Chehalis Basin Strategy

EIS Executive Summary

Reducing Flood Damage and
Restoring Aquatic Species Habitat

DEPARTMENT OF ECOLOGY
State of Washington

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EXECUTIVE SUMMARY

The Chehalis Basin has experienced both devastating flood damage and extensive loss of aquatic species habitat

For more than 100 years, extreme flooding and the declining health of the Chehalis River and its aquatic species have continued without a comprehensive response. Since 1971, there have been 14 federally declared disasters in the Chehalis Basin from flooding. Flood damage reduction has been extensively examined in more than 830 studies since the 1930s; however, the efforts conducted to date have not resulted in appreciable reduction of flood damage. Productivity for native aquatic species has also been reduced for decades, with current habitat degraded by as much as 87% for some species. This loss has harmed tribal and non-tribal fishers, as well as diminished the biodiversity of the Chehalis Basin. The Governor and Washington State Legislature have made it a priority to develop a comprehensive strategy that integrates flood damage reduction and aquatic species habitat restoration within the Chehalis Basin, and have invested in identifying potential solutions. The Chehalis Basin Strategy is intended to be a program of integrated actions focusing on maximizing the benefits of flood damage reduction and aquatic species habitat restoration over both the short and long term, while avoiding and minimizing adverse environmental, social, cultural, agricultural, and economic impacts.

The Washington State Department of Ecology (Ecology) has prepared a State Environmental Policy Act (SEPA) Draft Programmatic Environmental Impact Statement (EIS) at the request of the Governor's Chehalis Basin Work Group (Work Group), which has been tasked by the Governor with developing recommendations for small to large actions that reduce flood damage and restore aquatic species habitat. The EIS evaluates a suite of actions to address these two challenges in the Chehalis Basin. The SEPA environmental review provides a formal process to identify and assess the potential environmental effects of a proposal before deciding how to proceed. The process helps decision-makers and the public understand how a proposed action would affect people and the environment.


Major Roads
Rivers and Streams
Tribal Lands
Study Area
WA
OR
Olympic Mountains
Kalaloch
Queets
Quinault Indian Nation
Taholah
Moclips
Lake Quinault
Lake Cushman
Humptulips
West Fork Humptulips River
East Fork Humptulips River
Wynoochee River
West Fork Satsop River
Middle Fork Satsop River
East Fork Satsop River
Humptulips River
West Fork Hoquiam River
East Fork Hoquiam River
Wishkah River
Ocean Shores
Grays Harbor
Hoquiam
Aberdeen
Cosmopolis
Westport
John's River
Elk River
McCleary
Elma
Montesano
Chehalis River
Porter
Black Hills
Black River
Oakville
Confederated Tribes of the Chehalis Reservation
Olympia
Lacey
Nisqually River
Tenino
Bald Hills
Skookumchuck River
Grand Mound
Bucoda
Centralia
Chehalis
Raymond
Willapa Hills
Elk Creek
Bunker
Doty
Adna
Pe Ell
Boistfort
Chehalis River
South Fork Chehalis River
North Fork Newaukum River
South Fork Newaukum River
Cowlitz River
Pacific Ocean
Long Beach
Columbia River
Astoria
Kelso
Longview
101
8
12
107
6
5
510
507
Miles
0
5
10
N

THE CHEHALIS BASIN

The EIS focuses on the Chehalis Basin in Southwestern Washington, which is the second largest river basin within the state. The Chehalis Basin extends over eight counties, encompassing large portions of Grays Harbor, Lewis, and Thurston counties, and small parts of Pacific, Cowlitz, Wahkiakum, Mason, and Jefferson counties. The Chehalis River flows approximately 125 miles north-northwesterly to Grays Harbor and the Pacific Ocean, and drains an area of approximately 2,700 square miles. Many species of fish are found in the Chehalis Basin including salmonids such as steelhead and Chinook, coho, and chum salmon. Extensive and varied habitats within and adjacent to rivers and streams in the Chehalis Basin also support the most diverse amphibian population in Washington, an abundance of mudminnow, and numerous other native fish and wildlife species.

The Chehalis Basin has a high proportion of forestlands (80%), with 54% classified as managed forests. Major infrastructure, including Interstate 5 (I-5) and the BNSF Railway and Union Pacific Railroad lines, cut through the middle of the Chehalis Basin within the floodplain. The most intensive commercial and residential development in the basin is concentrated in the Chehalis-Centralia and Aberdeen areas. The greatest amount of commercial and residential development subject to flooding is also in these two areas of the basin. In the lower (northern) Chehalis Basin downstream of Centralia, the mainstem Chehalis River valley is much wider than the upper Chehalis Basin, less populated, and predominantly agricultural, except for Aberdeen, Hoquiam, and Cosmopolis at the Grays Harbor estuary.

The Confederated Tribes of the Chehalis Reservation is situated near the mouth of the Black River on the mainstem Chehalis River. The Quinault Indian Reservation is located outside of the Chehalis Basin, on the southwestern corner of the Olympic Peninsula in Grays Harbor County. Quinault Indian Nation usual and accustomed fishing areas include Grays Harbor and its tributaries.

PURPOSE AND NEED

In order to make a meaningful difference, the Chehalis Basin Strategy will need to provide a long-term, Basin-wide, integrated approach to substantially reduce damage from major floods and restore degraded aquatic species habitat in the Chehalis Basin

An integrated Basin-wide strategy should provide the following:

- A safer future for people
- A healthier, more resilient Chehalis Basin for aquatic species
- Reduced social and economic costs associated with floods and degraded aquatic species habitat

No action will stop all flooding. The strategy is intended to reduce the damages and adverse impacts of flooding and, at the same time, support the economic prosperity of communities, and restore fish populations and other natural resources in the Chehalis Basin.

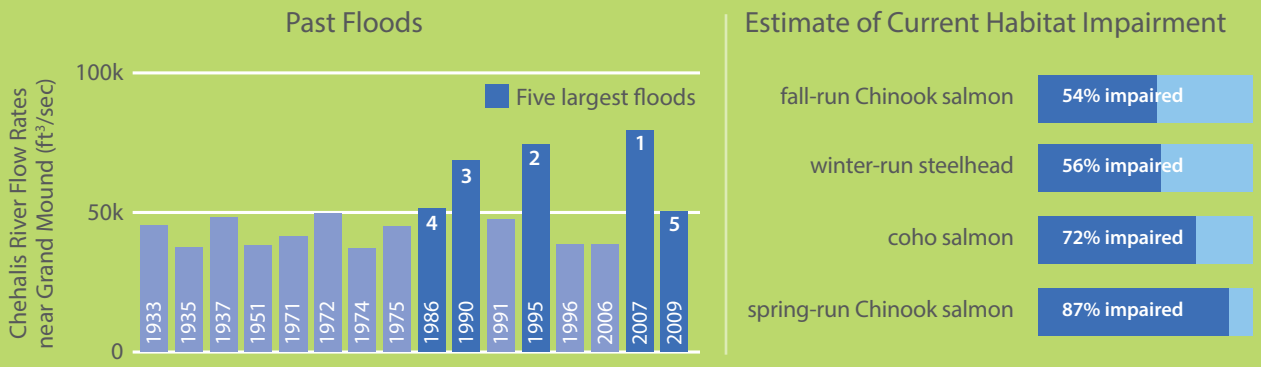
If action is not taken, communities and resources will experience greater hardships and loss

Flooding occurs on the Chehalis River and its tributaries in Lewis County, Thurston County, Grays Harbor County, and the Chehalis Tribe reservation. Five of the largest floods in the

Future climate conditions amplify the need

Temperatures, droughts, torrential rains, and severe floods are all increasing and the trends are projected to continue as the world's climate warms. Fish harvest has been limited by poor runs over the last 30 years, and aquatic species habitat productivity has been degraded by up to 87%.

Climate-related trends



history of the Chehalis Basin occurred in the last 30 years. In 2007 and 2009, two extreme floods occurred only 13 months apart. People lost their homes, businesses, agricultural equipment, and livestock. Roads and infrastructure were inundated with floodwaters, causing disruptions to emergency services. Repeated flooding makes it difficult to attract new industry to the Chehalis Basin, and the emotional and psychological costs to communities are significant.

In addition to worsening flood conditions, aquatic species habitat has also deteriorated. Beginning in the 1850s, human-caused impacts on aquatic habitat have been extensive. Although there have been robust runs of most salmon species every year for the last 30 years, poor returns of one or more species of salmon have significantly limited tribal and non-tribal harvest. In recent years, summers have become drier with warmer stream temperatures and lower streamflows, and these conditions are predicted to get worse in the future.

The natural resources of the Chehalis Basin have supported native people for millennia and continue to provide value to both tribal and non-tribal people of the basin. Farming, forestry, harvesting of shellfish, and fishing continue to be central to the area's economy. Salmon play a major cultural, recreational, and economic role, and the protection and restoration of salmon habitat is very important for many people in the Chehalis Basin. With no action, the future for flood damage and aquatic species will be significantly worse. People, communities, and natural resources will suffer at unprecedented levels. Further declines in habitat could result in future threatened or endangered species listings, causing federal government intervention into local actions and the harvesting of salmon.

