4 ACTION ELEMENTS: IMPACTS AND MITIGATION

4.1 Introduction

This chapter describes the potential short- and long-term impacts of the action elements on the affected environment (described in Chapter 3), as well as possible mitigation measures. Action elements are described in this chapter in order from the largest to smallest magnitude flood damage reduction actions, followed by aquatic species habitat actions. Therefore, this chapter begins with a discussion of the Large-scale Flood Damage Reduction Actions in Sections 4.2 through 4.6, followed by Local-scale Flood Damage Reduction Actions (Section 4.7), and Aquatic Species Habitat Actions (Section 4.8). Section 4.2 includes a summary assessment of the key adverse impacts and beneficial effects associated with the Flood Retention Facility; additional detailed information is provided in Appendix H.

Because the analysis of impacts in this EIS is programmatic, specific design and construction details for the implementation of many of the action elements have not been determined. Thus, short- and long-term impacts are discussed commensurate with the level of detail used to describe the action element. Chapter 5 evaluates the potential impacts of groupings of action elements when combined together into alternatives.

4.1.1 Impact Evaluation Considerations

Short-term impacts refer to temporary impacts that would occur during construction, typically localized to the construction footprint, with conditions returning to pre-construction status or function following completion of construction. Long-term impacts are those that would occur following implementation of an action element, and include permanent impacts resulting from construction and operation.

Action Elements

Large-scale Flood Damage Reduction Actions include the Flood Retention Facility (FRO or FRFA dam and associated reservoir), Restorative Flood Protection, Airport Levee Improvements, I-5 Projects, and Aberdeen/Hoquiam North Shore Levee.

Local-scale Flood Damage Reduction Actions include Floodproofing, Local Projects (including protection of roads and infrastructure), Land Use Management, and Flood Warning System Improvements.

Aquatic Species Habitat Actions includes a number of measures to restore aquatic habitat such as riparian habitat restoration, fish passage barrier removal, off-channel habitat restoration, wood installation, bank erosion reduction to naturally occurring rates, floodplain reconnection, and wetland creation, restoration, and enhancement.

Degree of Adverse Impacts

Minor = Minimal and/or easily mitigated

Moderate = Adverse but limited in scope and effect; limited in extent on a Basin-wide scale (smaller footprint and would result in limited changes); potentially consistent with regulatory standards; mitigation requirements would be straightforward and reasonably achievable

Significant = Adverse and larger in scope; greater magnitude and extent of impact across the Chehalis Basin (larger footprint and would result in greater changes); potentially inconsistent with regulatory standards; mitigation requirements would be extensive

Adverse impacts, if any, would be considered minor, moderate, or significant depending on their magnitude. The discussion of impacts and mitigation is focused on probable significant adverse impacts, and beneficial effects are described where applicable. The summary of impacts in this section is provided at a Basin-wide scale for the purposes of conducting a programmatic-level evaluation. Although an impact could be considered minor or moderate at the Basin-wide scale, it could be a significant impact locally, or for cultural or tribal resources. Ecology expects that a more detailed evaluation of project impacts would be required during project-level environmental review. The factors (or indicators) that were used to evaluate the degree of adverse impact for each element of the environment are described in Appendix I.

4.1.2 Short-term Impacts and Mitigation Common to Many Action Elements

To assist in the programmatic-level evaluation of short-term impacts, some basic assumptions regarding construction have been made for the purposes of this EIS. Potential construction-related activities, associated impacts, and possible mitigation that are similar across many action elements are listed in Table 4.1-1. The abbreviations in the short-term impacts column refer to the element(s) of the environment that would be affected. In addition to the measures outlined in Table 4.1-1, compliance with permit conditions and application of best management practices as part of future, project-specific permits and authorizations would avoid and minimize some of the short-term adverse impacts commonly associated with construction. Other short-term impacts and mitigation measures unique to specific action elements are described in the applicable sections of this chapter.

