5.6 Alternative 4: Restorative Flood Protection

Restorative Flood Protection (Alternative 4) would address flooding in the Chehalis River floodplain as well as in tributary areas of the Chehalis River—the North and South Fork Newaukum rivers, South Fork Chehalis River, Stearns Creek, Bunker Creek, Deep Creek, Lake Creek, Stillman Creek, and Elk Creek—largely through supporting relocation and adaptation of at-risk land uses under existing conditions. Alternative 4 would increase the areal extent and depth of 100-year floods upstream of Newaukum River confluence. Downstream of the Newaukum River confluence, including in the Chehalis-Centralia area, Alternative 4 would reduce flood extents and depths, but to a lesser degree than Alternative 1. As compared to the No Action Alternative and Alternatives 2 and 3, Alternative 4 would decrease flood extents and depths to a greater extent in the Chehalis River floodplain. Because Alternative 4 would relocate 16,000 acres of land uses, including 8,500 acres of agriculture, upstream of the Newaukum confluence, it would result in greater flood damage reduction compared to the No Action Alternative and other action alternatives (see Appendix C).

Over the long term, Alternative 4 would benefit aquatic species habitat function to a much greater degree compared to the No Action Alternative and other action alternatives; this would be achieved through implementation of the Aquatic Species Habitat Actions and Restorative Flood Protection treatments proposed under Alternative 4. Restorative measures, including placement of engineered wood structures, associated with implementation of this alternative are intended to reduce flood damage by slowing and storing the flow of floodwaters in the floodplain, and would be coordinated with Aquatic Species Habitat Actions. These actions would complement, rather than replace, the actions associated with Aquatic Species Habitat Actions.

5.6.1 Flood Damage Reduction

5.6.1.1 Benefits from Implementing Flood Damage Reduction Actions

Downstream of the Newaukum River confluence, Alternative 4 would reduce flooding on approximately 815 acres through a reduction of peak flood flows entering the mainstem Chehalis River. Compared to Alternatives 1 and 2, there would be less reduction in water surface elevation during a 100-year flood along the Chehalis River in the Chehalis-Centralia area than Alternative 1, and similar reductions in specific locations to Alternative 2. The reduction in inundation for Alternative 4 during a 100-year flood is shown in Figure 5.6-1.

Downstream of Restorative Flood Protection treatment areas, within the Chehalis-Centralia city limits, 136 high-value structures would experience reduced inundation. Within river management areas or greenways in the Restorative Flood Protection treatment areas, flood inundation would be increased on approximately 16,000 acres, affecting approximately 280 high-value structures that are not anticipated to flood under current conditions. Flood depths and frequencies would increase and further affect 182 high-value structures within the treatment areas that do flood under current conditions during a 100-year flood. Alternative 4 would permanently address flood damage to these 462 structures by

