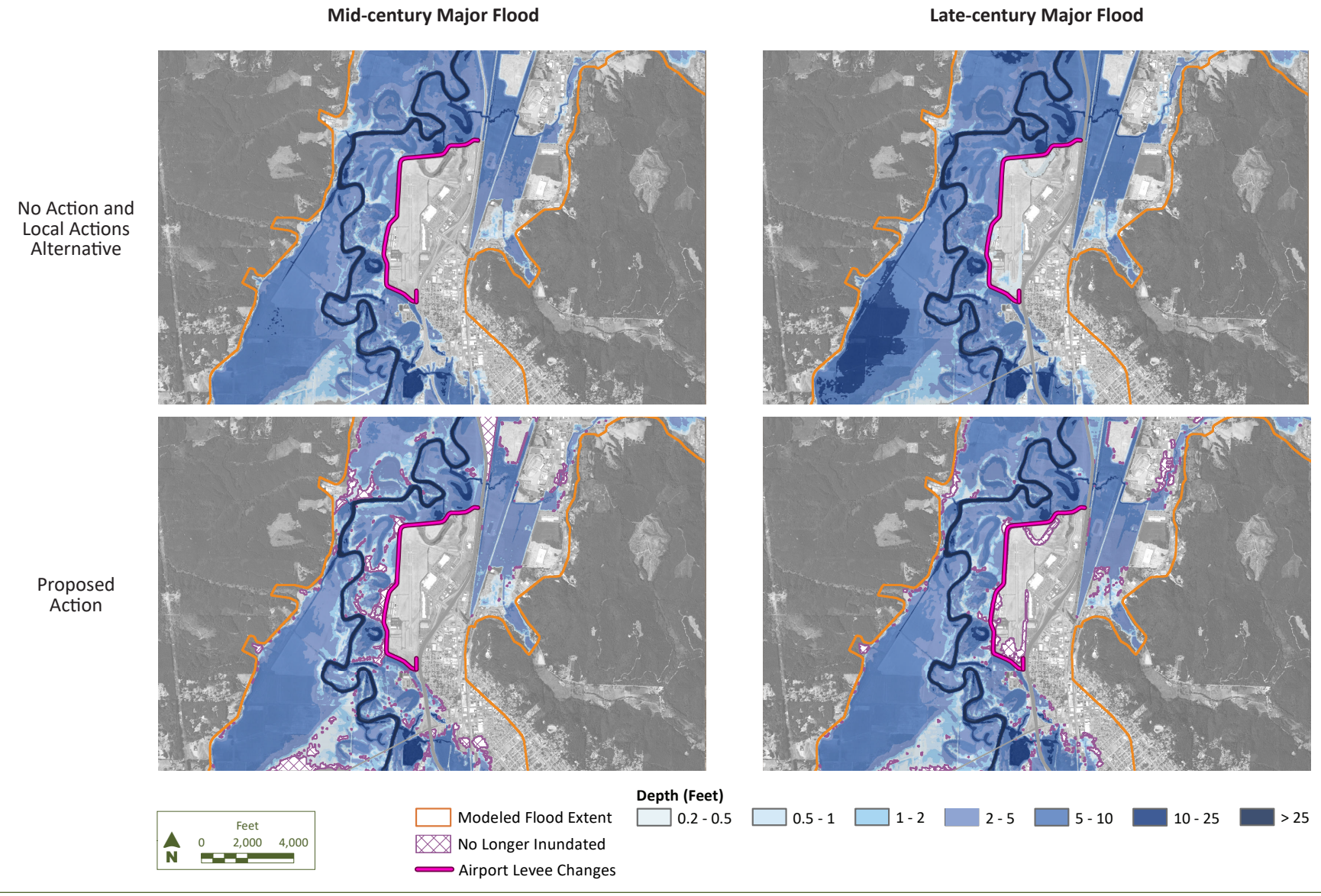
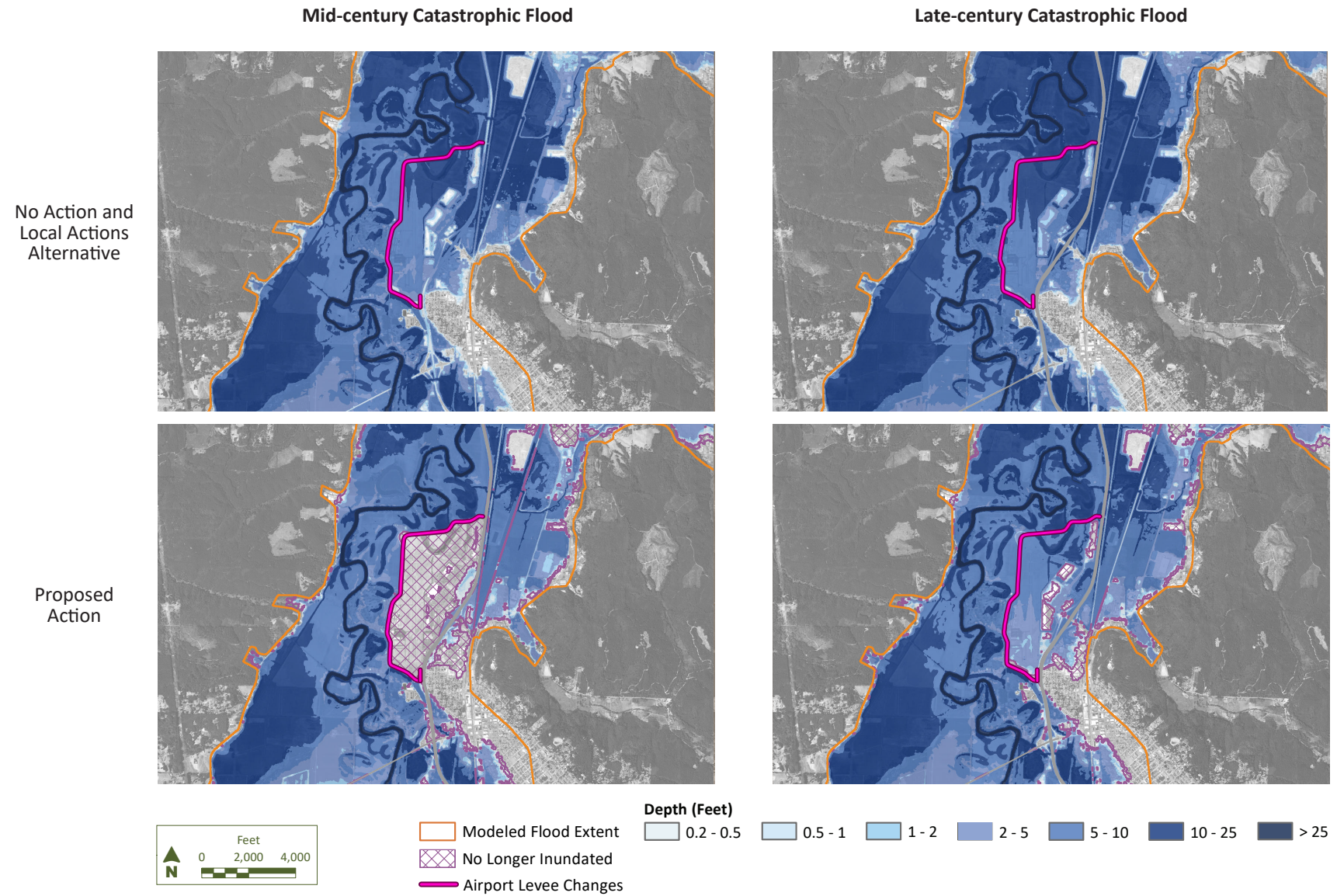