Mitigation Considerations

When considering mitigation, the first step would be to avoid or minimize impacts through design or siting (such as avoiding impacts on wetlands and vegetation communities). The next step would be to rectify the impact by repairing the affected environment. For impacts that cannot be avoided or minimized, compensatory mitigation could include restoration or rehabilitation, preservation, or monitoring the impact and taking appropriate corrective measures.

Table 4.1-1

Summary of Short-term Impacts and Possible Mitigation for Action Elements

CONSTRUCTION ACTIVITY	SHORT-TERM IMPACTS	AVOIDANCE AND MINIMIZATION	COMPENSATORY MITIGATION
Water diversions for activities involving in-channel construction, placement of cofferdams to isolate the work area and/or construction of a bypass channel to reroute the river; temporary dewatering could also be required depending on the construction activity	• Increased turbidity and sedimentation (WR, GG, FW, VQ) • Localized hyporheic exchange alterations (the zone of interaction between the shallow groundwater and surface water of the river; WR, WV, FW) • Localized shallow groundwater aquifer recharge effects (WR, WV, FW) • Fish stranding, gill and skin injuries, impaired foraging or predator avoidance, obstruction of passage (FW, R) • Impacts on wildlife species that breed, forage, or overwinter in stream habitats affected by dewatering (FW, R) • Modification of wetland hydrology (WV, FW)	• Implement an approved Erosion Control Plan to control and prevent sediment inputs to receiving waters, including use of silt fences and turbidity curtains • Pump and infiltrate groundwater from excavation pits • Limit in-water and near-water work to periods where sensitive aquatic species are not present and to periods of low flow • Install fish barrier • Remove and relocate aquatic species from dewatered area • Design bypass channel with hydraulic conditions to ensure upstream and downstream fish passage during its use, including avoiding delay through adequate attraction to the bypass channel; monitor passage through the bypass channel for effectiveness	• Restore and/or compensate for temporary impacts on fish and wildlife • Restore and/or compensate for temporary impacts on natural resources, such as wetlands or vegetation, to maintain ecological function

CONSTRUCTION ACTIVITY	SHORT-TERM IMPACTS	AVOIDANCE AND MINIMIZATION	COMPENSATORY MITIGATION
Upland excavation and clearing activities, as well as fill placement, associated with project construction	• Increased turbidity and sedimentation (WR, GG, FW, VQ) • Temporary fill in wetlands, wetland buffers, and riparian habitat (WV, FW) • Reduced habitat function through temporary loss of potential priority habitat	• Implement an approved Erosion Control Plan to control and prevent sediment inputs to receiving waters, including use of silt fences and other erosion control measures • Implement seasonal restrictions for protection of wildlife using upland habitats	• Acquire in-kind habitat, or create wetland mitigation sites that would create or improve wetlands and wetland buffers • Create, restore, and/or protect in-kind riparian habitat, such as riparian vegetation for shading and nutrient inputs or priority habitats that support a variety of native fish and wildlife species
Temporary road construction and use, as well as transport and placement or stockpiling of excavation material	• Increased pollutant-laden stormwater runoff (WR, FW, VQ) • Increased truck traffic on roadways with associated vehicle emissions and potential damage to local roadways (AQ, VQ, T, EHS) • Increased particulate matter (e.g., dust; AQ, VQ) • Increased turbidity and sedimentation from handling of excavated materials and construction and operation of the temporary roads (WR, GG, FW, VQ, T) • Removal of vegetation and/or priority habitat for construction of the temporary roads or stockpile areas (WV, FW, VQ)	• Minimize number and length of construction roads to limit surface area subject to sediment production • Meet applicable stormwater manual requirements (i.e., the most recent version of Ecology's *Stormwater Management Manual for Western Washington*) • Develop a Traffic Control Plan • Maintain access to properties to the extent possible by installing signs, marking detour routes, flagging, and providing information to the public, including notifications in advance of construction activities • Comply with applicable dust control policies and plans • Implement an approved Erosion Control Plan to control and prevent sediment inputs to receiving waters, including use of silt fences and other erosion control measures • Locate temporary roads and stockpiling areas to limit disturbance of vegetation communities	• Decommission construction roads that are not necessary for long-term maintenance of the action element • Revegetate, maintain, and monitor decommissioned road or stockpile areas • Create, restore, and/or protect priority habitats that support a variety of native fish and wildlife species