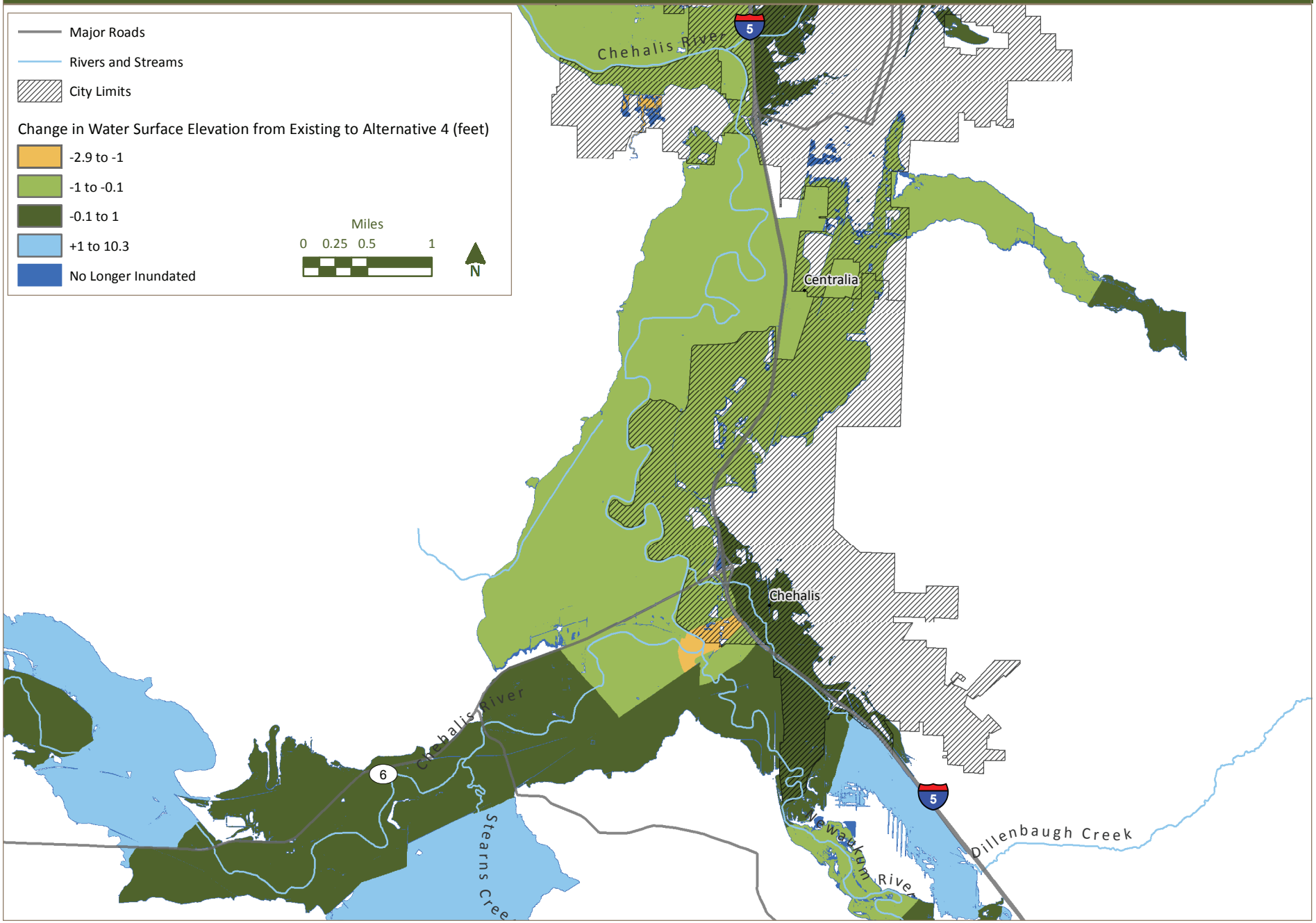
removing them, and providing compensation, relocation, or adaptation assistance to landowners. If all landowners with structures that currently experience flooding, and where flooding would increase, participated, 182 fewer structures within treatment areas would be flooded than under current conditions, and approximately 16,000 acres would no longer experience flood damage because these land uses would be relocated.

Similar to the other action alternatives, remaining residential, commercial, and industrial structures—in this case, outside of river management corridors, but within the future Restorative Flood Protection 100-year floodplain, as well as in the remainder of the Chehalis River floodplain—would have to be floodproofed to experience a reduction in flood damage.

In the Chehalis-Centralia area, Alternative 4 would reduce flood durations on local roads. Restorative Flood Protection would protect the Chehalis-Centralia Airport during smaller floods, allowing flights to continue, but the airport would continue to flood during 100-year floods. Restorative Flood Protection would likely decrease the frequency of rail closures downstream of the Newaukum confluence.

