

## 5.4 Alternative 2: Structural Flood Protection Without Flood Retention Facility

Structural Flood Protection Without Flood Retention Facility (Alternative 2) would reduce flood damage during a major flood or greater when compared to the No Action Alternative. As compared to the other action alternatives, Alternative 2 would reduce flood damage in a much smaller geographic area than Alternatives 1 and 4, but in a greater geographic area than Alternative 3. Flood damage reduction in Alternative 2 would be achieved through installation of the Airport Levee Improvements, I-5 Projects, Aberdeen/Hoquiam North Shore Levee, and Local-scale Flood Damage Reduction Actions.

Alternative 2 would have an increased benefit to aquatic species habitat function when compared to the No Action Alternative as a result of implementation of Aquatic Species Habitat Actions. As compared to the other action alternatives, Alternative 2 would result in greater benefits to aquatic species habitat function than Alternative 1, similar benefits as Alternative 3, and less benefit than Alternative 4.

### 5.4.1 Flood Damage Reduction

#### 5.4.1.1 *Benefits from Implementing Flood Damage Reduction Actions*

Installation of the Airport Levee Improvements and I-5 Projects would result in areas behind (east of) the levee being no longer inundated during a 100-year flood (see Figure 5.4-1). In other portions of the Chehalis-Centralia area, there would be a reduction of 0.1 to 1 foot, depending on the location. On the west side of the Chehalis River, there would be a 0.1 to 0.9-foot increase in inundation, affecting 14 acres, due to the walls and levees shifting water upstream during a flood. Reductions in flood levels would not occur in the upper, remainder of the middle, or lower Chehalis Basin (see Figures 5.4-2 and 5.4-3); therefore, these Large-scale Flood Damage Reduction Actions would not reduce flood damage in those areas. Similar to Alternative 1, it is anticipated that the Aberdeen/Hoquiam North Shore Levee would prevent coastal flooding to the areas behind the levee in Aberdeen and Hoquiam (not shown on the figures).

Implementation of the Airport Levee Improvements and I-5 Projects would reduce flooding (and therefore flood damage) to approximately 88 high-value residential and commercial structures in the Chehalis River floodplain during a 100-year flood when compared to the No Action Alternative (WSE 2014d; Karpack 2016c). This is fewer than Alternatives 1 and 4, but more than Alternative 3.

Figure 5.4-1

Alternative 2 Changes in Downstream Inundation During 100-year Flood – Upper Chehalis Basin