CONSTRUCTION ACTIVITY	SHORT-TERM IMPACTS	AVOIDANCE AND MINIMIZATION	COMPENSATORY MITIGATION
Borrow pit and quarry pit development	• Increased pollutant-laden stormwater runoff (WR, FW, VQ) • Increased truck traffic on roadways with associated vehicle emissions and potential damage to local roadways (AQ, VQ, T, EHS) • Increased dust (AQ, VQ) • Increased turbidity and sedimentation from handling of excavated materials and construction and operation of the temporary roads (WR, GG, FW, VQ, T) • Removal of vegetation and/or priority habitat for construction of temporary roads or pits (WV, FW, VQ) • Temporary fill in wetlands, wetland buffers, and riparian habitat (WV, FW)	• In addition to measures outlined for "temporary road construction and use" and "upland excavation and clearing activities," minimize the number of borrow (rock and soil) sites, and locate them as close to the dam site as possible to limit the need for long transportation routes and the production of sediment on roads	• Reclaim pit areas that are not necessary for long-term maintenance of the action element • Create, restore, and/or protect priority habitats that support a variety of native fish and wildlife species
Concrete production and use	• Increased potential for high pH releases to nearby waterbodies and wetlands, with resulting impacts on fish and aquatic species (WR, FW)	• Install work area isolation measures and rigorous wastewater management procedures	• Restore temporary impacts on natural resources, such as wetlands and riparian areas, to maintain ecological function
Construction of staging areas to accommodate storage of equipment and stockpiling of material	• Increased pollutant-laden stormwater runoff (WR, FW, VQ) • Increased dust (AQ, VQ) • Removal of vegetation for construction of staging or stockpiling areas (WV, FW, VQ)	• Meet applicable stormwater manual requirements (i.e., the most recent version of Ecology's *Stormwater Management Manual for Western Washington*) • Comply with applicable dust control policies and plans • Limit disturbance of vegetation communities	• Revegetate staging and stockpiling areas post-construction

CONSTRUCTION ACTIVITY	SHORT-TERM IMPACTS	AVOIDANCE AND MINIMIZATION	COMPENSATORY MITIGATION
Equipment use such as compactors, pile drivers, jackhammers, rock drills, cranes, and generators	• Increased noise and vibration levels that are injurious or inhibit normal behavior, resulting in temporary hearing impairments or displacement of humans, fish, and wildlife (FW, N, R) • Increased potential for accidental spills of fuel or oil (WR, FW, VQ) • Increased vehicle emissions from mechanized construction equipment (AQ)	• Limit noise-generating work such as blasting to time periods when sensitive species are not breeding or nesting • Construction equipment would be required to comply with WAC 173-60 – Maximum Environmental Noise Levels • Implement a Blasting Noise Mitigation Plan • Develop project-specific Spill Prevention and Response Plan that outlines provisions for storing fuels, refueling locations, spill control measures, and necessary containment equipment and materials • Avoid idling of equipment	None proposed
Temporary removal or disturbance of upland, riparian, and wetland vegetation communities, as well as disturbance of mixed coniferous/deciduous upland forest vegetation	• Increased turbidity and sedimentation from ground disturbance (WR, GG, FW, VQ) • Change in composition of wildlife species that occupy the existing habitat types (FW, R) • Increased dust (AQ, VQ)	• Limit disturbance of vegetation communities • Implement an approved Erosion Control Plan to control and prevent sediment inputs to receiving waters, including use of silt fences and other erosion control measures • Implement wildlife seasonal restrictions • Comply with applicable dust control policies and plans	• Revegetate cleared areas with native species • Monitor and maintain planted areas to ensure the success of mitigation plantings

Notes:
AQ = Air Quality
EHS = Environmental Health and Safety
FW = Fish and Wildlife
GG = Geology and Geomorphology
N = Noise
R = Recreation
T = Transportation
VQ = Visual Quality
WR = Water Resources
WV = Wetlands and Vegetation

4.1.3 Long-term Impacts

Long-term impacts are characterized as those projected to occur within a 100-year timeframe for each action element. The impact evaluation considers the net effect of the action following implementation of avoidance and minimization measures (e.g., the creation of fish passage facilities for the dam). The long-term impacts associated with the implementation of the action elements are variable and discussed in more detail in Sections 4.2 through 4.8.