Figure 5.6-1

Alternative 4 Changes in Inundation During 100-year Flood – Upper Chehalis Basin



Note: Difference in water surface elevation (feet) of a 100-year storm event between existing conditions and with the Restorative Flood Protection Alternative

In addition to flood damage reduction benefits within and downstream of Restorative Flood Protection treatment areas, Alternative 4 would benefit wetlands and improve riparian vegetation communities, and improve connectivity to floodplain habitat. These treatment actions would create conditions that are beneficial to fish and wildlife, both in the channels and within connected floodplain habitats. Potential long-term impacts on tribal resources consider impacts following construction on fishing, hunting, gathering, and other traditional cultural activities and treaty-reserved resources. Restorative Flood Protection actions taken to reduce flood damage as part of Alternative 4 are expected to have beneficial outcomes for tribal resources, primarily because of the significant improvement in self-sustaining habitat conditions that would benefit fisheries.

5.6.1.2 Impacts of Implementing Flood Damage Reduction Actions

As described in this section, impacts on land use, transportation, public services and utilities, and, potentially, cultural resources could be significant. While there would be a localized significant impact on vegetation as a result of relocating approximately 16,000 acres of floodplain land uses to converted uplands (currently managed forestland), this impact may be moderated through restorative actions. This would include measures such as planting native vegetation across equal valley bottom areas; the impact would also be reduced when considering benefits to vegetation that result from the implementation of Aquatic Species Habitat Actions.

Restorative Flood Protection treatment areas would occupy much of the channels and floodplains of the Newaukum, South Fork Chehalis, and mainstem Chehalis rivers; and Stearns, Stillman, Elk, Bunker, Deep, and Lake creeks. Based on screening-level analysis, this could result in new or increased flooding to an area potentially reaching 21,000 acres in size, which is considered a moderate impact on surface water quantity. This includes approximately 12,100 acres of active farmland, where approximately 8,500 acres of agricultural land would be converted to floodplain forest.

The treatments required, and resultant changes to the river system in those areas, would likely displace many rural residential homes and farms; some public and commercial land uses could also be displaced or affected. Approximately 462 high-value structures would be relocated or experience more flooding. Although this action includes compensating willing landowners for property or structures that would become inundated (or experience more inundation), and assistance for interested landowners to relocate to areas of the Chehalis Basin that do not flood, the potential adverse impacts are still considered significant. Permanently relocating or moving these structures out of flood-prone areas can, however, also be considered a long-term benefit.

Upstream of the Newaukum River confluence, Alternative 4 would increase the duration of closure of SR 6 by approximately 4 days, SR 506 by approximately 1 to 2 days, and SR 508 by approximately 2 days during a 100-year flood. Compared to the No Action Alternative and other action alternatives, this could increase disruptions to industry, commercial businesses, and public services. Downstream of the Newaukum confluence with the Chehalis River, I-5 closures would continue during major floods (up to

4 days), requiring the use of WSDOT's detour route. Under Alternative 4, local roadways that currently flood during major floods would continue to do so, even though smaller-scale flood damage reduction projects could reduce flooding of local roadways in some places. The Chehalis-Centralia Airport would continue to flood during 100-year floods, restricting flights and use of the airport for emergency response.

Compared to the No Action Alternative and Alternatives 1 and 2, Alternative 4 does not improve access to critical medical facilities because flooding of local and regional roads would continue, and in some locations would be expanded. Higher flood levels and increased duration of flooding of SR 6 and local roadways could prevent or delay emergency service access. Restorative Flood Protection includes relocation of residential, agricultural, commercial, and public service land uses out of the 10-year floodplain, which would reduce the demand for emergency services during floods as part of Alternative 4, but access to areas outside the 10-year floodplain within treatment areas may still be required.

Alternative 4 includes relocation of agricultural, residential, and commercial land uses. New public services and utilities would need to be provided to the upland areas where the displaced land uses would be relocated. This would not directly increase the demand for public services and utilities, but relocation of land uses would require removal and relocation of public services and utilities throughout the 10-year floodplain, which would be a significant adverse impact.