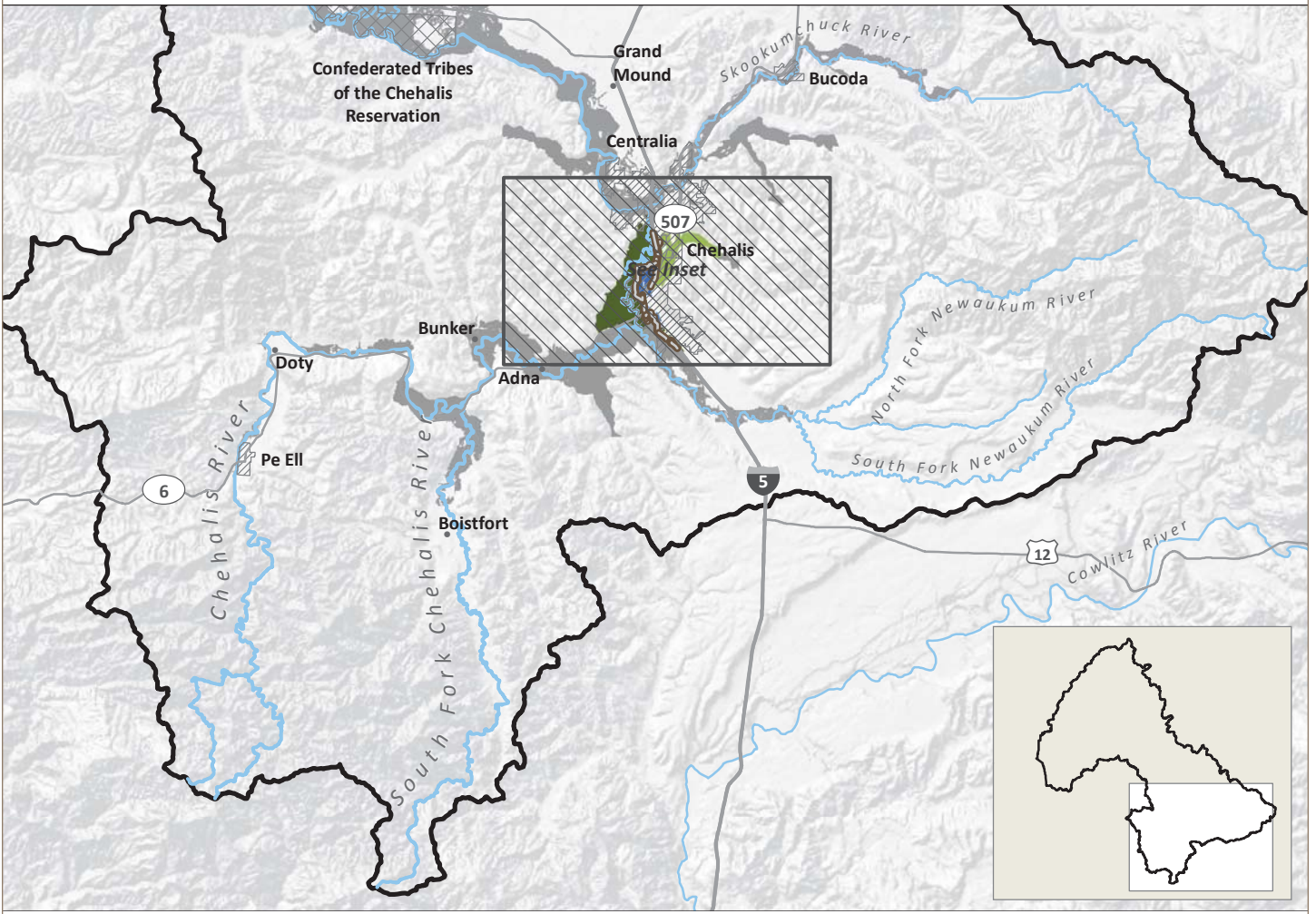
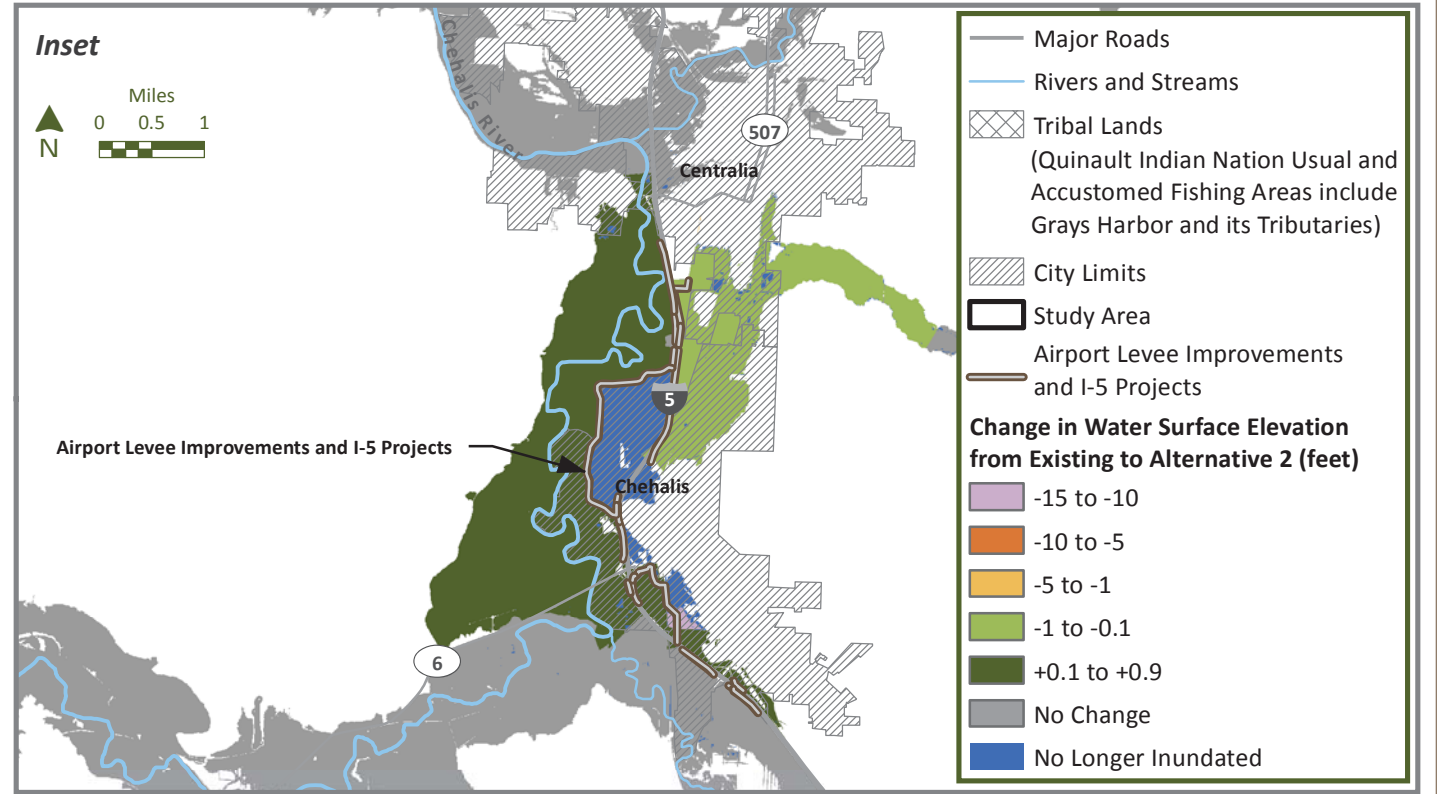