TIMELINE OF FLOODS AND ACTIVITIES

1887 — **1890s**

1910 — **1900s, 1910s**

1933, 1935, 1937 — **1930s**

1951 — **1940s, 1950s**

1971, 1972, 1974, 1975 — **1960s, 1970s**

1986, 1990, 1991, 1995, 1996 — **1980s, 1990s**

2001

Grays Harbor County Comprehensive Flood Hazard Management Plan

2006, 2007 — **2000s**

Chehalis Lead Entity Salmon Habitat Restoration and Preservation Work Plan for WRIAs 22 and 23

2008

2009 — **2000s**

WSDOT I-5 Protection Alternatives Analysis

2012

Washington State Legislature calls on Office of Financial Management to evaluate alternatives and recommend priority actions to reduce flood damage and improve conditions for aquatic species

2011

Governor's Chehalis Basin Work Group formed

2012

Work Group recommends actions to reduce flood damage and restore aquatic species habitat

2012

2010s

Farm pad

Elevated home

Fish-passable culvert replacement

Implementation of early projects

2016–2017

Work Group technical studies: aquatic species restoration, floodplain structures, hydrologic/hydraulic modeling, water retention and fish passage, water quality, economics, and geomorphology and sediment transport

2013–2015

1998

Flood reduction studies including proposed modifications of the State Route 6 and Mellen Street bridges

2007

Chehalis River Basin Flood Authority formation and Lewis County Flood Disaster Recovery Strategy

2009

Confederated Tribes of the Chehalis Reservation Comprehensive Flood Hazard Management Plan

2012

Ruckelshaus Center releases Alternatives Report

2014

Work Group releases Recommendation Report

Flood damage reduction extensively examined in more than 830 studies; however, the efforts conducted to date have not resulted in appreciable reduction of flood damage

1930s–2007

2010

Flood Authority Comprehensive Flood Hazard Management Plan

2013

Washington Coast Sustainable Salmon Plan and Thurston County Flood Hazard Mitigation Plan

Programmatic EIS and continuation of technical studies regarding aquatic species and water retention

2015–2017

U.S. Army Corps of Engineers Twin Cities Project Alternatives Evaluation

1980s–2011

Work Group develops preliminary alternatives

2013–2014

Chehalis Basin Strategy Activities

Floods

Related Technical Studies

ALTERNATIVES

No single action alone will address all the problems—a combination of actions is needed

The EIS looks at four action alternatives and a No Action Alternative. Each action alternative combines flood damage reduction actions (large-scale and local-scale) and aquatic species habitat actions.

Many have been involved in developing the alternatives and information

Ecology has worked closely with agencies, tribes, and local communities for the past several years to develop the elements for comprehensive approaches to address flood damage and aquatic species habitat concerns. In 2014, the Governor's Chehalis Basin Work Group published a Recommendation Report outlining a program of integrated, long-term, flood damage reduction and aquatic species habitat actions for further analysis. These actions were refined and are being evaluated during the EIS process.

A formal scoping process occurred in September and October 2015 to seek input on the content and emphasis of the EIS. Scoping also provided notice to the public and other agencies that an EIS was being prepared, and initiated their involvement in the process. During the scoping period, Ecology received public comments through mail, email, the Chehalis Basin Strategy website, and scoping meetings.

Following scoping, Ecology obtained input from the Governor's Chehalis Basin Work Group, agencies, and tribal governments during development of the EIS through formal groups and review, as well as informal consultation on specific issues. Continued public involvement also occurred through outreach at fairs, festivals, and community group meetings to share information about the Chehalis Basin Strategy and solicit input.

Flood Damage Reduction

Large-scale

- Flood Retention Facility (Dam and Associated Reservoir)
- Airport Levee Improvements
- I-5 Projects
- Aberdeen/Hoquiam North Shore Levee
- Restorative Flood Protection

Local-scale

- Floodproofing
- Local Projects (Small Flood Reduction)
- Land Use Management
- Flood Warning System Improvements

Aquatic Species Habitat Actions

- Restore Riparian Habitat
- Remove Fish Passage Barriers
- Restore Off-channel Habitat
- Add Wood to Streams for Habitat
- Restore Bank Erosion to Naturally Occurring Rates
- Reconnect the Floodplain
- Create, Restore, and Enhance Wetlands

Different combinations of **Large-scale Flood Damage Reduction Actions** are included in each action alternative evaluated in the EIS.

Actions to reduce flood damage

Flood damage reduction actions are intended to lessen the damage caused by major floods.

Five **Large-scale Flood Damage Reduction Actions** are evaluated in the EIS. These would involve large-scale actions intended to alter the current extent and depth of flooding and reduce flood damage. Specific elements include a Flood Retention Facility (dam and associated reservoir), Restorative Flood Protection, and three new or improved levee systems. In the levee category, the *I-5 Projects* action element includes a series of new levees, floodwalls, and bridge replacements to help reduce flooding and closures of I-5 in the Chehalis and Centralia areas. Improvements to an existing levee are also being evaluated in the *Airport Levee Improvements* action element, which would provide additional flood protection to the Chehalis-Centralia Airport, local businesses, and a portion of I-5. An *Aberdeen/Hoquiam North Shore Levee* is also evaluated, which would be a new levee to provide coastal flood protection for residents and business in low-lying areas within those two cities, both currently and when considering potential future sea level rise.

A *Flood Retention Facility* is also evaluated, which would be intended to substantially reduce damages during major floods. The dam is being considered for the mainstem Chehalis River, and would be located about 1 mile south of Pe Ell. Two types of dams are being considered. A dam with a temporary reservoir would be designed to temporarily hold back water during major floods. This is known as a Flood Retention Only (FRO) facility. The river would flow normally during regular conditions or smaller floods. A dam with a permanent reservoir would be designed to retain water all year (instead of only during major floods). This is known as a Flood Retention Flow Augmentation (FRFA) facility. In addition to reducing flood damage during the winter, the water from the reservoir would be released in late spring to early fall to provide more water and cooler water temperatures in reaches of the river downstream of the dam. Both options would be designed to accommodate fish passage through tunnels, ladders, or collection systems.

Restorative Flood Protection is intended to rebuild some of the lost natural flood storage capacity of the Chehalis Basin upstream of Chehalis, by reversing landscape changes that contribute to downstream flooding and erosion. The flood storage capacity of the Chehalis Basin would be increased by adding engineered large wood structures and plantings to create "roughness" (or resistance to flow) in river and stream channels and the floodplain, and by reconnecting river channels to floodplain storage. Restorative Flood Protection would reduce flood peaks on the Chehalis River downstream of the confluence with the Newaukum River, which

is where the greatest flood damages have historically occurred. There are about 140 river miles (RMs) within the Restorative Flood Protection treatment area, and the associated floodplain area that is engaged by these rivers during a 100-year flood is about 21,000 acres. To attain downstream reductions in flooding, large areas of valley bottom land in treatment areas would be converted from agricultural, residential, and commercial land uses to river management corridors or greenways where flooding would occur more frequently than it currently does. This action would be dependent upon landowner willingness and would reduce flood damage downstream of the Newaukum confluence, including Centralia and Chehalis.

Local-scale Flood Damage Reduction Actions include *Floodproofing* buildings in the floodplain, by elevating them or building floodwalls around them, and demolishing or buying frequently flood-damaged properties from willing landowners that cannot be elevated or otherwise protected. Floodproofing also includes protecting livestock and farm investments by constructing farm pads (raised areas where farm animals and equipment will be safe during floods), and creating evacuation routes. Another action element called *Local Projects* would protect key infrastructure like roads and wastewater treatment plants from flood damage, and restore individual floodplain areas. Improvements to *Land Use Management* would include improving regulatory flood

The same **Local-scale Flood Damage Reduction Actions** are included in all of the action alternatives evaluated in the EIS.

data, floodplain protection, and construction standards in local land use and floodplain regulations to protect remaining floodplain functions and prevent future flood damage from new development or land uses in the floodplain. Finally, existing *Flood Warning Systems* would be improved as part of Local-scale Flood Damage Reduction Actions.

Actions to restore aquatic species habitat

Aquatic Species Habitat Actions include a number of measures to protect, improve, and create sustainable ecosystem processes and functions that support the long-term productivity of native aquatic and semi-aquatic species, and at much higher levels of abundance than current conditions support. "Low" and "high" restoration scenarios are included in the EIS to bracket the potential range of measures that could ensue from implementation of the *Aquatic Species Restoration Plan* (ASRP), which is being developed by the Washington Department of Fish and Wildlife. The restoration actions identified in the final ASRP will be dependent upon site conditions and landowner willingness, and would likely be within the low and high restoration scenarios.

The same low and high scenarios of **Aquatic Species Habitat Actions** are included in all of the action alternatives in the EIS.

Salmon abundance would be increased by actions in two geographic areas of the Chehalis Basin: areas that are in active timber management (managed forest), which are generally located in the upper Basin and fall under the Washington Forest Practices Act and Habitat Conservation Plans, and areas downstream of the managed forestlands in lowland areas of the Basin where active habitat restoration is proposed. In the lowland areas, measures would include restoring habitat along the mainstem Chehalis River and in tributaries throughout the Chehalis Basin, and adding native plants and vegetation. Habitat measures would also include removing fish passage barriers to open up streams for migrating fish. Off-channel habitat on the mainstem Chehalis River would be restored, wood would be added in the mainstem and tributaries to trap sediment and improve habitat for salmon and other species, bank erosion would be restored to naturally occurring rates, and floodplains and oxbows would be reconnected in specific areas, allowing the river channel to migrate within the floodplain to help support habitat-forming processes. Wetlands would also be created, restored, or enhanced for use by aquatic and semi-aquatic species.

Managed forestland was studied and modeled along with Aquatic Species Habitat Actions to account for the overall habitat improvement in the Chehalis Basin as fish use both managed forestland and downstream areas for spawning, rearing, and migrating. There is uncertainty as to the long-term effectiveness of riparian maturation in managed forestland. As a result, in the model, the effectiveness of riparian maturation in managed forestland was reduced from 100% to a range from 20% to 60% effective to account for this uncertainty.