Although the degree or severity of impact on cultural resources would depend on the nature of the disturbance, moderate to significant adverse impacts on cultural resources could occur due to the predicted archaeological potential. Potential impacts on tribal cultural resources or graves, Indian human remains, or traditional cultural properties would be determined in coordination with tribes and government-to-government consultations.

5.6.2 Aquatic Species Habitat Action Evaluation

Alternative 4, when implemented as a comprehensive strategy, would substantially increase 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. As described in the introduction to Section 5.6, the long-term impacts of Alternative 4 would have an increased benefit to aquatic species habitat function as compared to the No Action Alternative and other action alternatives through implementation of the Aquatic Species Habitat Actions and Restorative Flood Protection treatments. The predicted impacts on salmon and steelhead abundance are shown in combination with the beneficial effects of the low and high restoration scenarios in Table 5.6-1 and Figure 5.6-2.

Similar to the No Action Alternative and Alternative 1, modeled results of salmon habitat potential for Alternative 4 include the maturation of riparian areas in managed forestlands and active restoration from the Aquatic Species Habitat Actions compared to current conditions. The contribution of managed forestlands to total salmonid abundance would, on average, contribute 59% of the restoration benefit under the low scenario and 27% under the high scenario. Most of the benefit of riparian and fish

passage improvements in managed forestlands would accrue to coho and steelhead because a larger portion of their habitat is located in the Satsop, Humptulips, and Wynoochee basins that are largely managed forestland[4].

Table 5.6-1
Potential Response in Salmonid Abundance for the Chehalis Basin with Alternative 4