Figure K-14
Predicted Changes in Flood Inundation Depths from a Catastrophic Flood in the Chehalis-Centralia Airport Area



3.2.2.2 Indirect

No indirect impacts on the transportation system due to operation of the Proposed Action are anticipated.

3.2.3 Required Permits

The following permits from DNR related to the construction and maintenance of forest roads may be required:

- **Forest Practices Applications/Notifications (FPA/N) (DNR):** FPAs associated with the construction of the FRE facility on non-federal forestland, including and not limited to timber harvest, use of rock pits, constructing or abandoning forest roads, and converting land to non-forestry use, would be subject to the Forest Practices Rules (WAC 222).
- **Local Land Use and Development Permits (Lewis County and City of Chehalis)**: The Proposed Action would affect water-related resources regulated by Lewis County (FRE facility) and the City of Chehalis (Airport Levee Changes) under Shoreline Master Programs, Critical Areas Ordinances, and floodplain and stormwater management codes. Permits from both local governments would be needed in accordance with their local development codes.
- **NPDES Construction Stormwater General Permit (Ecology)**: Construction of the Proposed Action would result in more than 1 acre of ground disturbance and involve stormwater discharges to surface waters. Therefore, coverage under an Ecology Construction Stormwater Permit would be required. The NPDES permit would include conditions requiring the permittee to prepare a Stormwater Pollution Prevention Plan (SWPPP) and implement appropriate erosion, sediment, and pollution control measures for the duration of construction.

3.2.4 Proposed Mitigation Measures

This section describes the mitigation measures proposed for the Applicant to implement that would reduce and compensate for impacts related to transportation from construction and operation of the Proposed Action. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 3.2.3.

- **TRANSP-1**: To reduce impacts on the environment from construction, upgrades, use, or abandonment of roads not covered under Forest Practices Rules, mitigation is proposed for the Applicant to meet all Forest Practices Act requirements for road building, maintenance, and abandonment for roads at the FRE facility site or in the temporary reservoir area. The Applicant will ensure that road construction, equipment on the roadway, and maintenance are in accordance with state requirements for protection of streams, wetlands, unstable slopes, or other sensitive sites.

Other Related Mitigation Plans:

- **WATER-1 (Surface Water Quality Mitigation Plan):** To reduce probable impacts to 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*).

3.2.5 Significant and Unavoidable Adverse Impacts

Compliance with laws and implementation of the measures described above would reduce impacts on transportation. There would be **no significant and unavoidable adverse** environmental impacts on transportation as a result of the Proposed Action.

3.3 Local Actions Alternative

3.3.1 Impacts from Construction

3.3.1.1 Direct

Of the six local action measures identified under this alternative, three measures could result in the need for construction. 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 localized construction traffic distributed over an extended time.

Likewise, floodplain storage improvements and channel migration protection would also be expected to require sporadic, localized construction activity over an extended period, resulting in minimal construction traffic. Consequently, construction activities under the Local Actions Alternative would be a **minor** adverse impact with respect to transportation.

3.3.1.2 Indirect

No indirect impacts on the transportation system from the construction of the Local Actions Alternative are anticipated.

