CHAPTER 4.0 IMPACTS AND MITIGATION MEASURES

4.1 Introduction

This chapter of the PEIS describes the short- and long-term impacts of the Program Alternatives. Short-term impacts are those that are limited in duration and are not permanent or ongoing, and are often related to construction. Long-term impacts are those that would occur as a result from project operation. This chapter also identifies mitigation measures that would help to address short-term and long-term impacts.

Because this is a programmatic EIS, the level of project descriptions varies. The impacts discussed are based on a conceptual understanding of many of the proposed project elements. Some projects may require a project-level EIS if additional significant adverse impacts are identified over the course of project development.

This chapter discusses probable environmental impacts associated with the Program Alternatives and the no-action Alternative for each of the resources described in Chapter 3. Each section provides a description of the impacts of each alternative, with a detailed project-by-project discussion of the potential impacts associated with the individual project elements. Projects that are common to more than one alternative are only described once, in the first alternative where they are included, and subsequent mentions are cross-referenced to this description.

Potential mitigation measures are described at the end of each environmental element section to address both short- and long-term impacts. Overall, cumulative and unavoidable adverse impacts are described near the end of this chapter, along with environmental commitments.

4.2 Earth

This section addresses potential short-term and long-term impacts of the Icicle Strategy's Program Alternatives to Earth elements including topography, geology, and soils.

4.2.1 No-action Alternative

4.2.1.1 Short-term Impacts

Under the No-action Alternative, various construction and maintenance activities of individual entities would continue that could result in short-term impacts to Earth elements. This is anticipated to entail construction of water diversions modifications, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure at the Alpine Lakes including the restoration of

the Eightmile Lake Dam, and improvements to existing domestic and irrigation water use systems.

Ground-disturbing activities have the greatest potential to increase erosion and sedimentation, particularly when they occur near water courses. These impacts would be localized at construction sites on lower Icicle Creek and at the Alpine Lakes, resulting from construction of new water diversion and flow control structures, various types of fish passage improvements, and improvements to irrigation canal and pipe systems. The modification of existing structures would occur at the Alpine Lakes as gate infrastructure and outlet works are improved and the Eightmile Lake Dam is repaired to historic working conditions. Construction activities along the banks of streams and lakes and in adjacent uplands would likely result in the removal of vegetation, disturbance of soil, and the stockpiling of materials in areas near the work sites. Such activities could cause local, temporary increases in erosion potential.

The agencies or entities implementing projects under the No-action Alternative would be required to comply with applicable local, state, and federal environmental review requirements and permits as described in Section 1.9, Related Permits, Actions, and Laws, as is the case with all alternatives contemplated in this document. Applicable permits would require appropriate mitigation measures to reduce impacts on water quality, such as implementing construction BMPs designed to reduce the potential for erosion (Section 4.5.7, Mitigation Measures). Therefore, the No-action Alternative would not be expected to result in significant short-term impacts.

4.2.1.2 Long-term Impacts

The long-term impacts to earth elements under the No-action alternative are expected to be less than the Program Alternatives because fewer projects would be implemented. However, construction of water diversions modification, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure at the Alpine Lakes including the restoration of the Eightmile Lake Dam, and improvements to existing domestic and irrigation water use systems are expected albeit for potentially different purposes than described in the Guiding Principles. The primary long-term impacts include erosion and sedimentation resulting from increased streamflow. However, the increase in streamflow would be on the order of 32 cfs, which is well within the range of naturally occurring variability, and would restore flow to more natural conditions in the late summer.

4.2.2 Alternative 1

The short-term and long-term impacts of Alternative 1 are primarily related to construction activities and increased streamflow in Icicle Creek and its tributaries, respectively. The primary construction-related impacts involve ground disturbance and erosion. The primary long-term impacts include erosion and sedimentation resulting from increased streamflow. However, the increase in streamflow is within the range of

naturally occurring variability and would restore flow to more natural conditions in the late summer. The increased stream flow would mostly occur during the low-flow period when erosion, sedimentation, and bedload transport are least likely to occur. The impacts to Earth elements are expected to be less than significant. The following section describes the potential impacts associated with individual project elements proposed as part of Alternative 1.

4.2.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Improvements to lake infrastructure would involve hand labor construction methods resulting in minor ground disturbance over small areas. Ground-disturbing activities would include excavations of footings and borrow/placement of fill for building small enclosures to house control equipment. Modifications to existing concrete head gate control towers at Klonaqua and Colchuck Lakes could require partial demolition of the structures and disposal of demolition materials onsite. While some ground disturbance would occur, the scale of the activities is minimal and is not likely to result in significant increases in erosion.