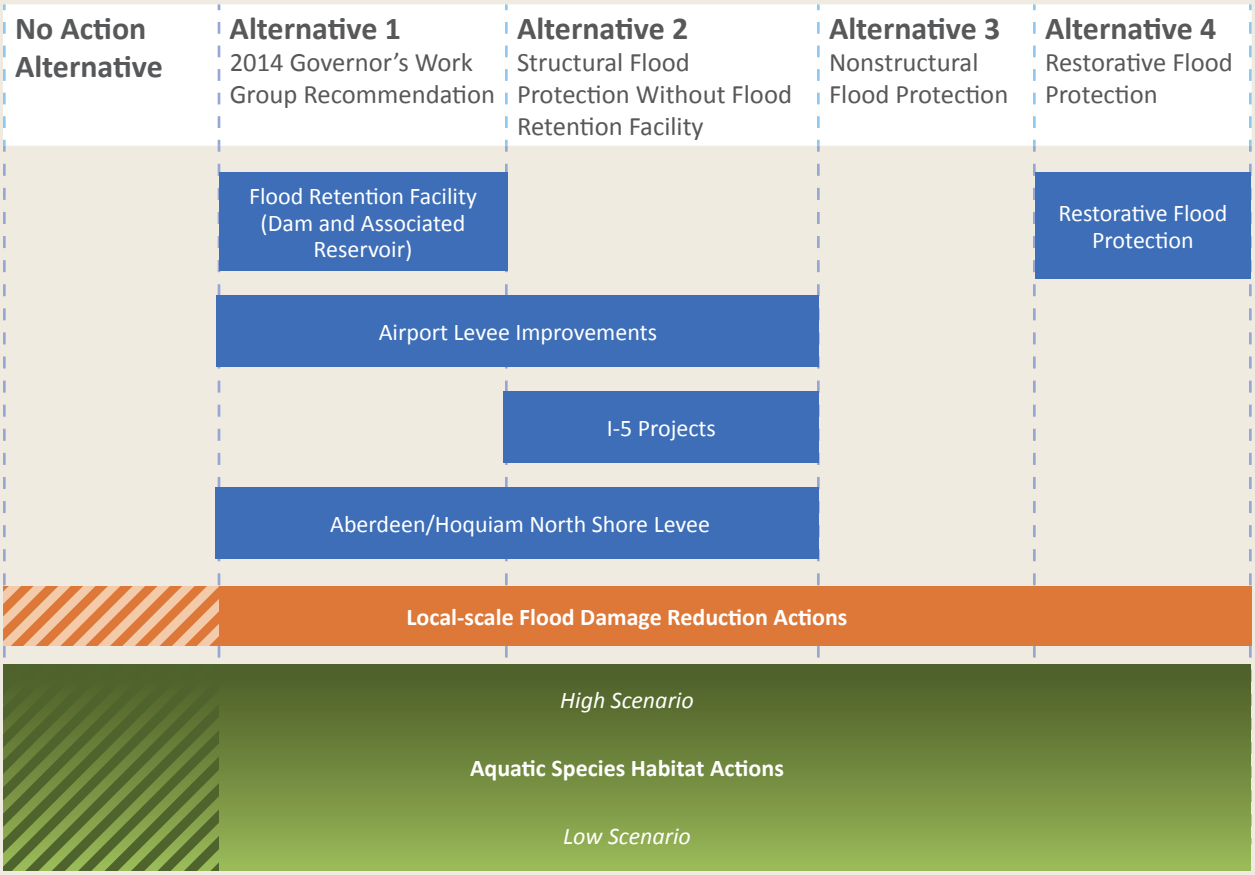
Aquatic Species Habitat Actions

Low scenario	High scenario
Restores 21 – 63 RMs, 1,150 – 2,900 acres (20% to 60% of reaches)	Restores 71 – 214 RMs, 3,900 – 9,750 acres (20% to 60% of reaches)
Focus on spring-run Chinook salmon spawning reaches	Includes spawning reaches for spring- and fall-run Chinook salmon, coho salmon, chum, and steelhead with the highest restoration potential
Habitat potential primarily in upper Basin in managed forestland	Larger proportion of restoration benefit outside managed forestlands; wider array of reaches throughout Basin
Replacing or removing more than 400 culverts, opening up more than 295 miles of streams for migrating fish by removing barriers that partially or completely block fish passage	
Contribution of managed forestlands to salmon habitat potential:	
63% (spring-run Chinook salmon) to 99% (chum salmon) benefit	18% (spring-run Chinook salmon) to 87% (chum salmon) benefit

The EIS alternatives

The EIS evaluates four action alternatives, which are characterized by different combinations of flood damage reduction and a range of aquatic species habitat actions. The EIS evaluates how these combinations of actions elements may function when combined, with regard to their impacts on people and the environment. Any combination of actions will require voluntary participation of Chehalis Basin landowners.

The chart below illustrates the action elements that are combined into the alternatives for consideration in the EIS. Large-scale Flood Damage Reduction Actions, which differ among the alternatives, are shown in **blue**. A No Action Alternative is included in the EIS for purposes of comparison, and represents the most likely future expected in the absence of implementing any of the action alternatives.



Over the years, many flood damage reduction approaches have been studied in the Chehalis Basin—from raising bridges and removing constrictions, to levees, dredging, and a series of smaller projects. Some projects have been eliminated from further detailed study in the EIS for a variety of reasons, and have not been carried forward. Details are provided in Chapter 2 of the EIS.

Your continuing input and participation will help determine the path forward

The Draft EIS does not include a preferred alternative. Based on input from the public, Governor, legislature, tribes, and agencies, a preferred alternative could be identified in the Final EIS.

Ecology invites your input on the Draft EIS to guide a collaborative, integrated, Basin-wide strategy to reduce flood damage and restore aquatic species habitat.

ALTERNATIVES EVALUATION

A comprehensive evaluation was undertaken

In the EIS, the analysis of impacts is conducted at a Basin-wide scale, for a programmatic evaluation of the alternatives. Localized impacts are noted, where known. Collaboration with tribes; federal, state, and local agencies; and technical reviewers has been an important part of identifying potential environmental impacts as described in the EIS.

There are similarities across the action alternatives

All action alternatives include the same Local-scale Flood Damage Reduction Actions and the same range of Aquatic Species Habitat Actions scenarios. Consequently, the effects of these elements are the same across the action alternatives. Aquatic Species Habitat Actions would primarily result in beneficial effects, as they are designed to protect, improve, and create sustainable ecosystem processes and functions that support the long-term productivity of native aquatic and semi-aquatic species—at much higher levels of abundance than current conditions support. Local-scale Flood Damage Reduction Actions would also primarily result in beneficial effects due to increased safety; a reduction in flooding to structures, infrastructure, roads, and agricultural land; the potential to result in less development within the 100-year floodplain; and potentially maintain open space.

Regardless of the actions chosen, floodproofing needs to be part of every alternative to reduce flood damage. However, floodproofing alone would not reduce flood damage to agriculture, transportation systems, and some commercial or public structures.

Actions would require a substantial number of willing landowners

Because several individual action elements and combined action alternatives would need to be implemented on private property or would affect landowners once implemented, cooperation among Chehalis Basin communities and residents, and willing landowners, would be required before implementing those actions.

Information presented in this summary

The EIS details the potential adverse impacts and beneficial effects of the individual action elements and combined alternatives on the built and natural environment, during construction (short term) as well as during operation (long

term), at a programmatic level. Potential mitigation measures are identified that could be implemented or might be required to reduce potential adverse impacts; site- and project-specific mitigation measures would be identified and implemented during project design, environmental review, and permitting. As detailed in the EIS, the type, location, and degree of the impacts vary by alternative. In the EIS, the alternatives were also evaluated relative to the Chehalis Basin Strategy objectives to determine their effectiveness in reducing flood damage and improving aquatic species habitat.

In this Executive Summary, an overview of the significant adverse impacts and beneficial effects of each alternative is summarized. A comparison of the alternatives relative to the Chehalis Basin Strategy objectives is also presented. Please note, this Executive Summary does not include a full explanation or context; for detailed analysis, refer to the complete EIS.

Chehalis Basin Strategy Objectives

Reduce the damage caused by a major flood	
	Threats to human health and safety, including access to critical medical facilities
	Flood damage to commercial and residential properties
	Flood damage to agricultural properties, livestock, and crops
5	Disruption in transportation systems, including closures of I-5 and local and regional transportation systems
	Disruption to industry, commercial businesses, and public services
Protect and restore aquatic species habitat function	
	Improve resiliency of natural floodplain processes and ecosystems from the effects of climate change, including warming stream temperatures, low flows, and other effects
	Increase abundance of native aquatic species, including increased populations of healthy and harvestable salmon and steelhead
ESA	Reduce the potential for future Endangered Species Act (ESA) listings
	Enhance tribal and non-tribal fisheries

No Action Alternative

Although the No Action Alternative would include the continuation of certain ongoing efforts aimed at reducing flood damage and restoring aquatic habitat, it would generally not meet the Chehalis Basin Strategy objectives because it would result in limited reduction to flood damage and continued degradation of aquatic species habitat over both the short and long term. The No Action Alternative includes salmon habitat potential benefits from the maturation of riparian areas in managed forestland compared to current conditions. In contrast, the action alternatives include benefits from managed forestland along with active restoration in the lowlands (included within Aquatic Species Habitat Actions) compared to current conditions.

Flood damage reduction and habitat restoration projects would be completed in a piecemeal fashion, with associated impacts and mitigation measures identified on a site-specific, project-level basis. Because the No Action Alternative would not involve a coordinated and integrated approach, benefits are likely to be localized and minimal.

The limited local benefits of the No Action Alternative would be outweighed at the Basin scale by the adverse impacts that would occur during the next major flood, and would allow both continued flood damage and continued degradation of aquatic species habitat.

Potential long-term, significant adverse impacts related to the No Action Alternative are summarized below.

- **Land Use:** Structures within the floodplain would remain vulnerable and could incur substantial damages during major floods. After reoccurring floods, the cost of relief and recovery—and associated psychological effects—could hinder economic growth and development in the Chehalis Basin. Agricultural losses would be lessened to some degree by farm pads that have been constructed, but flooding would continue to cause substantial damage to agricultural lands and infrastructure, potentially including the loss of crops and livestock.

- **Recreation:** Recreational fishing opportunities would continue to decline, and recreation areas and the access roads and bridges to recreational facilities would remain at risk of damage from major floods.

- **Transportation:** During major floods, transportation impacts would continue to occur and could increase impacts related to I-5 closures, other flooded highways and local roads, flooding within the Chehalis-Centralia Airport, and flooded rail lines.

- **Public Services and Utilities:** Public service facilities and utilities located within the floodplain would continue to be adversely affected by floods, including damaged infrastructure, interrupted services, and temporary service outages.