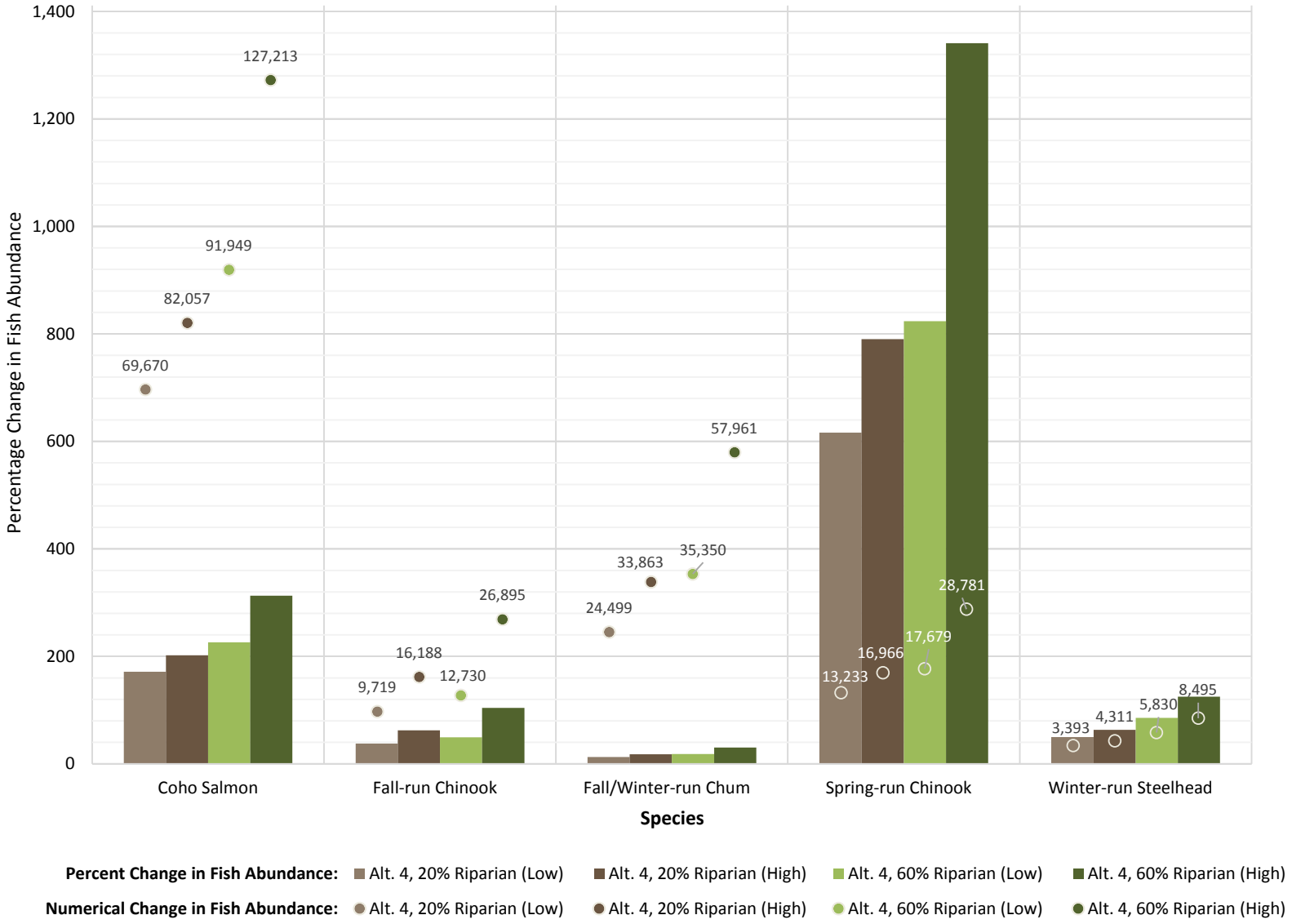
SPECIES (CURRENT HABITAT POTENTIAL)	CHANGE IN ABUNDANCE IN NUMBER OF FISH (%)				
	NO RESTORATION	WITH LOW RESTORATION; 20% OF REACHES	WITH HIGH RESTORATION; 20% OF REACHES	WITH LOW RESTORATION; 60% OF REACHES	WITH HIGH RESTORATION; 60% OF REACHES
Coho salmon (40,642)	46,471 (114%)	69,670 (171%)	82,057 (202%)	91,949 (226%)	127,213 (313%)
Fall-run Chinook salmon (25,844)	6,782 (26%)	9,719 (38%)	16,188 (63%)	12,730 (49%)	26,895 (104%)
Fall/Winter-run chum salmon (190,550)	5,573 (3%)	24,499 (13%)	33,863 (18%)	35,350 (19%)	57,961 (30%)
Spring-run Chinook salmon (2,146)	10,153 (473%)	13,233 (616%)	16,966 (790%)	17,679 (824%)	28,781 (1,341%)
Winter-run steelhead (6,800)	1,306 (19%)	3,393 (50%)	4,311 (63%)	5,830 (86%)	8,495 (125%)

Source: ICF 2016

[4] Refer to Draft EIS Addendum dated October 17, 2016.

Figure 5.6-2

Potential Response in Salmonid Abundance to Habitat Change in the Chehalis Basin with Alternative 4



Source: ICF 2016

5.6.3 Climate Change Analysis

This section provides an analysis of the adverse effects of Alternative 4 contributing to climate change, as well as the effects of climate change on Alternative 4.

5.6.3.1 Adverse Effects Contributing to Climate Change

No long-term adverse impacts that contribute to the effects of climate change are anticipated from the implementation of Alternative 4. Benefits to offset the adverse impacts of climate change that would occur with Restorative Flood Protection and Aquatic Species Habitat Actions are greater than those described under the other action alternatives, because these actions would increase the amount of forestland in the Chehalis Basin and offset forestland impacts that may occur from relocating floodplain land uses to converted uplands.

5.6.3.2 Effects of Climate Change on the Proposed Alternative

Actions taken under Alternative 4 would anticipate the changes in precipitation, increased flooding, and drought conditions that are predicted with climate change forecasts. Similar to Alternatives 1 and 2, the extent of flooding in downstream areas from more intense heavy winter rains anticipated with climate change could be moderated, to some degree, in a broad geographic area through the implementation of Alternative 4.