Figure 5.4-2

Alternative 2 Changes in Downstream Inundation During 100-year Flood – Middle Chehalis Basin

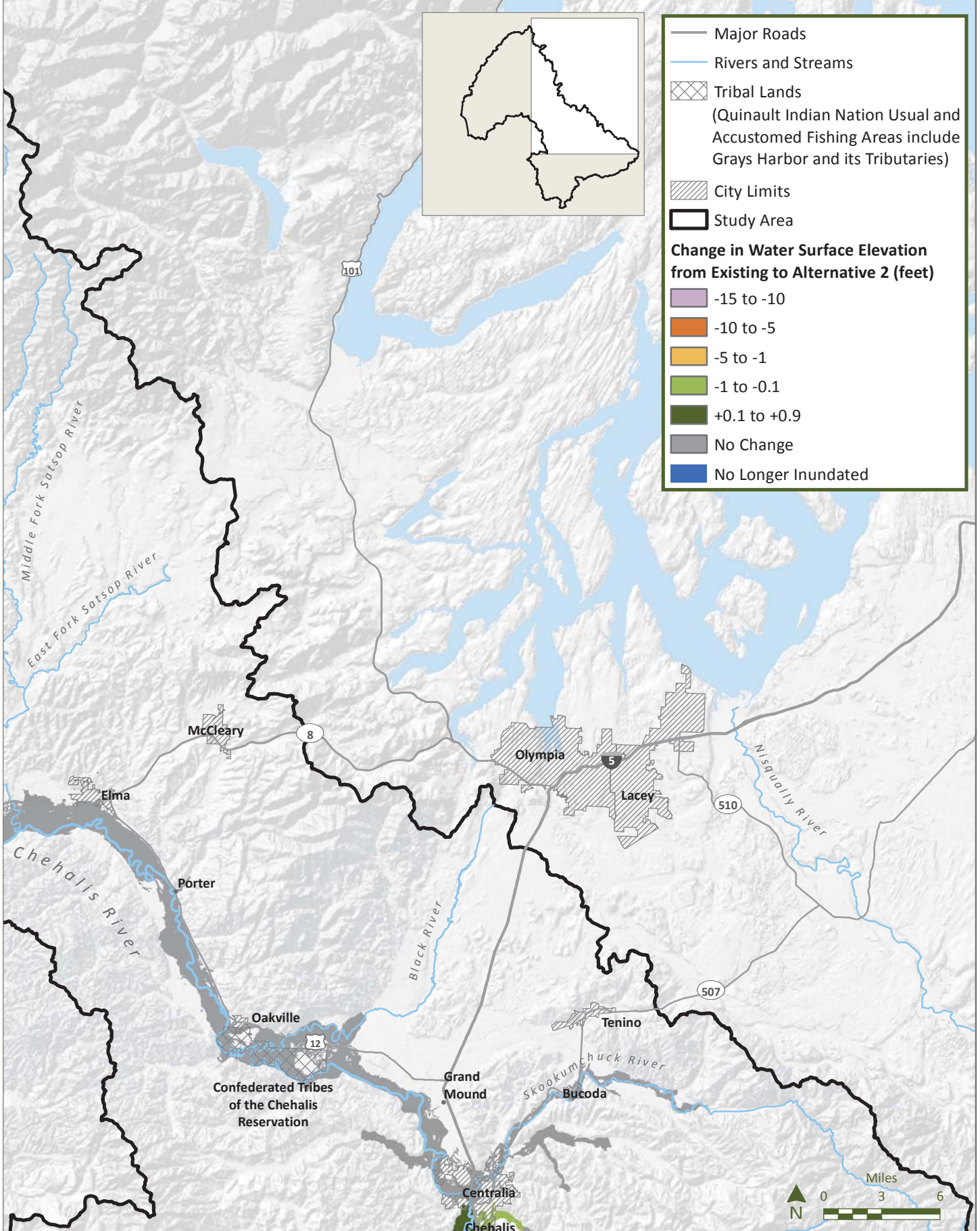
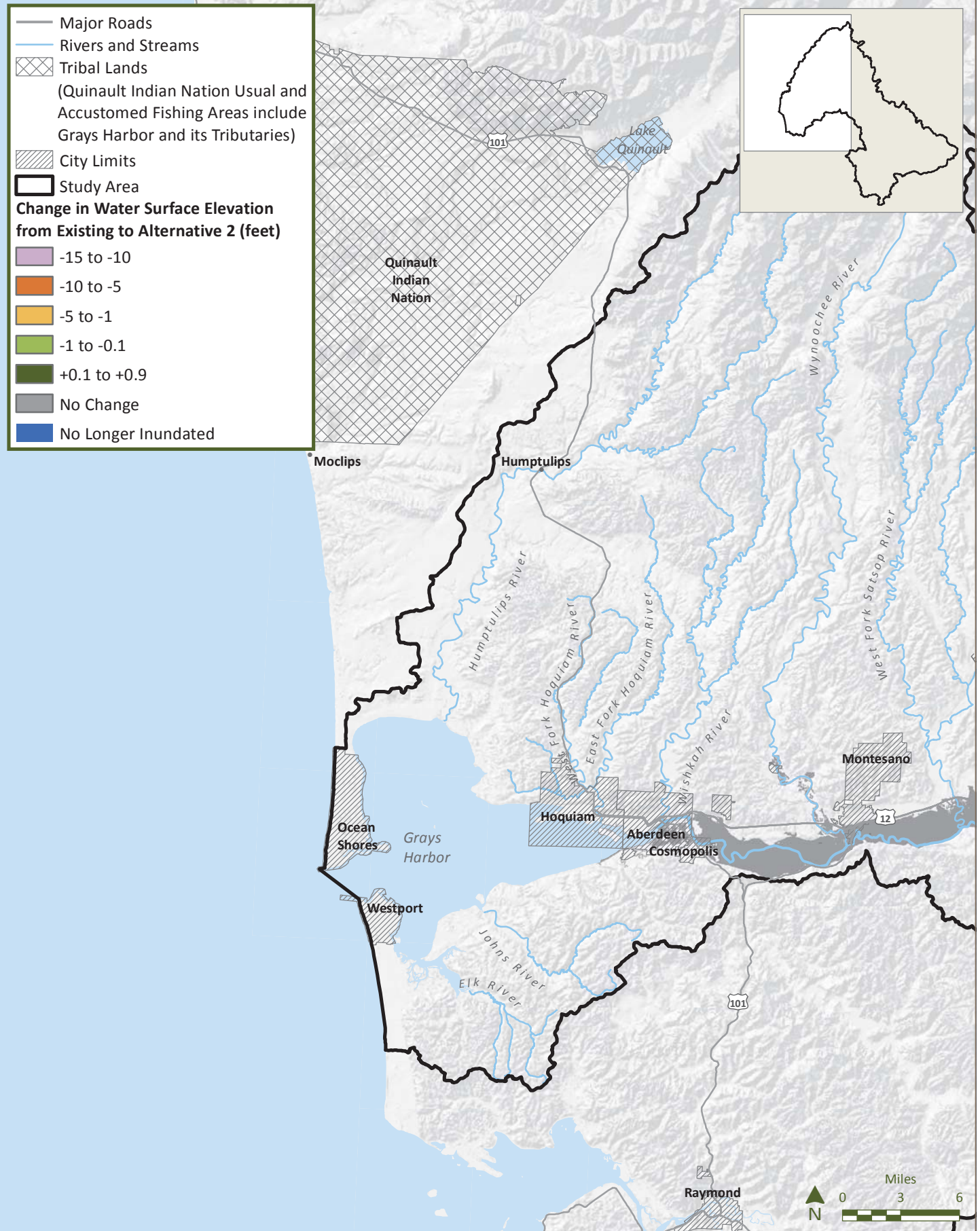