Potential Change in Salmon Abundance with Climate Change

Species	Current Potential Abundance in the Chehalis Basin	Change from Current Conditions with Climate Change (Number of Fish and Percent)
Coho salmon	40,642	-22,390 | -55%
Fall-run Chinook salmon	25,844	-6,969 | -27%
Winter/fall-run chum salmon	190,550	-8,270 | -4%
Spring-run Chinook salmon	2,146	-1,869 | -87%
Winter-run steelhead	6,800	-3,741 | -55%

- **Environmental Health and Safety:** Without a coordinated strategy, there would continue to be delays in emergency response, complications from critical facilities located in the floodplain, and continued potential for contamination of wells and surface water during major floods.

- **Climate Change:** By mid-century, rainfall events are projected to become more severe, and summer streamflows are projected to decrease. Anticipated effects of climate change could result in increased flooding, channel erosion and incision, bank instability and erosion, lateral bank migration, and saltwater intrusion into freshwater areas. Other anticipated effects include shifts in forest composition, reduced air quality from more forest fires, higher temperatures in rivers and streams, and changes in fish and wildlife species composition. Notably, depending on the increases in summer water temperature, spring-run Chinook salmon and other species of salmon and trout could be eliminated from the Chehalis Basin. Without an integrated strategy, flood damage reduction and habitat restoration projects would be completed in a piecemeal fashion, which could reduce the potential to formulate and adapt strategies that are capable of adjusting to changing climatic conditions.

- **Tribal Resources:** Impacts on tribal resources would continue to occur, primarily related to impacts on fish resources.

- **Cultural Resources (Historic and Archaeological):** Potential adverse impacts on cultural resources would continue to occur. Continued flooding would result in ground disturbance, channel mobility and erosion, increased or changed vehicular and foot traffic patterns, and changing flooding and sedimentation patterns that could potentially expose cultural resources, resulting in damage. Ongoing floodproofing or habitat restoration efforts could also affect cultural resources.

1 Alternative 1:
2014 Governor's Work Group Recommendation

The Work Group published the 2014 Recommendation Report, outlining a program of integrated, long-term flood damage reduction and aquatic species habitat actions for further study in the 2015 to 2017 state biennium budget. Since then, the Work Group membership has changed, and they are evaluating the alternatives detailed in the EIS and public comments in crafting their recommendation to the Governor later in 2016.

Alternative 1 would achieve flood damage reduction through the construction of a dam with a temporary (FRO) or permanent (FRFA) reservoir, Airport Levee Improvements, the Aberdeen/Hoquiam North Shore Levee, and Local-scale Flood Damage Reduction Actions. The Aquatic Species Habitat Actions element would accomplish the restoration objectives outlined in the Work Group recommendations.

Based on the information in the EIS, the 2016 Work Group—with updated membership—may update their recommendation to the Governor with a different combination of actions to achieve flood damage reduction and aquatic habitat species restoration.

Compared to the other alternatives, Alternative 1 would result in the greatest reduction in flood depth and extent in the Chehalis River floodplain during a major flood. Flood damages are reduced by flow control provided by a dam in combination with Floodproofing, the Aberdeen/Hoquiam North Shore Levee, and other local flood projects. Flood damage reductions would be most pronounced in the upper and middle Chehalis Basin, depending on the location, as well as in Aberdeen and Hoquiam. Some areas would no longer be inundated, some would experience a 10-foot reduction in inundation, and most areas would experience a 0.1-foot to 5-foot reduction in inundation. In the lower Chehalis Basin downstream of Grand Mound, most reductions in inundation would be about 0.5-foot. Alternative 1 focuses flood damage reduction in the Chehalis River floodplain, with some benefits extending up portions of tributary floodplains like the South Fork Chehalis River and Salzer Creek. Even with reduced flood elevations, some structures would be damaged by floods. It is anticipated that the Aberdeen/Hoquiam North Shore Levee would protect the areas behind the levee in Aberdeen and Hoquiam from coastal flooding. Reductions in flood extents have corresponding benefits for land use, recreation, transportation, public services and utilities, and environmental health and safety in the Chehalis River floodplain.

When implemented as a comprehensive strategy, this alternative would provide a benefit to aquatic species habitat function. The potential response in salmon and steelhead abundance ranges from an increase of 14% to 54% for the FRFA facility, or 18% to 72% for the FRO facility. However, as compared to the other action alternatives, Alternative 1 would result in more impacts on native salmon and aquatic species habitat function because of the permanent and significant changes to the upper mainstem Chehalis River and floodplain caused by a Flood Retention Facility.

Aside from the benefits described previously, potentially significant, long-term adverse impacts related to Alternative 1 are summarized below.

- **Water Resources:** The Flood Retention Facility has the potential to reduce water quality with regard to temperature, dissolved oxygen, and turbidity conditions. A comparison of the potentially significant impacts of the FRO and FRFA facility types is provided on page 22. In comparison to the Flood Retention Facility, other actions in this alternative would have minor impacts on water resources.

- **Geology:** Geologic conditions would be most affected by the dam. Landslides along the perimeter of the proposed reservoir have the potential to increase as a result of fluctuating water levels. Although the likelihood is low of a earthquake occurring over the life of the Flood Retention Facility when the reservoir is full during flood operations, the dam and appurtenant structures would be designed to withstand this potential situation. If a major earthquake occurs when the reservoir is full, and the dam is damaged despite being designed for this situation, it could have an adverse impact on downstream communities.

- **Geomorphology:** Geomorphic functions would be affected by the change in the delivery and distribution of sediment and woody material downstream of the dam to approximately the Skookumchuck River confluence.

- **Wetlands and Vegetation:** Permanent losses of wetlands and forested vegetation would occur with the construction and operation of the action elements associated with Alternative 1, primarily the Flood Retention Facility. Alternative 1 would have the most unavoidable adverse impacts on wetlands and vegetation as compared to the No Action Alternative and other action alternatives.

- **Fish and Wildlife:** Alternative 1 would temporarily or permanently inundate fish and wildlife habitat and decrease the current flood regimes that affect some amphibians, which could result in benefits or impacts, depending on the species. Over time, potential changes to habitat could change the composition of species that occur. The long-term impacts on wildlife vary, because different classes of wildlife species (such as amphibians, reptiles, and some mammal and bird species) have different habitat needs and home ranges, with different potential responses to the disturbance and conversion of their habitat.

  There would be impacts on fish and amphibians resulting in the potential decline of some species, particularly when considering climate change predictions over the next 100 years. Impacts on fish were modeled for the combination of the Flood Retention Facility and Aquatic Species Habitat Actions paired with climate change predictions; the dam associated with Alternative 1 would potentially significantly adversely affect some populations, species, or life stages of salmonids and lamprey. However, when combined with aquatic species habitat actions, many of these impacts are lessened at a Basin-wide scale.

- **Tribal Resources:** Impacts on tribal resources would occur, primarily related to impacts on treaty-reserved fish resources, although disruption to plant and wildlife resources and traditional cultural practices could also occur. The determination of the extent of potential impacts on tribal resources is pending additional coordination with tribes and continued government-to-government consultations.

- **Cultural Resources (Historic and Archaeological):** Impacts on cultural resources following construction of the action elements in Alternative 1 could include sedimentation of any submerged resources, changes in erosion and potential exposure of resources, and increased or changed vehicular and foot traffic patterns that could affect resources. There is a high to moderate potential for archaeological deposits to exist within the vicinity of some of the actions based on the Washington Statewide Archaeological Predictive Model. Impacts on cultural resources may occur due to the predicted archaeological potential in several areas of proposed construction. Potential impacts on tribal cultural resources or graves, Indian human remains, or traditional cultural properties would be determined in coordination with tribes, and continued government-to-government consultations.

Areas of Controversy: Alternative 1 is unique in that it includes the Flood Retention Facility action element. Due to the ongoing regional debate about the pros and cons of construction and operation of dams and associated reservoirs, construction of either the FRO or FRFA facility is controversial.