3.3.2 Impacts from Operation

3.3.2.1 Direct

No operational-related impacts on the transportation system are anticipated from implementation of the Local Actions Alternative.

3.3.2.2 Indirect

No indirect impacts on the transportation system from operation of the Local Actions Alternative are anticipated.

3.3.3 Flood Conditions and Impacts

This discipline report analyzes probable impacts to transportation under the No Action Alternative and similar impacts would likely occur for the Local Actions Alternative. Flooding along roadways, railroads, and the airport throughout the study area would not be reduced. Floods would continue to pose substantial flood risk to transportation facilities as well as passenger and freight rail and transit service and air service at the airport. As discussed in Section 3.2.2 and 3.4, and presented in Tables K-8 and K-9, transportation facilities would continue to flood and roadway closures would be necessary.

Floods would continue to periodically disrupt travel in and around the study area, and could cause long-term damage to facilities and loss of access. During floods, the primary transportation routes in the study area could be unusable or inaccessible while inundated. This could increase the use of other

roadways in the area that were not affected by flooding. Use of these unofficial detour routes could temporarily increase traffic and temporarily affect the LOS along non-arterial roadways.

3.4 No Action Alternative

3.4.1 Flood Conditions and Impacts

This discipline report analyzes probable impacts to transportation under the No Action Alternative. It analyzes potential impacts for major and catastrophic floods in the future, including expected increases in precipitation and flood peaks from climate change. The analysis used hydraulic modeling to provide the expected duration and height of flooding at key intersections in the study area.

Flooding along roadways, railroads, and airports throughout the study area would not be reduced under the No Action Alternative. Floods would continue to pose substantial flood risk to transportation facilities as well as passenger and freight rail and transit service and air service. As discussed in Section 3.2.2 and presented in Tables K-8 through K-13, transportation facilities would continue to flood and roadway closures would be necessary.

Floods would continue to periodically disrupt travel in and around the study area, and could cause long-term damage to facilities and loss of access. During floods, the primary transportation routes in the study area could be unusable or inaccessible while inundated. This could increase the use of other roadways in the area that were not affected by flooding. Use of these unofficial detour routes could temporarily increase traffic and temporarily affect the LOS along non-arterial roadways.

I-5 Main Line and Interchanges

Seven locations along I-5 or on its interchanges were reviewed as part of this analysis (Figure K-6). As presented in Table K-8, flooding would not occur during a major mid-century or late-century flood. However, during a catastrophic event (mid- or late-century), six of the seven locations would experience flooding. During a mid-century catastrophic flood, depths would range from 2.4 inches at the I-5 and 13th Street interchange to 7 feet at the I-5 and NW Chamber of Commerce Way interchange. During a late-century catastrophic flood, depths would range from 6 inches at the I-5 and 13th Street interchange to 8.4 feet at the I-5 and NW Chamber of Commerce Way interchange. The duration of flooding during a late-century catastrophic flood would be under 24 hours for all locations but NW Chamber of Commerce which would be inundated for 59 hours (Exhibit 5.15-3).

State Route 6

As presented in Table K-8, limited flooding of SR 6 would occur under the No Action Alternative during a mid-century major flood at Twin Oaks Road (1.1 feet) and Heden Road (4.8 inches). For a late-century major flood, the same two locations would experience flooding. Five of the six locations along SR 6 would flood during a mid-century catastrophic flood under the No Action Alternative. Flood depths would range from just under 4 inches (SR 6 at Donahoe Road) to just under 6 feet (SR 6 at Boistfort Road). Five of the six locations along SR 6 would also flood during a late-century catastrophic flood with a depth ranging from 0.5 to 6.4 feet. The duration of flooding for all locations during a late-century

catastrophic flood would be less than 24 hours except for SR 6 and Twin Oaks Road which would be inundated for 35 hours

Chehalis, Centralia, and Napavine Roadways

As presented in Table K-8 for the mid-century major flood scenario, under the No Action Alternative, limited or no flooding would occur on the major arterials analyzed, except at the following locations:

- Harrison Avenue at I-5 interchange: 2.4 inches
- SW Riverside Drive and SW Newaukum Avenue: 7.2 inches
- SW Chehalis Avenue and SW John Street: 2.3 feet
- Rush Road under I-5 interchange: 3.4 feet

For the late-century major flood scenario, under the No Action Alternative, the following five of the eight major arterial locations analyzed would experience flooding deep enough to likely result in a roadway closure:

- SW Chehalis Avenue and SW John Street: 3.3 feet
- SW Riverside Drive and SW Newaukum Avenue: 10.8 inches
- NE Kresky Avenue and Exhibitor Road: 1.1 feet
- Harrison Avenue at I-5 interchange: 1.5 feet
- Rush Road under I-5 interchange: 3.6 feet

Flooding levels during a mid-century catastrophic flood under the No Action Alternative would occur at all locations reviewed. Flood depths would range from 12 inches (Mellen Street at I-5 interchange) to just over 6 feet (SW Chehalis Avenue and SW John Street).

Flooding during a late-century catastrophic flood under the No Action Alternative would occur at all eight locations. Flood depths would range from 2.4 feet (Mellen Street at I-5 interchange) to around 7 feet (SW Chehalis Avenue and SW John Street).

Western Lewis County

As presented in Table K-8, limited flooding (just over 2 inches) or no flooding would occur under the No Action Alternative for either the mid-century or late-century major flood scenarios. Therefore, roadway closures are not anticipated. Flooding levels during a mid-century catastrophic flood under the No Action Alternative would occur at all four locations presented in Table K-8. Flood depths would range from 1.3 feet (Bunker Creek Road at Deep Creek Road) to 5 feet (Leudinghaus Road East of Chandler Road).