Figure 5.4-3

Alternative 2 Changes in Downstream Inundation During 100-year Flood – Lower Chehalis Basin



The Airport Levee Improvements and I-5 Projects would primarily protect structures in the Chehalis-Centralia area near the airport and I-5, and would not reduce flood damage in communities within Thurston and Grays Harbor counties. Similar to Alternative 1, the Aberdeen/Hoquiam North Shore Levee would prevent coastal flooding behind the levee, where up to 2,715 structures could potentially be protected (Franklin 2016). These structures have not been determined to be of high or limited value at this time. Similar to the other action alternatives, remaining residential, commercial, and industrial structures would have to be floodproofed to experience a reduction in flood damage.

Implementation of the Airport Levee Improvements and I-5 Projects would reduce inundated area during major floods by approximately 565 acres, all located within Lewis County (see Table 5.4-1 and Figure 5.4-1). Most of this would be on commercial land (333 acres) and public land or parks (210 acres), with some on residential land (36 acres). Raising the airport levee and constructing the I-5 Projects has the potential to increase flood extents and depths on approximately 14 acres of agricultural/forestlands to the west of (and upstream and downstream) these actions. Changes would be localized in nature, occurring upstream to north of SR 6 and downstream to just north of Mellen Street. Increased flood extents would occur around the edges of the Chehalis River floodplain; and increases in flood depths are not anticipated to exceed 1 foot (WSE 2014c).