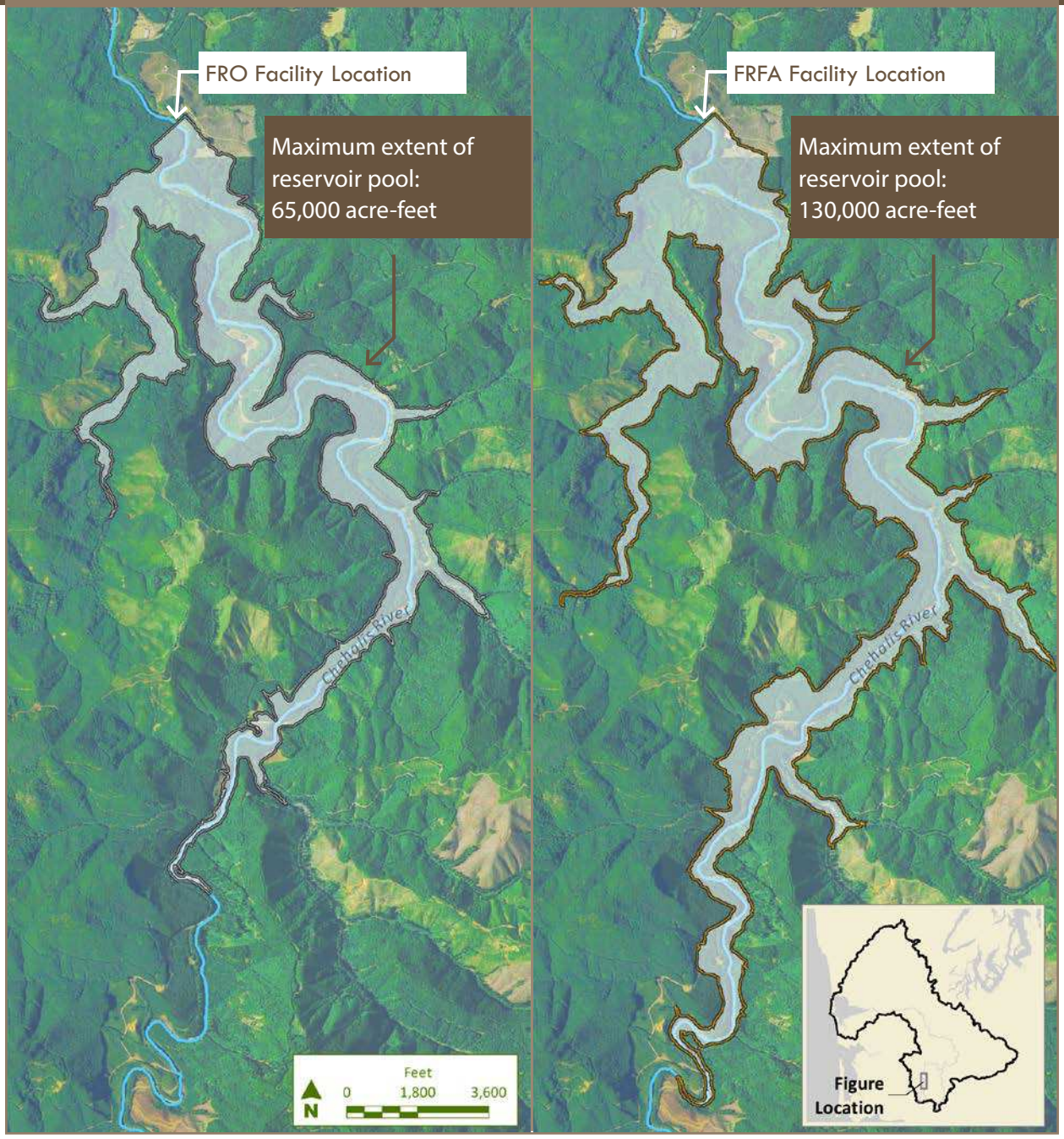
Areas of Uncertainty: It is uncertain how different fish species will respond to the effects of climate change under current conditions, and how they would respond if a Flood Retention Facility was constructed. In general, climate change will likely benefit warm water species and impact cold water species such as salmon, but it is possible that both types of fish species may adapt their behavior to a warmer system over time. This potential adaptation to climate change creates uncertainty on how fish species would respond to the decreases in water temperature that would be provided with the FRFA facility.

Comparison of the Flood Retention Facility types for Alternative 1

	FRO	FRFA
Water Resources	River generally free-flowing; use of reservoir would be temporary with transition to flood retention operations only during major floods (average once in 7 years for up to 32 days) Violation of state water quality criterion for turbidity Up to 4°C increase in summer water temperatures with a reduction to background temperatures at approximately the confluence of the South Fork Chehalis River; where temperatures are increased, there would be a decrease in dissolved oxygen	6.3 miles of Chehalis River converted from free-flowing to a permanent reservoir Increased thermal stratification (i.e., temperature layers) and decrease in dissolved oxygen within the permanent reservoir during summer and fall Benefits to river flows and temperatures through cool-water flow augmentation downstream of dam to approximately the confluence of the Skookumchuck River during late spring to early fall
Geology and Geomorphology	Temporary disruption of sediment transport (when operational) including deposition and erosion of sediment in reservoir (up to 5 miles), with up to 50% of bedload retained Trap approximately 6,000 to 7,000 cubic yards of wood (when operational)	Increased landslide potential in reservoir area Permanent disruption of sediment transport, including deposition and erosion of sediment at upstream end of reservoir (up to 1.5 miles), with all bedload retained Trap all large wood
Wetlands and Vegetation	Potential loss of up to 68 acres of wetlands and 6 acres of vegetation	Potential loss of up to 98 acres of wetlands and 720 acres of vegetation
Fish and Wildlife	Reduced habitat function for fish and wildlife species upstream of the dam Reduced fish survival and potential interruptions to salmon spawning due to fish passage impediments during flood operations	Greater reduced habitat function for fish and wildlife species, including loss of stream habitat, and salmon spawning and rearing habitat, in the permanent reservoir Greater reduced fish survival; fish passage impediments result in almost total elimination of passage for some species Pacific lamprey could be eliminated from the upper Chehalis Basin above the dam, but would continue to occur in the rest of the Basin Fish downstream of dam, such as spring-run Chinook salmon that require cool-water refuge during peak summer months, may benefit from flow augmentation and decreased water temperatures Creation of reservoir habitat that some species and life stages that currently exist in the area would use for rearing or foraging, such as coho salmon, steelhead, largescale sucker, mountain whitefish, or sculpin

FRO

FRFA


FRO Facility Location
Maximum extent of reservoir pool: 65,000 acre-feet
Chehalis River
Feet
0
1,800
3,600
N
FRFA Facility Location
Maximum extent of reservoir pool: 130,000 acre-feet
Chehalis River
Figure Location

2 Alternative 2:
Structural Flood Protection Without Flood Retention Facility

Alternative 2 would result in reduced flood damage during a major flood and have a benefit to aquatic species habitat function 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. Reduced flood extents in Alternative 2 would be achieved through the construction of the Airport Levee Improvements and I-5 Projects. Flood damage would be reduced because some areas would no longer be inundated, primarily behind the Airport Levee, and in parts of the Chehalis-Centralia area there would be a reduction of floodwater depths between 0.1 foot and 1 foot, depending on the location. Some structures that experience reduced flood elevations would still be damaged by floods. Alternative 2 would increase floodwater depths upstream of the levees and walls in some areas, by between 0.1 foot and 0.9 foot. It is anticipated that the Aberdeen/Hoquiam North Shore Levee would protect the areas behind the levee in Aberdeen and Hoquiam from coastal flooding. In areas where flood extents are reduced, there would be benefits related to land use, recreation, transportation, public services and utilities, and environmental health and safety.

Implementation of the Aquatic Species Habitat Actions element of Alternative 2 would substantially increase the abundance of native aquatic species, thereby reducing the potential of a future ESA listing, and substantially enhance tribal and non-tribal fisheries as compared to the No Action Alternative. The benefits of combined actions within Alternative 2 to fish, wildlife, and non-salmonid fish have not been modeled but are estimated based on the Aquatic Species Habitat Actions (see page 36). Compared to the other action alternatives, Alternative 2 is anticipated to 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 floodplain resulting from the Flood Retention Facility. Alternative 2 is anticipated to result in similar benefit to aquatic species habitat as Alternative 3 and less benefit than Alternative 4.

Aside from the benefits described previously, potentially significant, long-term adverse impacts related to Alternative 2 are summarized below. Significant adverse impacts that cannot be mitigated without substantial intervention include those associated with the permanent loss of wetlands from the levees and I-5 Projects. Specific measures could be identified and implemented during project-level design,

environmental review, and permitting to help reduce the other potentially significant adverse impacts related to Alternative 2 that are summarized below.

- **Wetlands:** Permanent loss of wetlands would be required to construct the levees and I-5 Projects included in Alternative 2. The alternative would have fewer unavoidable adverse impacts on wetlands than Alternative 1 because it would include limited structural actions in comparison. Alternative 2 would have greater adverse impacts than Alternatives 3 and 4 due to the potential construction-related impacts and floodplain habitat connectivity constraints associated with the levee projects, which are not a part of those alternatives.

- **Tribal Resources:** Impacts on tribal resources would likely occur, primarily related to impacts on fisheries. Impacts on plants and wildlife and disruption of traditional cultural practices could also occur. The potential long-term impacts on fish in Alternative 2 are primarily related to a change in flood extents and elevations upstream and downstream of the levee during major floods. The extent of potential impacts on tribal resources is pending additional coordination with tribes and continued government-to-government consultations.

- **Cultural Resources (Historic and Archaeological):** Impacts on cultural resources may occur due to the potential for archaeological deposits to exist within the vicinity of proposed areas of construction, although the degree or severity of the impact would depend on the nature of the cultural resources that would be disturbed. Potential impacts on tribal cultural resources or graves, Indian human remains, or traditional cultural properties would be determined in coordination with tribes, and continued government-to-government consultations.

3 Alternative 3:
Nonstructural Flood Protection

Alternative 3 would not result in geographically broad-scale flood damage reduction during a major flood when compared to the other action alternatives. The implementation of Local-scale Flood Damage Reduction Actions would protect key properties and infrastructure from flood damage, and would protect a substantial portion of the structures in the Chehalis River floodplain through elevation, other floodproofing measures, and buy-outs. This alternative would significantly reduce the pattern of damage and recovery to structures and their contents associated with major floods, but would not reduce flood damage at a Basin-wide scale to reduce flood damage to transportation systems and agricultural properties or crops. Low-lying areas in Aberdeen and Hoquiam would continue to be at risk from coastal flooding.

This alternative would result in a greater benefit to aquatic species habitat function than Alternatives 1 and 2 because there would be none of the adverse effects associated with Large-scale Flood Damage Reduction Actions. When implemented as a comprehensive strategy, Alternative 3 would substantially increase the abundance of native aquatic species, reduce the potential for future ESA listings, and enhance tribal and non-tribal fisheries as compared to the No Action Alternative. The benefits of combined actions within Alternative 3 to fish, wildlife, and non-salmonid fish have not been modeled but are estimated based on the Aquatic Species Habitat Actions (see page 36). Alternative 3 would have less benefit to aquatic species habitat function than Alternative 4 because of the treatments, including placement of engineered wood structures associated with flood damage reduction measures implemented as part of that alternative.

The benefits of Alternative 3 would be localized to structures that are floodproofed, and properties and infrastructure protected by Local Projects. During major floods, I-5 closures, flooding of the Chehalis-Centralia Airport, and flooding of rail lines would continue to occur. Local roadways that currently flood during major floods would continue to do so, except where smaller-scale flood reduction projects reduce flooding of local roadways. Alternative 3 has the potential to reduce threats to human health and safety when compared to the No Action Alternative, because Alternative 3 would protect structures in the floodplain and allow people the option of safely waiting out many floods in their homes. However, Alternative 3 would not improve the ability to access critical medical facilities as compared to the No Action Alternative, and would not reduce disruption to industry, commercial businesses, and public services—with the exception of protecting the structures that house them in the event those structures have been floodproofed.