Restorative Flood Protection actions in Alternative 4 include restoring floodplain connectivity, restoring streamflow regimes, and re-aggrading incised channels. These actions, along with Aquatic Species Habitat Actions, are likely to ameliorate streamflow and temperature changes and increase habitat resilience in the face of climate change. Protection and restoration of natural watershed processes is also anticipated to mitigate climate change through carbon sequestration. Distributing flood damage reduction actions in all three of the upper sub-basins in the Chehalis Basin may further buffer against future variability in the magnitude and spatial distribution of precipitation patterns that could result from climate change.

The impacts of Alternative 4 on fish abundance under climate change conditions were modeled using EDT. The results indicate that Alternative 4 would increase salmon population abundance in the Chehalis Basin, with the most notable increase in abundance in spring-run Chinook salmon (ICF 2016). See Table 5.6-2 and Figure 5.6-3 for a summary of the modeled results.

Table 5.6-2

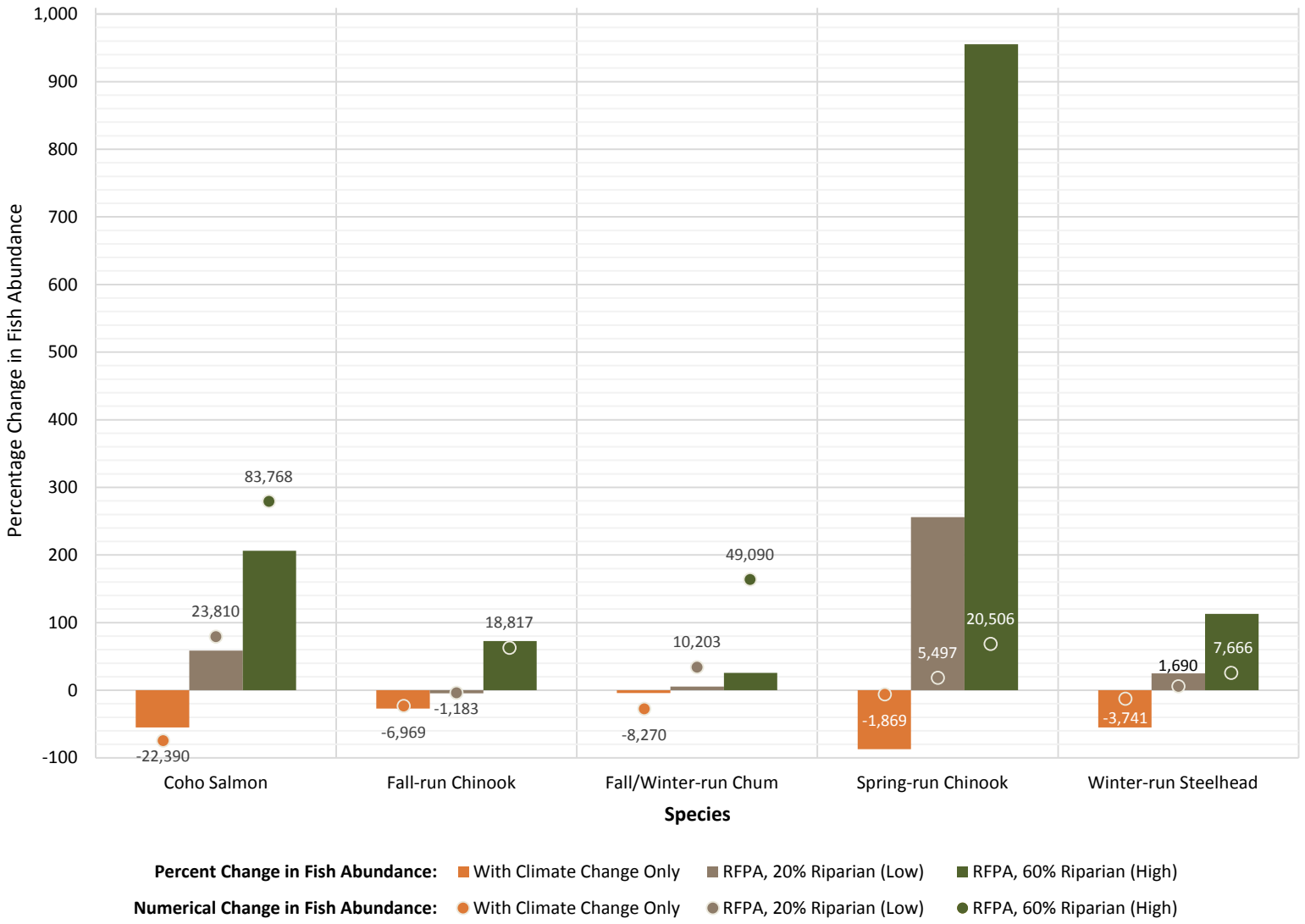
Potential Response in Salmonid Abundance for the Chehalis Basin with Alternative 4 and Climate Change