Grand Mound to Montesano

During the mid-century major flood scenario, 188th Avenue and Moon Road would experience 2.6 feet of inundation under the No Action Alternative. At Elma Gate Road and Shelton Road, under the No Action Alternative, there would be 7 inches of flooding.

Under the late-century major flood scenario, 188th Avenue and Moon Road would experience 3.0 feet of inundation under the No Action Alternative. At Elma Gate Road and Shelton Road, under the No Action Alternative, there would be 1.1 feet of flooding.

Flooding would occur at all six locations analyzed during a mid-century catastrophic flood under the No Action Alternative. Flood depths would range from 8.4 inches (US 12 and Blockhouse Road) to 4.4 feet (188th Avenue and Moon Road).

Flooding would occur at all locations during a late-century catastrophic flood under the No Action Alternative. Flood depths would range from 1.7 feet (US 12 and Blockhouse Road) to 4.9 feet (188th Avenue and Moon Road).

Rail, Transit and Airports

Under the No Action Alternative, flooding would occur at the BNSF lines south of I-5 at Dillenbaugh Creek under the mid- and late-century major and catastrophic flood scenarios.

The flood inundation model indicates that under the No Action Alternative, the Chehalis-Centralia Airport would not be inundated during a major flood, and therefore would continue to operate. The airport (along the runway) could be inundated by 6.8 feet for 54 hours during a mid-century catastrophic flood, and by as much as 8.2 feet and for as long as 61 hours during a late-century catastrophic flood. Similar levels of flooding are expected in the area of the airport operations center. The flood inundation model indicates the Elma Municipal Airport runway would experience minimal flooding during a major flood, with the most flooding occurring at the airport operations building (1.2 feet for a duration of 26 hours during a late-century major flood). The airport runway could be inundated by 3.1 feet and for a duration of 37 hours during a mid-century catastrophic flood, and 4.3 feet and for a duration of 46 hours during a late-century catastrophic flood.

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Attachment K-1
AADT and LOS Sources

WSDOT State Route 6
Annual Average Daily Traffic
2017

Source:

Joe St. Charles
WSDOT
March 6, 2019

LRS_Date	StateRouteNumber	Begin_ARM	End_ARM	Location	AADT	RteType
12/31/2017	006	0.00	1.13	From Milepost 0.00 A to Milepost 1.13 A	4,900	SR
12/31/2017	006	1.13	1.45	From Milepost 1.13 A to Milepost 1.45 A	4,300	SR
12/31/2017	006	1.45	2.04	From Milepost 1.45 A to Milepost 2.04 A	2,900	SR
12/31/2017	006	2.04	3.11	From Milepost 2.04 A to Milepost 3.11 A	2,700	SR
12/31/2017	006	3.11	3.26	From Milepost 3.11 A to Milepost 3.26 A	2,400	SR
12/31/2017	006	3.26	5.35	From Milepost 3.26 A to Milepost 5.35 A	2,500	SR
12/31/2017	006	5.35	8.04	From Milepost 5.35 A to Milepost 8.04 A	2,200	SR
12/31/2017	006	8.04	13.34	From Milepost 8.04 A to Milepost 13.34 A	1,500	SR
12/31/2017	006	13.34	14.62	From Milepost 13.34 A to Milepost 14.62 A	1,200	SR
12/31/2017	006	14.62	27.83	From Milepost 14.62 A to Milepost 27.83 A	1,200	SR
12/31/2017	006	27.83	28.21	From Milepost 27.83 A to Milepost 28.21 A	1,300	SR
12/31/2017	006	28.21	28.26	From Milepost 28.21 A to Milepost 28.26 A	1,600	SR
12/31/2017	006	28.26	28.31	From Milepost 28.26 A to Milepost 28.31 A	1,900	SR
12/31/2017	006	28.31	28.78	From Milepost 28.31 A to Milepost 28.78 A	2,300	SR
12/31/2017	006	28.78	28.94	From Milepost 28.78 A to Milepost 28.94 A	2,300	SR
12/31/2017	006	28.94	34.20	From Milepost 28.94 A to Milepost 34.20 A	2,500	SR
12/31/2017	006	34.20	42.38	From Milepost 34.20 A to Milepost 42.38 A	2,700	SR
12/31/2017	006	42.38	42.53	From Milepost 42.38 A to Milepost 42.53 A	3,000	SR
12/31/2017	006	42.53	44.91	From Milepost 42.53 A to Milepost 44.91 A	3,600	SR
12/31/2017	006	44.91	45.64	From Milepost 44.91 A to Milepost 45.64 A	3,800	SR
12/31/2017	006	45.64	45.77	From Milepost 45.64 A to Milepost 45.77 A	4,100	SR
12/31/2017	006	45.77	46.45	From Milepost 45.77 A to Milepost 46.45 A	5,700	SR
12/31/2017	006	46.45	46.96	From Milepost 46.45 A to Milepost 46.96 A	6,700	SR
12/31/2017	006	46.96	47.27	From Milepost 46.96 A to Milepost 47.27 A	7,600	SR
12/31/2017	006	47.27	49.08	From Milepost 47.27 A to Milepost 49.08 A	8,100	SR
12/31/2017	006	49.08	49.21	From Milepost 49.08 A to Milepost 49.21 A	8,600	SR
12/31/2017	006	49.21	49.40	From Milepost 49.21 A to Milepost 49.40 A	10,000	SR
12/31/2017	006	49.40	50.56	From Milepost 49.40 A to Milepost 50.56 A	11,000	SR
12/31/2017	006	50.56	51.28	From Milepost 50.56 A to Milepost 51.28 A	11,000	SR
12/31/2017	006	51.28	51.37	From Milepost 51.28 A to Milepost 51.37 A	12,000	SR