**Table 5.4-1  
Change in Flooded Area Under Alternative 2**

GENERAL ZONE	LEWIS COUNTY	GRAYS HARBOR COUNTY	THURSTON COUNTY <sup>1</sup>
Agricultural/forestland	14	0	0
Commercial/industrial	-333	0	0
Parks	0	0	0
Public land	-210	0	0
Residential	-36	0	0
<b>Total</b>	<b>-565</b>		

Note:

1. Does not include the Chehalis Tribe reservation

The Airport Levee Improvements combined with the I-5 Projects would reduce the duration of closures of I-5 during major floods up to 3 days, which is a lesser extent than Alternative 1 but greater than the other action alternatives. The Airport Levee Improvements and I-5 Projects would decrease flood elevations east of I-5, and some areas south of Chehalis would no longer be inundated (generally behind the airport levee but in localized areas as well). However, the projects would increase flood levels on the west side of I-5, which could increase flooding of SR 6 and local roadways. Rail lines, including BNSF, Union Pacific, and the Curtis Industrial Park line, would continue to be flooded during major floods.

As described in Alternative 1, decreased flooding extents would reduce the need for emergency response, increase public safety, reduce impacts on access to critical medical facilities, and would affect public services and utilities to a lesser degree.

#### **5.4.1.2 Impacts of Implementing Flood Damage Reduction Actions**

While implementing Alternative 2 would be beneficial with regard to reducing flood damage, unavoidable significant adverse impacts would occur—primarily as a result of implementing the Large-scale Flood Damage Reduction Actions, as described in more detail in Chapter 4. As described in this section, impacts on water resources, geology, wetlands and vegetation, fish and wildlife, tribal resources, and cultural resources would occur to a lesser degree than Alternative 1. Adverse impacts on wetlands, tribal resources, and cultural resources could be undetermined or significant, depending on the resource.

Minor adverse impacts on water resources could occur in limited areas through the implementation of Alternative 2. The adverse impacts are primarily related to an increase in water depths in areas immediately upstream and downstream of the levee (WSE 2014d). Approximately 29 high-value structures would experience new inundation, only 7 of which would experience an increase of more than 1 inch. Most of these structures are residential, while some are commercial and agricultural.

For Alternative 2, the potential exists for minor adverse impacts on geology due to increased land settlement from construction of the Airport Levee Improvements and the Aberdeen/Hoquiam North Shore Levee as compared to the No Action Alternative, Alternative 3, and Alternative 4. This could cause long-term settlement of surrounding land and adjacent buildings. The occurrence of landslides and induced seismicity in the upper watershed would be less than Alternative 1 because the Flood Retention Facility would not be built. For geomorphology, the potential exists for moderate adverse impacts as a result of altering the geomorphic characteristics (i.e., channel migration potential) of the Chehalis River in the vicinity of the Aberdeen/Hoquiam North Shore Levee. With bank-hardening measures or levee placement, there is the potential to increase the velocity in the Chehalis River as well as redirect high-velocity flows downstream or to an adjacent or opposite bank, increasing erosion.

Alternative 2 would have significant adverse impacts on wetlands, primarily due to the permanent loss of wetlands that would be required to construct the Large-scale Flood Damage Reduction Actions. Alternative 2 would result in greater impacts on wetlands when compared to the No Action Alternative. In comparison to the other action alternatives, Alternative 2 would have fewer unavoidable significant adverse impacts on wetlands than Alternative 1 (see Table 5.4-2), but greater adverse impacts than Alternatives 3 and 4 due to the potential construction-related impacts and floodplain habitat connectivity constraints associated with the levee actions.

Table 5.4-2 provides a comparison of the approximate area of wetlands in the Chehalis River floodplain under the No Action Alternative with the approximate area of wetlands in the Chehalis River floodplain

under Alternatives 1 and 2—both of which include structural flood protection actions. As indicated, the area of floodplain wetlands subject to 100-year floods under Alternative 2 would be less than the No Action Alternative, but greater than Alternative 1. This indicates that Alternative 1 would result in a greater reduction in area of downstream wetlands subject to flooding than Alternative 2. The potential change in downstream wetlands flooded by a 100-year flood was not modeled for Alternatives 3 and 4, but would be less than Alternative 2 due to the lack of large-scale structural flood actions under Alternative 3, and the fact that one of the primary goals of Alternative 4 is to increase flood storage within the floodplain.