Alternative 3 does not result in significant adverse impacts on any elements of the built or natural environment; however, bank stabilization impacts on fish habitat cumulatively could be significant, depending on the project setting.

- **Tribal Resources:** The extent of potential impacts on tribal resources is pending additional coordination with tribes and continued government-to-government consultations.

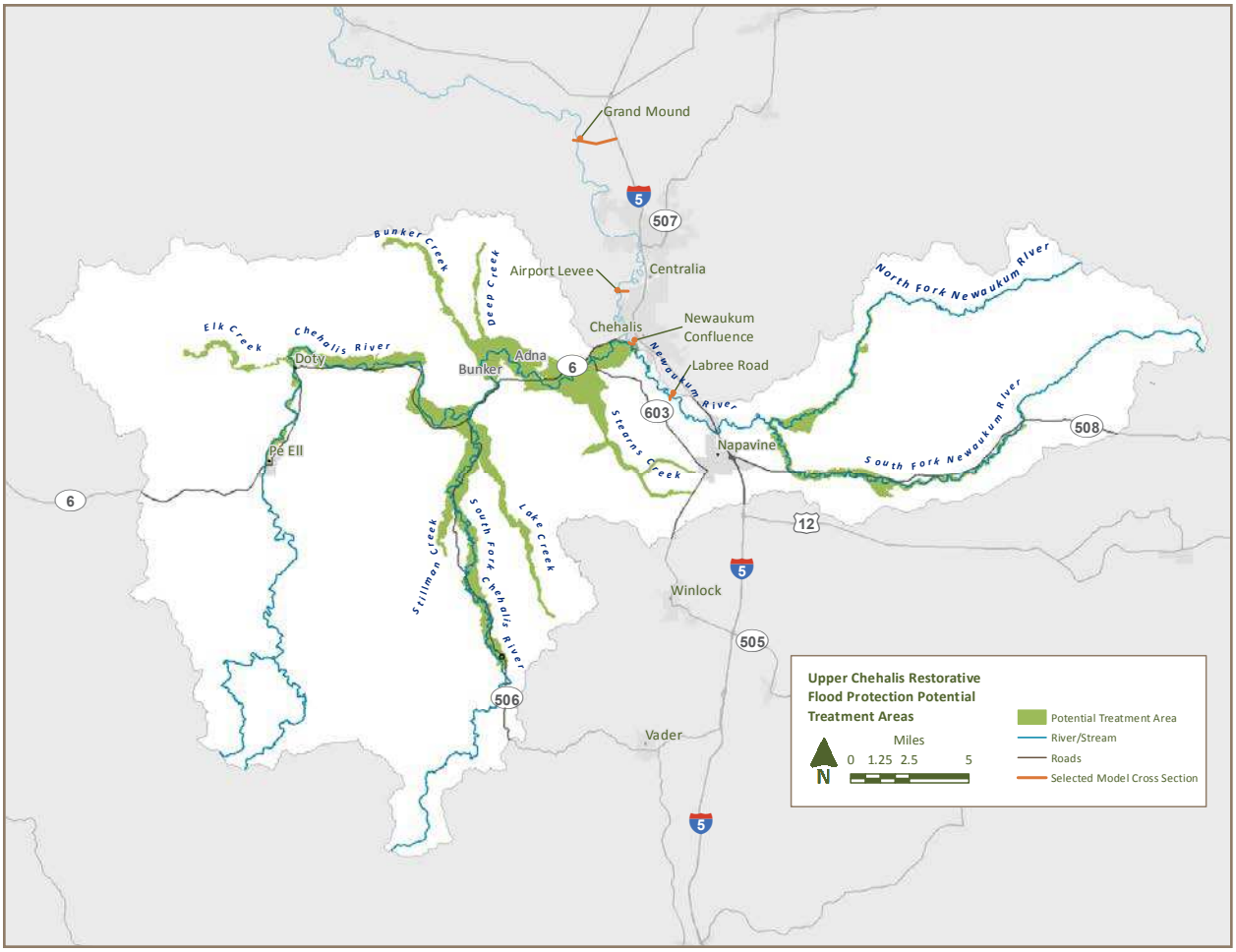
- **Cultural Resources (Historic and Archaeological):** Impacts on cultural resources may occur due to the potential for archaeological deposits to exist within the vicinity of proposed areas of construction, although the degree or severity of the impact would depend on the nature of the cultural resources that would be disturbed. Potential impacts on tribal cultural resources or graves, Indian human remains, or traditional cultural properties would be determined in coordination with tribes, and continued government-to-government consultations.

4 Alternative 4:
Restorative Flood Protection

Alternative 4 addresses flooding in tributary areas of the Chehalis River—the North and South Fork Newaukum River, South Fork Chehalis River, Stearns Creek, Bunker 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 extent and depth of flooding above the Chehalis River confluence with the Newaukum River, and reduce the extent and depth of flooding in the Chehalis-Centralia area (although less than Alternative 1). However, because Alternative 4 includes relocation of 16,000 acres of current land uses upstream of the Newaukum confluence, it would result in a greater reduction of flood damage than Alternative 1. Restorative measures associated with implementation of this action are intended to reduce flood damage by slowing and storing the flow of floodwaters in the floodplain.

When implemented as a comprehensive strategy, Alternative 4 would substantially increase the abundance of native aquatic species, prevent future ESA listings, and substantially enhance tribal and non-tribal fisheries as compared to the No Action Alternative. Alternative 4 would increase wetland areas, improve riparian vegetation communities, and improve connectivity to floodplain habitat. These treatment actions would provide the most benefits to fish and wildlife, both in the channels and within connected floodplain habitats. The potential response in salmon and steelhead abundance ranges from an increase of 45% to 94%.

Alternative 4 is intended to rebuild the natural flood storage capacity of the Chehalis Basin by reversing landscape changes that contribute to downstream flooding and erosion. Restorative Flood Protection would increase the flood storage capacity of the Chehalis Basin by adding engineered large wood and plantings to create "roughness," or resistance to flow, to river and stream channels and the floodplain, and by reconnecting river channels to floodplain storage. Restorative Flood Protection treatment areas would occupy up to 21,000 acres within the channels and floodplains of the Newaukum, South Fork Chehalis, and mainstem Chehalis rivers, and Stearns, Stillman, Elk, Bunker, and Lake creeks. Within these treatment areas, increased flooding would occur, which would be addressed through buy-outs, floodproofing, and easements. Much of this area is subject to current flood



and erosion risk, which is predicted to worsen under climate change forecasts. With removal of existing structures and conversion of land uses within the newly created greenway, future flooding and damage to these properties would be eliminated.

Aside from the benefits described previously, potentially significant, long-term adverse impacts related to Alternative 4 are summarized on the next page.

- **Vegetation:** Within upland areas where greenway land uses are relocated, long-term impacts on vegetation could include converting up to 16,000 acres of managed forestland to other uses that primarily support upland vegetation and impervious areas (e.g., residential and commercial development). This conversion may be offset by restorative treatments that include planting riparian vegetation in equivalent valley bottom areas.

- **Land Use:** Restorative Flood Protection actions would be incompatible with many existing land uses. Based on the preliminary analysis conducted, the area within the 10-year floodplain following implementation would be largely unsuitable for people to reside. This zone, described in the Restorative Flood Protection description as the "river management zone" or "greenway," is expected to experience active channel migration, engagement of floodplain wetlands, and frequent flooding such that structures would be at risk to severe flood and erosion damage. There are currently approximately 16,000 acres within this zone, including 8,500 acres of active farmland. New or increased flooding to an area potentially reaching 21,000 acres in the future 100-year floodplain could occur, which would include a total of 12,100 acres of active farmland. Willing landowners would be offered a suite of compensation options, which could include relocating to suitable upland areas that would not be affected by the Restorative Flood Protection treatments.

- **Cultural Resources (Historic and Archaeological):** Although the degree or severity of the 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 continued government-to-government consultations.

- **Transportation:** Upstream of the Newaukum River confluence during a 100-year flood, the duration of closure of State Route (SR) 6 would increase by approximately 4 days, SR 506 by approximately 1 to 2 days, and SR 508 by approximately 2 days. Closures of I-5 and flooding of local roads and the Chehalis-Centralia Airport would continue during 100-year floods.

- **Public Services and Utilities:** Relocation of agricultural, residential, and commercial land uses out of the future Restorative Flood Protection 10-year floodplain would require

disconnection and decommissioning of existing public utilities and relocation of services and utilities to the upland areas where the displaced land uses would be relocated. This could require extension of utilities including electricity, water supplies, and sewer services.

- **Environmental Health and Safety:** Increased flooding could affect emergency response services in the areas upstream from the Newaukum River confluence with the Chehalis River. Higher flood levels and increased duration of road and airport closures could prevent or delay emergency service access.

Areas of Controversy: For Alternative 4 to effectively reduce flood damage, landowners along key corridors in the upper Chehalis Basin would need to voluntarily allow parts or all of their existing floodplain property to be flooded longer and floodplain land in valley bottoms to be reforested. In some locations, increased inundation or the addition of engineered log structures and vegetation to the floodplain would significantly affect existing structures and land uses, and would require relocation of these residents and their properties/land uses to adjacent or nearby uplands, most of which are currently in managed forest use.

COMPARISON OF ALTERNATIVES

Potential significant adverse impacts resulting from each alternative were summarized in the previous section. This section compares the alternatives to the Chehalis Basin Strategy objectives of substantially reducing damage from major floods and restoring degraded aquatic species habitat. In general, the Flood Retention Facility in Alternative 1 and Restorative Flood Protection in Alternative 4 would have the greatest Basin-wide effects of all of the alternatives. Therefore, much of the comparison in this section focuses on comparing these two alternatives.

Reduce the damage caused by a major flood

Reductions in flood depths and extents—or moving people, structures, and uses out of harm's way—would result in reduced threats to human health and safety, including access to critical medical facilities; reduced flood damage to commercial, residential, and agricultural properties, livestock, and crops; reduced disruption in transportation systems; and reduced disruption to industry, commercial businesses, and public services.