Lewis County Select Routes
Annual Average Daily Traffic and Locations
2018

Source:

Michael Kroll
Lewis County Public Works
April 1 and 2, 2019

A>B : SOUTH
B>A : NORTH
MP. : 1.36

Site: MULLER
Monday, 05/20/2002 8:45 AM -
Thursday, 05/23/2002 8:15 AM

Volume Grand Totals

Average Hourly Volumes

	A>B	B>A	Combined
12:00 AM	0.0	0.7	0.7
1:00 AM	0.7	3.3	4.0
2:00 AM	5.3	2.7	8.0
3:00 AM	32.7	10.7	43.3
4:00 AM	32.3	12.7	45.0
5:00 AM	10.7	10.0	20.7
6:00 AM	5.0	6.7	11.7
7:00 AM	5.3	5.7	11.0
8:00 AM	5.5	8.5	14.0
9:00 AM	4.7	8.0	12.7
10:00 AM	7.7	5.3	13.0
11:00 AM	15.0	9.3	24.3
12:00 PM	10.0	18.0	28.0
1:00 PM	21.0	36.7	57.7
2:00 PM	14.0	19.0	33.0
3:00 PM	3.7	14.3	18.0
4:00 PM	1.0	3.7	4.7
5:00 PM	1.3	2.0	3.3
6:00 PM	1.0	2.3	3.3
7:00 PM	1.0	1.0	2.0
8:00 PM	0.0	0.3	0.3
9:00 PM	0.3	1.7	2.0
10:00 PM	1.7	5.0	6.7
11:00 PM	0.3	2.3	2.7
Average Daily Traffic (ADT)	180.2	189.8	370.0

Volume Totals

A>B	B>A	Combined
536	565	1101
48.7 %	51.3 %	

A>B: : South
B>A: : North
MP: : 1.420

Site: Airport Rd
Monday, 06/04/2018 11:00 AM -
Thursday, 06/07/2018 10:45 AM

Volume Grand Totals

Average Hourly Volumes

	A>B	B>A	Combined
12:00 AM	7.0	14.3	21.3
1:00 AM	4.7	6.7	11.3
2:00 AM	9.0	5.0	14.0
3:00 AM	16.7	10.7	27.3
4:00 AM	26.7	15.0	41.7
5:00 AM	55.0	28.3	83.3
6:00 AM	85.3	84.7	170.0
7:00 AM	144.0	117.7	261.7
8:00 AM	203.0	163.0	366.0
9:00 AM	212.7	187.0	399.7
10:00 AM	253.5	234.0	487.5
11:00 AM	275.0	269.0	544.0
12:00 PM	242.3	289.0	531.3
1:00 PM	241.7	291.0	532.7
2:00 PM	264.3	299.3	563.7
3:00 PM	261.3	338.7	600.0
4:00 PM	225.3	296.3	521.7
5:00 PM	175.0	211.0	386.0
6:00 PM	140.3	214.0	354.3
7:00 PM	98.3	165.0	263.3
8:00 PM	65.7	112.7	178.3
9:00 PM	41.7	63.7	105.3
10:00 PM	21.7	37.0	58.7
11:00 PM	12.7	24.7	37.3
Average Daily Traffic (ADT)	3082.8	3477.7	6560.5

Volume Totals

A>B	B>A	Combined
9161	10365	19526
46.9 %	53.1 %	

A>B : SOUTH
B>A : NORTH
MP. : 1.36

Site: MULLER
Monday, 05/20/2002 8:45 AM -
Thursday, 05/23/2002 8:15 AM

Volume Grand Totals

Average Hourly Volumes

	A>B	B>A	Combined
12:00 AM	0.0	0.7	0.7
1:00 AM	0.7	3.3	4.0
2:00 AM	5.3	2.7	8.0
3:00 AM	32.7	10.7	43.3
4:00 AM	32.3	12.7	45.0
5:00 AM	10.7	10.0	20.7
6:00 AM	5.0	6.7	11.7
7:00 AM	5.3	5.7	11.0
8:00 AM	5.5	8.5	14.0
9:00 AM	4.7	8.0	12.7
10:00 AM	7.7	5.3	13.0
11:00 AM	15.0	9.3	24.3
12:00 PM	10.0	18.0	28.0
1:00 PM	21.0	36.7	57.7
2:00 PM	14.0	19.0	33.0
3:00 PM	3.7	14.3	18.0
4:00 PM	1.0	3.7	4.7
5:00 PM	1.3	2.0	3.3
6:00 PM	1.0	2.3	3.3
7:00 PM	1.0	1.0	2.0
8:00 PM	0.0	0.3	0.3
9:00 PM	0.3	1.7	2.0
10:00 PM	1.7	5.0	6.7
11:00 PM	0.3	2.3	2.7
Average Daily Traffic (ADT)	180.2	189.8	370.0