**Table 5.4-2  
Wetlands Located Inside of 100-year Inundation Event Boundary  
for the No Action Alternative and Alternatives 1 and 2**

WETLAND TYPE	AREA (ACRES)		
	NO ACTION ALTERNATIVE	ALTERNATIVE 1	ALTERNATIVE 2
Potentially (previously) disturbed wetlands	4,276	3,902	4,154
Palustrine forested wetland	4,789	4,492	4,705
Palustrine scrub-shrub wetland	4,476	4,228	4,407
Palustrine emergent wetland	6,291	5,949	6,196
Estuarine emergent wetland	50	47	49
Unconsolidated shore	339	335	337
Open water	3,877	3,817	3,859
Palustrine aquatic bed wetland	71	71	71
Estuarine aquatic bed wetland	0	0	0
<b>Total</b>	<b>24,169</b>	<b>22,841</b>	<b>23,778</b>

Source: Ecology 2011b; modeled inundation extent (WSE 2014c)

Under Alternative 2, impacts on vegetation would be much less than those anticipated under Alternatives 1 and 4, and slightly more than those anticipated under the No Action Alternative and Alternative 3. Similar to the No Action Alternative and Alternative 3, adverse impacts on vegetation under Alternative 2 would be primarily from the localized clearing of vegetation and its replacement with flood control structures and components. Neither the large-scale vegetation clearing proposed for the dam under Alternative 1, nor the large-scale conversion of existing upland forestland proposed under Alternative 4 would occur under Alternative 2.

Minor adverse impacts could occur to fish and wildlife as a result of changing flood extents and elevations upstream and downstream of the Airport Levee Improvements and I-5 Projects (depending on the location), and Local Projects during 100-year floods. These adverse impacts are described in more detail in Chapter 4, and would be more than those described for the No Action Alternative due to the implementation of Airport Levee Improvements and I-5 Projects. As compared to Alternative 1,

Alternative 2 would have a much lesser degree of long-term impacts on fish and wildlife because it would exclude the permanent and large-scale changes to the Chehalis River and its floodplain resulting from the Flood Retention Facility. In comparison to Alternatives 3 and 4, the structural elements associated with Alternative 2 (floodwalls and levees) would result in a greater adverse impact on fish and wildlife.

Impacts on tribal resources would occur with the implementation of Alternative 2, primarily related to impacts on fish resources, although disruption to plant, wildlife, and traditional cultural practices could also occur. The extent of potential impacts on tribal resources is pending additional coordination with tribes and continued government-to-government consultations. In comparison to the No Action Alternative, Alternative 2 would have a greater potential for unavoidable adverse impacts on tribal resources due to the Large-scale Flood Damage Reduction Actions. As compared to other action alternatives, Alternative 2 would likely result in less impact on tribal resources than Alternative 1, and greater adverse impacts than Alternative 3 and Alternative 4.

Moderate to significant adverse impacts on cultural resources could occur due to the predicted archaeological potential in proposed areas of construction, although the degree or severity of the impact would depend on the nature of cultural resources that would be disturbed. As compared to the No Action Alternative, potential long-term impacts from Alternative 2 would be greater due to the additional disturbance activities during construction and operation within areas that have cultural resources potential. As compared to the other action alternatives, Alternative 2 would have less impact than Alternatives 1 and 4, and slightly more than Alternative 3 due to the additional excavation in areas with a high probability for archaeological material.

Development pressure could increase as a result of implementing the Airport Levee Improvements and I-5 Projects in areas where inundation is decreased. This would only affect residential (104 parcels) and commercial/industrial (68 parcels) in the incorporated areas of Chehalis and Centralia, and 1 parcel in Lewis County (in the UGA). In total, Alternative 2 could increase development pressure on up to 173 parcels in Lewis County. No agricultural parcels that could be further developed would be affected.