This section compares the following quantitative and qualitative differences among the alternatives: change in extent and depth of flood inundation, effects to agricultural land use, reduction in structure damage, and changes in disruption to transportation systems.

Change in Extent and Depth of Flood Inundation

Based on available data, Alternative 1 would reduce the areal extent and depth of 100-year floods to a greater extent than the No Action Alternative and the other action alternatives. Alternative 2 would primarily reduce flooding in the Chehalis-Centralia area near the airport and I-5. However, raising the airport levee and constructing the I-5 Projects have the potential to increase flood extent and depth on approximately 14 acres of agricultural/forestland to the west (and upstream and downstream) of these actions. Alternative 3 would not reduce flood extents. Alternative 4 would increase the areal extent and depth of 100-year floods upstream of the 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. However, 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. While Alternative 4 would increase flooding by 4,590 acres in many valley bottom areas upstream of the Chehalis River confluence with the Newaukum River, it would result in a reduction of approximately 815 acres of flooded area downstream of the Newaukum River confluence.

Effects to Agricultural Land Use

The increase or decrease in flood extents and depths would have an impact on land use. Alternative 1 would reduce flooding to a greater extent than the No Action Alternative and other action alternatives, due to the reduction in flooding to 1,956 acres of agricultural/forestland. Alternative 4 would have the greatest impact on agriculture because it could result in new or increased flooding to an area potentially reaching 21,000 acres in size in the future 100-year floodplain, including approximately 12,100 acres of active farmland, and would require relocation of 8,500 acres of farmland. The location, magnitude, and concentration of this potential impact from Alternative 4 has not been identified at this time.

Reduction in Flood Damage to High-value Structures During a 100-year Flood

The table below provides a comparison of the total number of structures that would be flooded or protected from damage during a 100-year flood. The Aberdeen/Hoquiam North Shore Levee action element is included in Alternatives 1 and 2, and would result in the protection of 2,715 additional structures that are not shown on this table.

	No Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Structures no longer flooded	0	559	88	0	136
Structures relocated	0	0	0	0	462
Structures floodproofed	0	500	812	802	645
Total structure damage reduced	**0**	**1,059**	**900**	**802**	**1,243**
Remaining structures flooded	1,379	320	479	577	598[1]

Note:

1. Structures relocated are not included in this total because it is currently unknown whether property owners would be willing to relocate.

Changes in Disruption to Transportation Systems During a 100-year Flood

	No Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4
I-5 closures (closed 4 days during 100-year flood)	No reduction	Reduced by 3 days	Reduced up to 3 days	No reduction	No reduction
Flooding of SR 6, US 101, US 12, and local roads	No reduction	Reduced by 1 to 3 days	Reduced behind levee, increased on west side of I-5 (SR 6 and local roadways)	No reduction	Reduced in Chehalis-Centralia area by up to 1 day, could be increased on SR 6 (4 days), SR 506 (1 to 2 days), and SR 508 (2 days)

Protect and restore aquatic species habitat function

Implementation of the Aquatic Species Habitat Actions low and high scenarios in all of the action alternatives would substantially increase riparian area and salmon abundance, resulting in a benefit to other aquatic species as well.

With Aquatic Species Habitat Actions, riparian area would be increased between 21 river miles (1,150 acres) and 214 river miles (9,750 acres). Alternative 1 would decrease 241 acres of riparian area in the FRFA reservoir due to clear-cutting and permanent inundation. As a combined action alternative, Alternative 1 would result in a total of between 909 and 9,509 acres of increased riparian habitat. Alternative 4 would increase the riparian area by between 562 and 6,552 acres by adding large wood in the treatment areas, for a total of 1,712 to 16,302 acres of increased riparian habitat.

A major difference between Alternative 1 and the other alternatives is the effect on salmon and other aquatic species that use the mainstem Chehalis River upstream and immediately downstream of the dam. The dam would have a significant adverse impact on the native species that use this area of the river. Although the FRO dam would allow passage of species, changes to habitat in the reservoir

area would decrease the survival of salmon and other species. The FRFA dam would more severely reduce upstream and downstream passage of aquatic species resulting significant reductions of salmon, lamprey, and other species in that portion of the Basin.

Alternative 1 would result in the least increase in salmon abundance, while Alternative 4 would result in the greatest increase in salmon abundance. The increase in salmon abundance for Alternatives 2 and 3 would be very similar to the Aquatic Species Habitat Actions. Across all alternatives, climate change would reduce salmon abundance, and the low restoration scenario would generally maintain the status quo. Based on the increased riparian area and salmon abundance, Alternative 4 would result in the greatest benefit to aquatic species compared to the No Action Alternative and other action alternatives. Alternative 1 would substantially restore habitat for aquatic species, but would result in the least benefit as a result of permanent and large-scale changes to the Chehalis River and floodplain caused by a Flood Retention Facility.

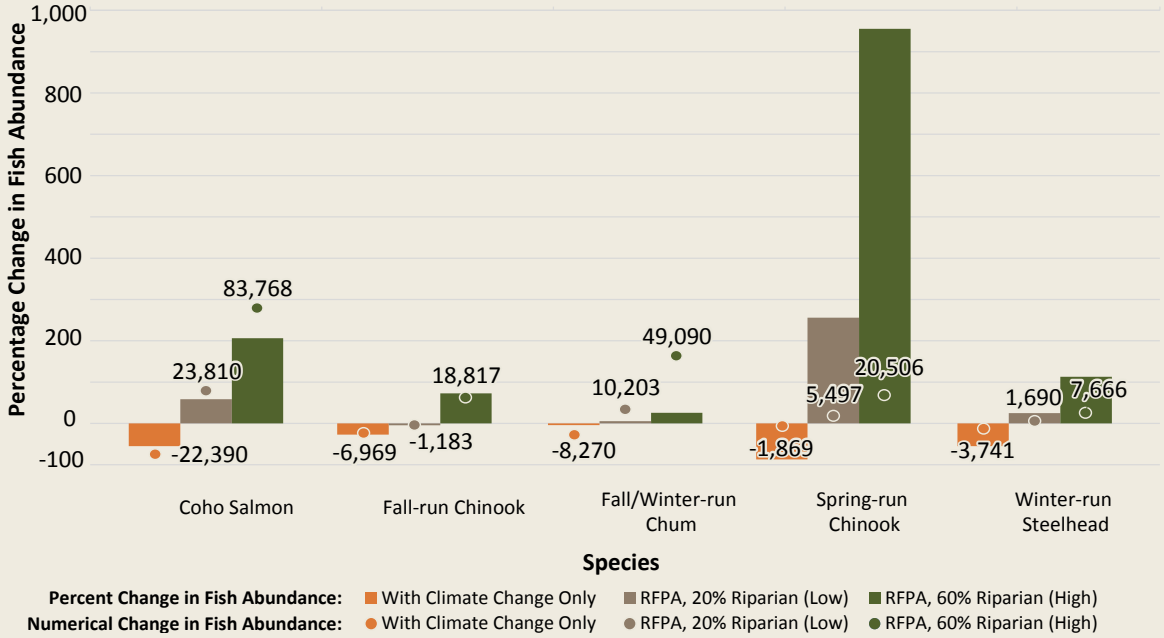
The potential response of some specific species at a Basin-wide level to Alternatives 1 and 4—accounting for climate change—are compared to current conditions in the charts on the next pages. The contribution of managed forestlands to salmon habitat potential would, on average, contribute 87% of restoration benefit for the low scenario and 57% for the high scenario, with the most benefit to chum salmon because much of their habitat is located in the Satsop, Wynoochee, and Wishkah basins that are largely managed forestland.

Potential Response in Salmon Abundance to Habitat Change in the Chehalis Basin with Different Action Alternatives

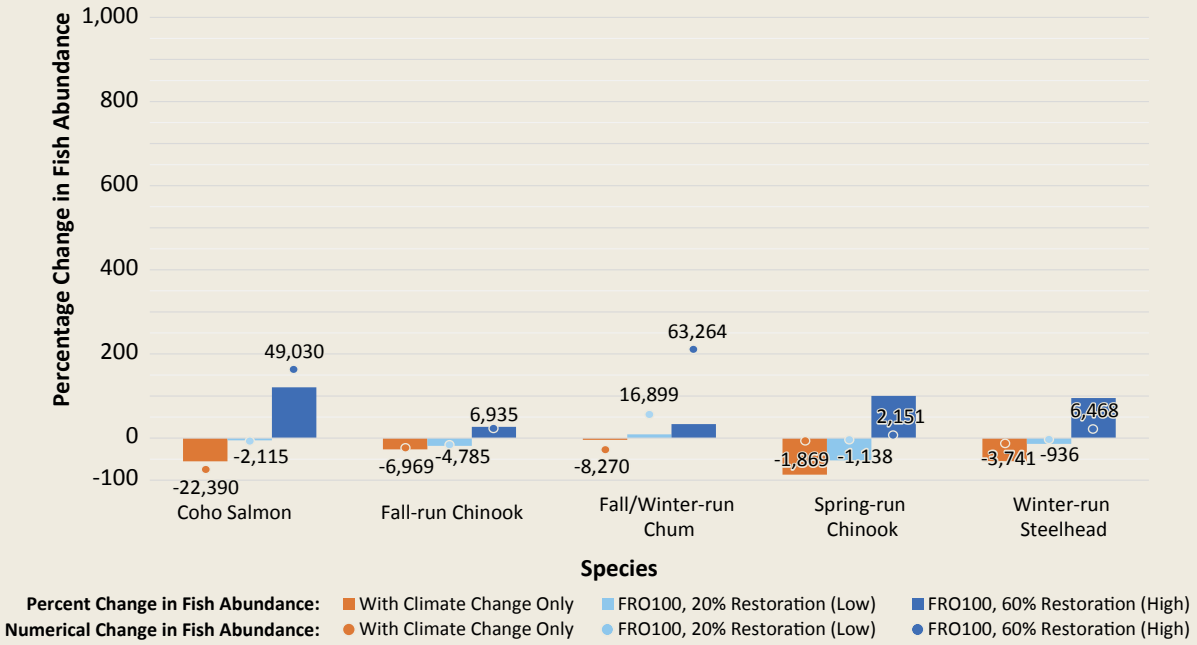
Change in Abundance for Chum, Spring-run and Fall-run Chinook, Coho, and Winter-run Steelhead (Number; Percentage)