Volume Totals

A>B	B>A	Combined
536	565	1101
48.7 %	51.3 %	

Road Feature List

Road Number	Milepost	Feature		Description
26030	**MULLER RD**			
	0.000	Reference Point	>>>	MULLER RD @ SR 6 @ 28.31
	0.059	Reference Point	>>>	MULLER RD @ CHEHALIS AVE (CITY ST)
	0.116	Reference Point	>>>	MULLER RD @ 3RD AVE (CITY ST)
	0.135	Reference Point	>>>	MULLER RD @ STOWE CREEK
	0.183	Reference Point	>>>	MULLER RD @ QUEEN AVE (CITY ST)
	0.238	Reference Point	>>>	MULLER RD @ PLEASANT AVE (CITY ST)
	0.297	Reference Point	>>>	MULLER RD @ CENTRAL AVE (CITY ST)
	0.380	Reference Point	>>>	MULLER RD @ OLIVE ST W (CITY ST)
	0.520	Reference Point	>>>	MULLER RD @ PE ELL CITY LIMITS
	0.520	Reference Point	>>>	MULLER RD @ GRABSKI LN (PVT)
	0.550	Reference Point	>>>	MULLER RD @ WILLAPA HILLS TRAIL CROSSING
	0.782	Reference Point	>>>	MULLER RD @ MULLER RD W (PVT)
	1.259	Reference Point	>>>	MULLER RD @ WELLS RD
	1.611	Reference Point	>>>	MULLER RD @ END OF MAINTENANCE
91026	**AIRPORT RD**			
	0.000	Reference Point	>>>	AIRPORT RD @ MELLEN ST (CITY ST)
	0.090	Reference Point	>>>	AIRPORT RD @ I-5 ON RAMP S BOUND
	0.354	Reference Point	>>>	AIRPORT RD @ I-5 OVERPASS
	0.505	Reference Point	>>>	AIRPORT RD @ CENTRALIA CITY LIMITS
	1.420	Reference Point	>>>	AIRPORT RD @ AIRPORT BRIDGE 1.42
	1.426	Reference Point	>>>	AIRPORT RD @ SALZER CREEK
	1.700	Reference Point	>>>	AIRPORT RD @ NW LOUISIANA AVE (CITY ST)
	2.833	Reference Point	>>>	AIRPORT RD @ CHEHALIS CITY LIMITS
	3.476	Reference Point	>>>	AIRPORT RD @ NW ARIZONA AVE (CITY ST)
	3.476	Reference Point	>>>	AIRPORT RD @ NW FLORIDA AVE (CITY ST)
	3.785	Reference Point	>>>	AIRPORT RD @ NW LOUISIANA AVE (CITY ST)

Annual Average Daily Traffic Projections: 2025 and 2030

Formula/Spreadsheet Source:

Michael Kroll
Lewis County Public Works
April 2, 2019

Future AADT

AADT forecasted for a specific succeeding year of interest.

$$\mathrm{AADT}_{Future} = \mathrm{AADT}_{Current} * (1 + AACR)^{n}$$

Where:

AADT_{Future} = Annual Average Daily Traffic for the forecasted year (veh/day)

$\mathrm{AADT}_{Current}$ = Annual Average Daily Traffic for the current year (veh/day)

AACR = Annual Average Change Rate

n = number of forecasted years

ADT YEAR	2018
AADT *Current*	370
AACR	2%
n	7

AADT *Future*	425

For: 2025

Future AADT

AADT forecasted for a specific succeeding year of interest.

$$\mathrm{AADT}_{Future} = \mathrm{AADT}_{Current} * (1 + AACR)^n$$

Where:

AADT_{Future} = Annual Average Daily Traffic for the forecasted year (veh/day)

$\mathrm{AADT}_{Current}$ = Annual Average Daily Traffic for the current year (veh/day)

AACR = Annual Average Change Rate

n = number of forecasted years

ADT YEAR	2018
AADT *Current*	370
AACR	2%
n	12

AADT *Future*	469

For: 2030

Future AADT

AADT forecasted for a specific succeeding year of interest.

$$\mathrm{AADT}_{Future} = \mathrm{AADT}_{Current} * (1 + AACR)^n$$

Where:

AADT_{Future} = Annual Average Daily Traffic for the forecasted year (veh/day)

$\mathrm{AADT}_{Current}$ = Annual Average Daily Traffic for the current year (veh/day)

AACR = Annual Average Change Rate

n = number of forecasted years

ADT YEAR	2018
AADT *Current*	6560
AACR	2%
n	7

AADT *Future*	7535

For: 2025

Future AADT

AADT forecasted for a specific succeeding year of interest.

$$\mathrm{AADT}_{Future} = \mathrm{AADT}_{Current} * (1 + AACR)^n$$

Where:

AADT_{Future} = Annual Average Daily Traffic for the forecasted year (veh/day)

$\mathrm{AADT}_{Current}$ = Annual Average Daily Traffic for the current year (veh/day)

AACR = Annual Average Change Rate

n = number of forecasted years

ADT YEAR	2018
AADT *Current*	6560
AACR	2%
n	12

AADT *Future*	8320

For: 2030

Future AADT

AADT forecasted for a specific succeeding year of interest.

$$\mathrm{AADT}_{Future} = \mathrm{AADT}_{Current} * (1 + AACR)^n$$

Where:

AADT_{Future} = Annual Average Daily Traffic for the forecasted year (veh/day)

$\mathrm{AADT}_{Current}$ = Annual Average Daily Traffic for the current year (veh/day)