Potential compensatory mitigation measures have also been identified for long-term impacts that cannot be avoided or minimized during design, construction, and implementation of the action elements. It is important to note that identified compensatory mitigation measures may not completely reduce or eliminate potential adverse impacts; significant unavoidable impacts for which effective mitigation measures have not been identified are noted.

Forecasting Climate Change

This EIS identifies and evaluates impacts related to climate change based on predicted future streamflows and temperature conditions. The process for anticipating future streamflows was led by CIG at the University of Washington and involved assimilating and scaling data from existing forecasting models. These models included several hydrologic models and 12 different Global Climate Models (GCMs), which were modified and applied to numerous sites in the Chehalis Basin, several different future timeframes, and three different GHG emission scenarios. Model data was used for the period 1951 to 2005 to define historical conditions, and 2040 to 2099 to define future conditions. Average percentage changes by month were applied to the historical daily flow time series to develop future (non-peak) flows. Average percentage changes to modeled peak flows were applied to the historical peaks to develop future peak flows.

The GCMs also provide projected future meteorological conditions, including air temperature and relative humidity, which are key factors in determining stream and reservoir temperatures. In conjunction with the projected changes to streamflow under climate change, the projected air temperature increases and relative humidity changes were applied to the suite of water quality models. The changes in simulated water temperatures under future conditions without a reservoir were compared to the simulated water temperatures under future conditions with the proposed reservoir. These predicted streamflows and water quality conditions are incorporated into the impact analyses for several elements of the environment and EIS action alternatives.

4.1.4 Comparison of Long-term Impacts

For all action elements, several potential impacts on tribal resources have been identified, with the extent of impacts pending additional coordination with tribes and continued government-to-government consultations. In addition, the action elements could result in moderate to significant adverse impacts on cultural resources due to the proposed actions and predicted archaeological potential based on

WSAPM. The degree or severity of the impact would depend on the nature of the cultural resources that would potentially be disturbed.

Long-term significant adverse impacts of the Flood Retention Facility would be greater than the rest of the action elements, and include the following:

- Increase in turbidity and temperature and decrease in DO
- Conversion of a reach of the upper Chehalis River from a free-flowing river to a permanent reservoir impoundment (FRFA facility only)
- Landslide potential around the reservoir footprint (FRFA facility only)
- Damage to the dam if an earthquake were to occur on the CSZ to the west of the Flood Retention Facility or Doty Fault Zone to the north, which would also effect environmental health and safety
- Geomorphic impacts on the Chehalis River and its floodplain downstream of the dam due to changes in sediment and wood transport processes
- Permanent loss of approximately 68 acres (FRO facility) and 98 acres (FRFA facility) of wetlands
- Permanent loss of vegetation: 6 acres for the FRO facility (in the dam footprint) and 720 acres for the FRFA facility (9 acres in the dam footprint, 711 acres in the reservoir area)
- Reduced fish passage for adult and juvenile salmonids and Pacific lamprey
- Reduced habitat for fish and wildlife species, including instream and off-channel habitat in the reservoir area
- Change in visual quality of the area due to clearing of vegetation

The long-term beneficial effects of the Flood Retention Facility include substantial reduction in the extent and depths of 100-year floods in downstream areas, including partially offsetting the anticipated effects of climate change on peak floods. Along the Chehalis River in the Chehalis-Centralia area, the flood level could be reduced up to 1.8 feet during a 100-year flood (WSE 2014d). The number of high-value structures inundated would also be reduced substantially (see Section 5.2.2.4 for more information on structures). These reduced flood elevations have corresponding beneficial effects to land use, recreation, transportation, public services and utilities, and environmental health and safety. In the case of the FRFA facility, temperature reduction in the Chehalis River downstream of the dam to approximately the confluence of the Skookumchuck River would result in beneficial effects to water quality and fish as described in Section 4.2.