Action	Low Restoration 20% Reaches (Current Conditions)	Low Restoration 20% Reaches (with Climate Change)	High Restoration 60% Reaches (Current Conditions)	High Restoration 60% Reaches (with Climate Change)
Aquatic Species Habitat Action (Alternatives 2 and 3 would be similar)	48,843 **(18%)**	5,019 **(2%)**	194,383 **(73%)**	141,135 **(53%)**
Alternative 1 (FRO)	46,602 **(18%)**	7,925 **(3%)**	192,560 **(72%)**	127,848 **(48%)**
Alternative 1 (FRFA)	38,215 **(14%)**	4,707 **(2%)**	143,975 **(54%)**	123,564 **(46%)**
Alternative 4 (Restorative Flood Protection and Aquatic Species Habitat Actions)	120,514 **(45%)**	40,017 **(15%)**	249,345 **(94%)**	179,847 **(68%)**

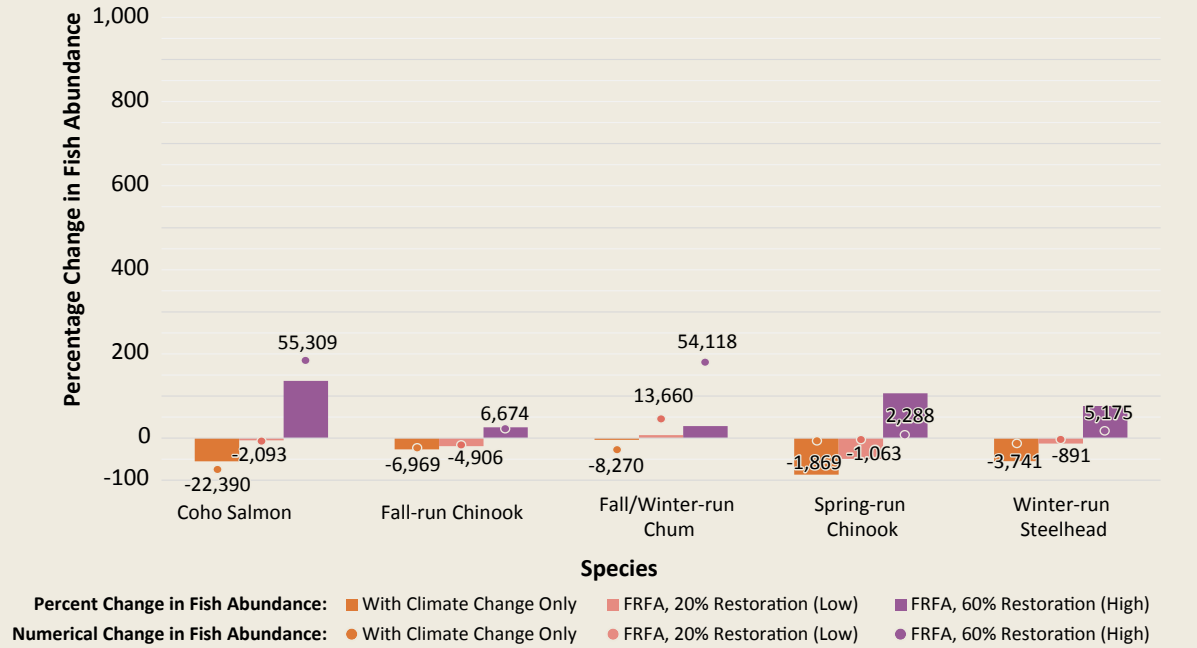
Alternative 4



Alternative 1 FRO



Alternative 1 FRFA



AREAS OF UNCERTAINTY

Potential impacts of the Chehalis Basin Strategy have been evaluated at a programmatic level, with the action elements assessed in different combinations. With this broad scope and evaluation comes a degree of uncertainty, whether it be from predicting the magnitude of effects from climate change, or the willingness of landowners to take voluntary actions that may affect their homes or livelihood.

One area of uncertainty is the magnitude of the effects of climate change on the Chehalis Basin (such as increased sea levels, reduced snowpack, changes in water availability, changes in streamflow timing, increased forest fires, and more extreme precipitation events and flooding). Adverse impacts that currently affect water resources and aquatic habitat are anticipated to worsen as a result of climate change. The effects of climate change may reduce the effectiveness of the projects implemented in association with Aquatic Species Habitat Actions. Research has shown that atmospheric rivers are projected to increase across the region, resulting in higher rainfall associated with these storms. The risk of winter flooding is also anticipated to increase, and summer low flows are anticipated to further decrease.

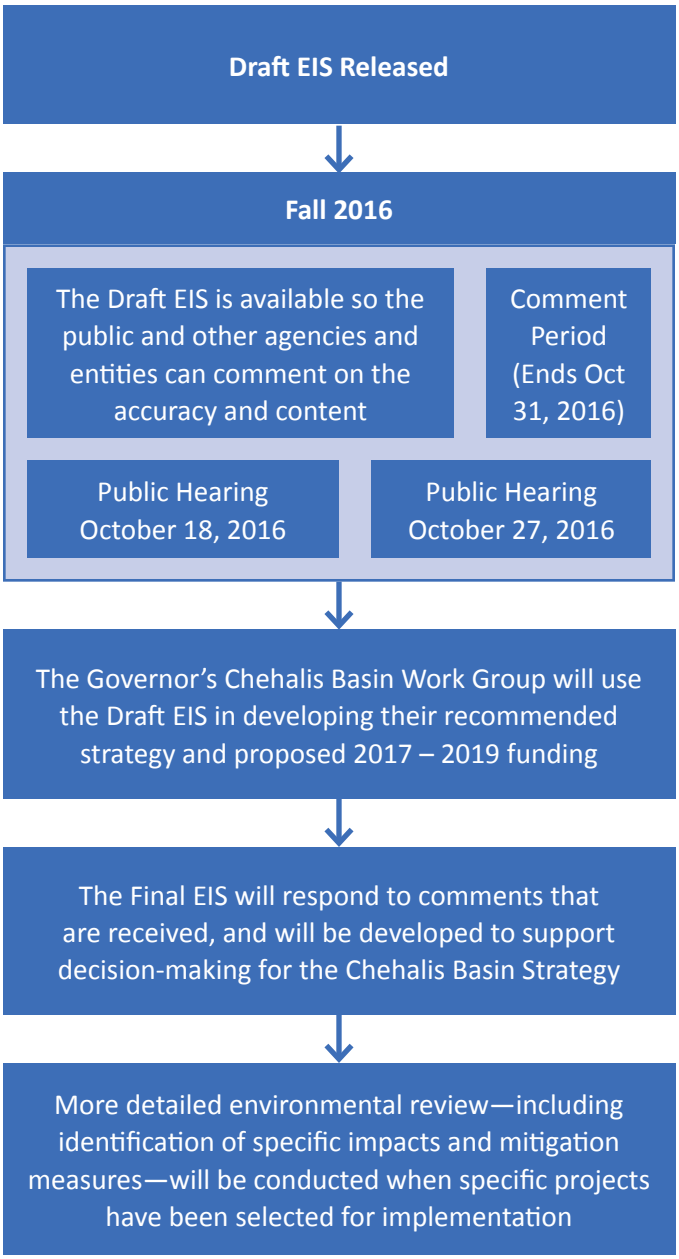
Because several action elements and combined action alternatives would be constructed on private property or affect landowners during operation, cooperation amongst Chehalis Basin communities and willing landowners would be required before implementing any of the flood damage reduction and aquatic species habitat actions. Ongoing engagement with Chehalis Basin communities, agencies, and tribes is expected to help reduce this area of uncertainty.

NEXT STEPS

The Draft EIS supports decision-making: a strategy is being developed and your input is critical

The analysis in the Draft EIS has been prepared to identify and assess the possible environmental effects associated with the No Action Alternative and the action alternatives.

The SEPA environmental review process helps decision-makers and the public understand how a proposed action would affect the natural environment and people, and provides a way to evaluate the possible environmental effects of a proposal before deciding whether to proceed. The Draft EIS is available so that the public and other agencies and entities can comment on its accuracy and content.



Ecology would like your input

A public comment period is being conducted from September 29 through October 31, 2016, and will include public hearings. Comments on the Draft EIS received during the public comment period will be addressed in the Final EIS, currently planned for release in 2017. Comments on the Draft EIS can be submitted in the following ways:

Online http://chehalisbasinstrategy.com/comment-form/

By mail Chehalis Basin Strategy EIS
c/o Anchor QEA
720 Olive Way, Suite 1900
Seattle, Washington 98101

In person October 18, 2016, 6:00 p.m.
Veterans Memorial Museum
100 S.W. Veterans Way
Chehalis, Washington 98532

October 27, 2016, 6:00 p.m.
Montesano City Hall
112 N. Main Street
Montesano, Washington 98563

The Draft EIS for the Chehalis Basin Strategy is available online at: http://www.ecy.wa.gov/programs/sea/sepa/chehalisbasin.html. Print copies or CDs of the document may be obtained by written request, or by calling (360) 407-6781. Persons with hearing loss can call 711 for Washington Relay Service, including TTY service. Persons with a disability can call 866-833-6341 to access a Communications Assistant with Washington's Speech-to-Speech service.

La Cuenca de Chehalis tiene problemas con inundaciones y la degradación del hábitat acuático. El Departamento de Ecología del Estado de Washington invita al público a comentar sobre las acciones que se quiere usar para corregir los problemas. El periodo de comentario público es del 29 de septiembre hasta el 31 de octubre, 2016. Para obtener más información, favor de comunicarse con Gretchen Newman al (360) 407-6097 o por correo electrónico a preguntas@ecy.wa.gov.

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