AACR = Annual Average Change Rate

n = number of forecasted years

ADT YEAR	2018
AADT *Current*	1950
AACR	2%
n	7

AADT *Future*	2240

For: 2025

Future AADT

AADT forecasted for a specific succeeding year of interest.

$$\mathrm{AADT}_{Future} = \mathrm{AADT}_{Current} * (1 + AACR)^n$$

Where:

AADT_{Future} = Annual Average Daily Traffic for the forecasted year (veh/day)

$\mathrm{AADT}_{Current}$ = Annual Average Daily Traffic for the current year (veh/day)

AACR = Annual Average Change Rate

n = number of forecasted years

ADT YEAR	2018
AADT *Current*	1960
AACR	2%
n	12

AADT *Future*	2486

For: 2030

Lewis County
Level of Service Goals and Definitions

Source:
Lewis County
Transportation Element 2018-2020
February 2018

Road Evaluation

Lewis County uses a variety of measures to monitor the characteristics of roads and bridges. These measures include evaluations of the capacity and condition of the facilities.

Capacity

Lewis County utilizes Level of Service to evaluate the capacity of road segments and intersections. This measure considers the amount of delay or congestion experienced by motorists as they pass through intersections and travel along a road.

Though Level of Service is a qualitative measure of traffic conditions, the analysis is based on quantitative indicators, including the time required to wait at an intersection or the overall congestion of a road.

To evaluate the Level of Service along road segments, the county utilizes the Volume to Capacity ratio (V/C). This measurement considers the overall capacity of the segments, and the volumes that exist or are likely on the facility. When a road segment has sufficient capacity for the traffic it handles (i.e. the road is not full), the Level of Service is high, traffic flows freely and overall driver comfort is maximized. When the volumes of a road approach the capacity of the facility, the LOS decreases, the road is congested, and drivers are forced to slow and/or wait in traffic.

Table T-1: Level of Service for Road Segments

Level of Service (LOS)	Characteristics of Traffic[1]	Volume to Capacity Ratio
A	Free flow, low volumes and densities. Drivers can maintain their desired speeds with little or no delay and are unaffected by other vehicles.	Less than .60
B	Reasonably free flow, operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed.	.60-.70
C	Speeds remain near free flow, but freedom to maneuver is noticeably restricted.	.70-.80
D	Speed begins to decline with increasing volume. Freedom to maneuver is further reduced, and the traffic stream has little space to absorb disruptions.	.80-.90
E	Unstable flow with volume at or near capacity. Freedom to maneuver is extremely limited, and level of comfort afforded to the driver is poor.	.90-1.00
F	Breakdown in flow. Both speeds and volumes can drop to zero.	Greater than 1.00

[1] From Wolfgang Homburger, Jerome Hall, Will Reilly, and Edward Sullivan. Fundamentals of Traffic Engineering. 16th ed.

To ensure that the overall functionality of roads and intersections does not decrease beyond a certain Level of Service, Lewis County and Washington State have established the following standards for their roadways.

State Level of Service – The Level of Service standard for state highways in Lewis County is C for rural roadways and D for urban facilities. Map T-3 depicts the levels of service for state highway facilities.

Local Level of Service – Local level of service is Level of Service D for area roadways and intersections.

Existing and Future Deficiencies

Utilizing these standards, Lewis County evaluated existing (as of 2015) and forecasted future roadway conditions (in 2040) based on the land use from the Land Use Element of this plan. Capacity issues as of 2015 are shown on Maps T-4 and T-6. Capacity issues projected in 2040 are shown on Maps T-5 and T-7.

Major roadway capacity issues identified within unincorporated portions of the county by 2040 include:

- The need for additional capacity along Harrison Avenue in the Centralia Urban Growth Area.
- The need for improvements along SR 505 to accommodate the development of the Winlock Urban Growth Area.
- The need for an intersection improvement at US Highway 12 and the southbound off-ramp of I-5.

Lewis County additionally anticipates that ongoing projects will be required along Interstate 5 in the Centralia, Chehalis, and Napavine areas (including at the interchanges) to help alleviate congestion.

Level of Service
Simplified Tables

Source:
Florida Department of Transportation
Quality/Level of Service Handbook, 2013

TABLE 1

Generalized **Annual Average Daily** Volumes for Florida's **Urbanized Areas**

12/18/12

INTERRUPTED FLOW FACILITIES

STATE SIGNALIZED ARTERIALS

Class I (40 mph or higher posted speed limit)

Lanes	Median	B	C	D	E
2	Undivided	*	16,800	17,700	**
4	Divided	*	37,900	39,800	**
6	Divided	*	58,400	59,900	**
8	Divided	*	78,800	80,100	**

Class II (35 mph or slower posted speed limit)

Lanes	Median	B	C	D	E
2	Undivided	*	7,300	14,800	15,600
4	Divided	*	14,500	32,400	33,800
6	Divided	*	23,300	50,000	50,900
8	Divided	*	32,000	67,300	68,100

Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways - 10%

Median & Turn Lane Adjustments

Lanes	Median	Exclusive Left Lanes	Exclusive Right Lanes	Adjustment Factors
2	Divided	Yes	No	+5%
2	Undivided	No	No	-20%
Multi	Undivided	Yes	No	-5%
Multi	Undivided	No	No	-25%
–	–	–	Yes	+ 5%

One-Way Facility Adjustment

Multiply the corresponding two-directional volumes in this table by 0.6

BICYCLE MODE[2]