During the next 100 years, population growth in the floodplain could result in development similar to that expected for the No Action Alternative, approximately 4 to 9 structures per year (total of 407 to 914 structures during the next 100 years). As a result of decreased flooding extents and the corresponding increase in development pressure on those parcels, future Chehalis River floodplain development rates under this alternative may tend toward the middle of the range. It is assumed that development pressure in Thurston and Grays Harbor counties would not be influenced by this alternative because flood extents and depths in those locations would not be reduced as a result of implementing the Airport Levee Improvements and I-5 Projects. Floodplain growth in those areas would occur consistent with the No Action Alternative. More analysis related to potential future development in the Chehalis River floodplain is included in Appendix L.



## **5.4.2 Aquatic Species Habitat Actions Evaluation**

Implementation of the Aquatic Species Habitat Actions of Alternative 2 would substantially increase the abundance of native aquatic species, reduce the potential for future ESA listings, and substantially enhance tribal and non-tribal fisheries as compared to the No Action Alternative (before factoring in climate change; see Section 5.4.3). The benefits of combined actions within Alternative 2 to fish, wildlife, and non-salmonid fish have not been modeled but are anticipated to be similar to the Aquatic Species Habitat Action.

As described in the introduction to Section 5.4, the long-term impacts of Alternative 2 would likely result in an increased benefit to aquatic species habitat function when compared to the No Action Alternative. As compared to the other action alternatives, Alternative 2 could result in greater benefits to aquatic species habitat function than Alternative 1, because it would exclude the permanent and large-scale changes to the Chehalis River and its floodplain resulting from the Flood Retention Facility. Alternative 2 is anticipated to result in less benefit to aquatic species compared to Alternatives 3 and 4, when considering the structural components associated with Alternative 2 versus the other action alternatives. Potential impacts on cultural resources and tribal resources from implementation of Aquatic Species Habitat Actions in Alternative 2 would be the same as those described under Alternative 1, though likely in less magnitude due to the relatively smaller construction and operational footprint of Alternative 2.

## **5.4.3 Climate Change Analysis**

Alternative 2 is anticipated to provide beneficial effects with regard to reducing flood damage and restoring habitat for aquatic species in response to the effects of climate change. These beneficial effects would be greater than under the No Action Alternative, due to structural flood protection measures that would be designed to provide resiliency with the potential for more frequent and intense floods resulting from climate change, and due to Aquatic Species Habitat Actions associated with this alternative. In comparison to other action alternatives, the long-term adverse impacts contributing to climate change from implementation of this alternative are similar to all other action alternatives, except for Alternative 1, which has additional adverse impacts related to the additional vegetation loss and resulting equivalent GHG emissions associated with construction and operation of the Flood Retention Facility.

Climate change has the potential to reduce the effectiveness of flood protection provided by levees and floodwalls (i.e., Airport Levee Improvements, I-5 Projects, and Aberdeen/Hoquiam North Shore Levee elements). Flood elevations could increase as a result of climate change, which could require additional freeboard in levee designs. Impacts of flood elevations that are increased upstream and downstream as a result of levees and walls are likely to be magnified with climate change, as floods occur more frequently and are more intense. Adverse impacts from the effects of climate change on Alternative 2 are anticipated to reduce the effectiveness of restoration for salmonid populations under both the low

and high restoration scenarios due to increased river temperatures and drier summers, although this effect has not been modeled.

#### **5.4.4 Mitigation**

Unavoidable adverse impacts that cannot be mitigated without substantial intervention include those associated with the permanent loss of wetlands. Impacts on fish and wildlife are expected to be minor for Alternative 2, but could result in undetermined adverse impacts on tribal resources. Impacts on cultural resources would depend on the nature of cultural resources that would be disturbed. Specific measures would be identified and implemented during project-level design and environmental review. Potential compensatory mitigation measures for potential impacts on wetlands, tribal resources, and cultural resources would be the same as those described under Alternative 1.