Restorative Flood Protection would also include significant adverse impacts due to land use impacts within the

Structure Value

Structures were delineated as either "high value" (e.g., schools, residences, businesses) or "limited value" (e.g., sheds, park shelters, carports; WSE 2014d). This EIS uses high-value structures to evaluate impacts.

treatment areas. Based on screening-level analysis, these impacts could cause new or increased flooding to an area, potentially reaching 21,000 acres in size, which includes approximately 12,100 acres of active farmland. The potentially affected area includes floodplains in the North Fork and South Fork Newaukum River, mainstem Chehalis River above the Newaukum River confluence, and the South Fork Chehalis River. The tributaries of Stearns, Stillman, Lake, Elk, and Bunker creeks are also included. The treatments required, and the 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 providing assistance to interested landowners to relocate to areas of the Chehalis Basin that do not flood, the potential adverse impacts are still considered significant. Significant adverse impacts on visual quality would also occur due to the construction of engineered-floodplain structures over an area up to 21,000 acres within the treatment areas.

Restorative Flood Protection would result in a reduction in flood elevations of 0.4 foot for the 100-year floodplain along the Chehalis River in the Chehalis-Centralia area, and 1.1 foot at the Newaukum River confluence. In addition to flood damage reduction benefits, Restorative Flood Protection would increase wetland areas, improve riparian vegetation communities, and improve connectivity to floodplain habitat. These treatment actions would provide conditions that are beneficial to fish and wildlife, both in the channels and within connected floodplain habitats. Eventually, this action element would be self-sustaining and would not require routine maintenance or upkeep.

The Airport Levee Improvements, I-5 Projects, and Aberdeen/Hoquiam North Shore Levee are not likely to result in long-term significant adverse impacts with regard to a majority of the elements of the environment. Adverse impacts are primarily minor in nature, except for the potential loss of fewer than 5 acres of wetlands as a result of the Airport Levee Improvements and I-5 Projects. For the Airport Levee Improvements and Aberdeen/Hoquiam North Shore Levee, there would also be moderate impacts due to increases in flood depths or extents upstream and downstream of the levee, and disruption of the groundwater flow regime within the footprint of the levee. These action elements would reduce damages during a 100-year flood, resulting in beneficial effects with regard to water resources, transportation, public services and utilities, and environmental health and safety.

Local-scale Flood Damage Reduction Actions, such as Floodproofing and Local Projects, are not likely to result in any long-term significant adverse impacts. These action elements would primarily result in benefits by reducing flood damage to structures, infrastructure and roads, and agricultural land, including the protection of livestock and farm equipment. Land Use Management actions would not result in long-term significant adverse impacts, and—in terms of benefits—could reduce future development in the Chehalis River floodplain, which would avoid repeated cycles of future flood damage and recovery. Flood Warning System Improvements would not result in long-term significant adverse impacts, and would benefit public safety.

Aquatic Species Habitat Actions would primarily result in beneficial effects, with adverse impacts identified for a few resources as described in Section 4.8. Actions would be designed 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 habitat conditions support. It is assumed that in the future, the selected restoration actions would fall between the low and high scenarios described in Section 2.3.3.3. With regard to impacts, the main difference between the high and low restoration scenarios is the magnitude of short- and long-term impacts. In other words, the low restoration scenario would result in similar benefits and impacts as the high scenario, but each to a lesser degree. All of the low and high restoration scenarios combined with the effects of climate change would result in an increased abundance of salmonids (or reduce the degree of predicted losses) compared to climate change conditions only. The high restoration scenarios with climate change would result in a significantly greater percentage increase in abundance (more than 75%) of coho salmon and spring-run Chinook salmon compared to the low restoration scenario when applied to either 20% or 60% of the reaches, as well as for winter-run steelhead when applied to 60% of the reaches. While the low restoration scenario would still result in reductions of spring-run Chinook salmon and coho salmon (when applied to 20% of the reaches), the abundance of fish under the high restoration scenario would exceed the habitat potential for these two species.