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Paved Shoulder/Bicycle Lane Coverage	B	C	D	E
0-49%	*	2,900	7,600	19,700
50-84%	2,100	6,700	19,700	>19,700
85-100%	9,300	19,700	>19,700	**

PEDESTRIAN MODE[2]

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Sidewalk Coverage	B	C	D	E
0-49%	*	*	2,800	9,500
50-84%	*	1,600	8,700	15,800
85-100%	3,800	10,700	17,400	>19,700

BUS MODE (Scheduled Fixed Route)[3]

(Buses in peak hour in peak direction)

Sidewalk Coverage	B	C	D	E
0-84%	> 5	≥ 4	≥ 3	≥ 2
85-100%	> 4	≥ 3	≥ 2	≥ 1

UNINTERRUPTED FLOW FACILITIES

FREEWAYS

Core Urbanized

Lanes	B	C	D	E
4	47,400	64,000	77,900	84,600
6	69,900	95,200	116,600	130,600
8	92,500	126,400	154,300	176,600
10	115,100	159,700	194,500	222,700
12	162,400	216,700	256,600	268,900

Urbanized

Lanes	B	C	D	E
4	45,800	61,500	74,400	79,900
6	68,100	93,000	111,800	123,300
8	91,500	123,500	148,700	166,800
10	114,800	156,000	187,100	210,300

Freeway Adjustments

Auxiliary Lanes Present in Both Directions	Ramp Metering
+ 20,000	+ 5%

UNINTERRUPTED FLOW HIGHWAYS

Lanes	Median	B	C	D	E
2	Undivided	8,600	17,000	24,200	33,300
4	Divided	36,700	51,800	65,600	72,600
6	Divided	55,000	77,700	98,300	108,800

Uninterrupted Flow Highway Adjustments

Lanes	Median	Exclusive left lanes	Adjustment factors
2	Divided	Yes	+5%
Multi	Undivided	Yes	-5%
Multi	Undivided	No	-25%

[1]Values shown are presented as two-way annual average daily volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the Highway Capacity Manual and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of motorized vehicles, not number of bicyclists or pedestrians using the facility.

[3] Buses per hour shown are only for the peak hour in the single direction of the higher traffic flow.

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

Source:
Florida Department of Transportation
Systems Planning Office
www.dot.state.fl.us/planning/systems/sm/los/default.shtm

TABLE 6

Generalized **Peak Hour Two-Way** Volumes for Florida's **Rural Undeveloped Areas** and **Developed Areas Less Than 5,000 Population**[1]

12/18/12

INTERRUPTED FLOW FACILITIES

STATE SIGNALIZED ARTERIALS

Lanes	Median	B	C	D	E
2	Undivided	*	1,220	1,350	**
4	Divided	*	2,790	2,890	**
6	Divided	*	4,300	4,350	**

Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways - 10%

Median & Turn Lane Adjustments

Lanes	Median	Exclusive Left Lanes	Exclusive Right Lanes	Adjustment Factors
2	Divided	Yes	No	+5%
2	Undivided	No	No	-20%
Multi	Undivided	Yes	No	-5%
Multi	Undivided	No	No	-25%
–	–	–	Yes	+ 5%

One-Way Facility Adjustment

Multiply the corresponding two-directional volumes in this table by 0.6

BICYCLE MODE[2]

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Rural Undeveloped

Paved Shoulder/Bicycle Lane Coverage	B	C	D	E
0-49%	*	120	190	300
50-84%	100	200	310	>1,010
85-100%	250	370	1,760	>1,760

Developed Areas

Paved Shoulder/Bicycle Lane Coverage	B	C	D	E
0-49%	*	220	460	1,480
50-84%	170	430	1,270	>1,760
85-100%	560	1,760	>1,760	**

PEDESTRIAN MODE[2]

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Sidewalk Coverage	B	C	D	E
0-49%	*	*	220	840
50-84%	*	120	780	1,390
85-100%	320	940	1,560	>1,820

UNINTERRUPTED FLOW FACILITIES

FREEWAYS

Lanes	B	C	D	E
4	3,020	4,510	5,490	6,300
6	4,510	6,720	8,220	9,720
8	6,040	8,970	10,960	12,970

Freeway Adjustments

Auxiliary Lanes Present in Both Directions + 1,800

UNINTERRUPTED FLOW HIGHWAYS

Rural Undeveloped

Lanes	Median	B	C	D	E
2	Undivided	440	790	1,350	2,710
4	Divided	2,440	3,820	4,840	5,500
6	Divided	3,680	5,730	7,280	8,240

Developed Areas

Lanes	Median	B	C	D	E
2	Undivided	820	1,550	2,190	2,990
4	Divided	2,460	3,860	4,970	5,660
6	Divided	3,680	5,790	7,440	8,500

Passing Lane Adjustments

Alter LOS B-D volumes in proportion to the passing lane length to the highway segment length

Uninterrupted Flow Highway Adjustments

Lanes	Median	Exclusive left lanes	Adjustment factors
2	Divided	Yes	+5%
Multi	Undivided	Yes	-5%
Multi	Undivided	No	-25%

[1]Values shown are presented as peak hour two-way volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the Highway Capacity Manual and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of motorized vehicles, not number of bicyclists or pedestrians using the facility.

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

Source:
Florida Department of Transportation
Systems Planning Office
www.dot.state.fl.us/planning/systems/sm/los/default.shtm