SPECIES (CURRENT HABITAT POTENTIAL)	FUTURE HABITAT POTENTIAL WITH CLIMATE CHANGE	CHANGE IN ABUNDANCE IN NUMBER OF FISH (%)	
		WITH ALTERNATIVE 4 AND LOW RESTORATION; 20% OF REACHES AND CLIMATE CHANGE	WITH ALTERNATIVE 4 AND HIGH RESTORATION; 60% OF REACHES AND CLIMATE CHANGE
Coho salmon (40,642)	-22,390 (-55%)	23,810 (59%)	83,768 (206%)
Fall-run Chinook salmon (25,844)	-6,969 (-27%)	-1,183 (-5%)	18,817 (73%)
Fall/Winter-run chum salmon (190,550)	-8,270 (-4%)	10,203 (5%)	49,090 (26%)
Spring-run Chinook salmon (2,146)	-1,869 (-87%)	5,497 (256%)	20,506 (955%)
Winter-run steelhead (6,800)	-3,741 (-50%)	1,690 (25%)	7,666 (113%)

Source: ICF 2016

Figure 5.6-3

Potential Response in Salmonid Abundance to Habitat Change in the Chehalis Basin with Climate Change and Alternative 4



Source: ICF 2016

5.6.4 Mitigation

The most significant impact associated with Alternative 4 is to existing land uses, transportation, and public services. Because Restorative Flood Protection has only been evaluated at a concept or screening level, land use, transportation, and public service impacts at specific locations have not yet been determined. Potential avoidance and minimization measures could include treatment area design that avoids construction of Restorative Flood Protection treatments in areas where the most or highest magnitude of impacts would occur, and where treatments would not significantly reduce downstream flood elevations.

An integral part of Alternative 4 is providing assistance to help willing property owners and residents adapt. Mitigation strategies could include the following:

- **Stay-in-place adaptation assistance –** This could include floodproofing, elevation of structures, farm pads, drainage improvements, or relocation of homes and structures to more upland portions of the same parcel
- **Buy-outs –** Property owners may prefer a buy-out option for their property
- **Conservation easements –** Permanent conservation easements could be used to compensate property owners for lost use of land
  - This could be combined with stay-in-place assistance where life and property would not be at risk, or be a strategy for parcels without structures
- **Relocation support to upland areas –** Relocation of some land uses to upland areas could be a viable option in portions of the watershed
  - The feasibility of this concept is very preliminary and could continue to be explored

Mitigation for potential long-term impacts on public services and utilities could include removal and decommissioning of utilities in the treatment areas, and areas where flood levels are anticipated to increase. Wastewater treatment systems, propane tanks, and underground fuel supplies would be decommissioned according to local and state guidelines to avoid potential contamination.

Mitigation for impacts on public services and utilities in areas that would experience increased flooding could include measures to floodproof or protect the affected utilities and services, or relocating them out of the flooded area.

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 cultural resources and tribal resources would be the same as those described under Alternative 1.