Ground-disturbing impacts can be mitigated by completing construction during periods when lake levels are drawn down to allow the majority of construction staging to occur on the lake bed as opposed to upland and shoreline areas. Use of on-site sources of fill material would reduce the number of haul trips to/from the site. Construction would occur in the dry season when the lakes are drawn down and BMPs would be used to minimize erosion.

IPID Irrigation Efficiencies

IPID Irrigation Efficiencies would include construction of conservation project, including canal to pipeline conversion and canal lining. The projects would use heavy equipment construction methods resulting in ground disturbance along affected canal alignments. Multiple access routes would be anticipated for ingress/egress of equipment and import material including pipe, aggregate and fill material, and concrete. One or more staging areas are likely. Grading along the alignment could increase the potential for erosion and sediment transport. Slope stability of the earth along the canal alignment could be impacted in areas where the canal traverses steep slopes or otherwise unstable ground because of new loading from material used to backfill along the pipeline. No impacts to Earth elements are anticipated for the on-farm efficiencies component of this alternative.

Ground-disturbing impacts from the IPID Irrigation Efficiencies Project can be mitigated by identifying pre-existing ingress/egress and haul routes, such as ditch access routes. Construction would, which means when irrigation facilities are not in use, and temporary erosion and sedimentation control BMPs would be used to minimize impacts and prevent transport of sediment to nearby streams and other surface water bodies. Slope stability considerations would be mitigated by adhering to geotechnical engineering practices.

COIC Irrigation Efficiencies and Pump Exchange

COIC Irrigation Efficiencies and Pump Exchange would use heavy equipment construction methods resulting in ground disturbance associated with constructing a new pump station near the confluence of Icicle Creek and the Wenatchee River and along the COIC canal and lateral alignment, where existing facilities would be replaced with pressurized pipelines. Impacts associated with these activities are the same as for the IPID Irrigation Efficiencies Project except that construction of a new pump station could require excavation below the water table and below the ordinary high water mark on Icicle Creek or the Wenatchee River, requiring dewatering techniques such as coffer dams.

Ground-disturbing impacts of the COIC Irrigation Efficiencies and Pump Exchange Project can be mitigated by identifying pre-existing ingress/egress and haul routes, such as public right-of-way and ditch access routes. Construction would likely occur when irrigation facilities are not in use and temporary erosion and sediment control BMPs would be used to minimize erosion and prevent transport of sediment to nearby streams and other surface water bodies. BMPs would also be implemented where construction would take place below ordinary high water to protect adjacent surface water. Slope stability considerations would be mitigated by adhering to geotechnical engineering practices. Work below ordinary high water in streams would occur during low water periods and in accordance with applicable regulations.

Domestic Conservation Efficiencies

Short-term impacts resulting from the Domestic Conservation Efficiencies Project would include the potential for increased erosion resulting from ground disturbance activities associated with repairing leaky infrastructure, including water mains, and replace meters.

These impacts would be mitigated by performing construction in the dry season and implementing BMPs to minimize erosion.

Eightmile Lake Storage Restoration

Restoration of the Eightmile Lake Storage would include removal of the existing concrete dam structure, excavation and removal of the low-level outlet pipeline, and placement of new materials for construction of a new low-level outlet pipeline and dam facilities. This work would require use of some heavy mechanized construction equipment. The site is a relatively remote location without road access within ALWA. The volume of earth material and large boulders that would need to be moved at the site would require use of an excavator. Depending on the construction means and methods used, a small tracked loader and some type of mechanical sorting equipment may also be needed to sort, move, and place earth and rocks.

Impacts to Earth elements would include ground disturbance at the dam site and staging areas. The largest construction challenge for the project would be determining how to mobilize an excavator and other heavy equipment to the site. A few options for this were evaluated as part of the *Eightmile Lake Storage Restoration Feasibility Study* (Anchor

QEA 2017) prepared concurrently with this PEIS and included in Appendix C. Mobilization of heavy equipment to the site would likely either require transport by a large helicopter, which would limit the size of equipment that can be transported to a small excavator, or mobilization overland via ingress/egress route that more or less would parallel follow the Eightmile Lake Trail. Ground-disturbing activities at the dam site would include excavation of remaining existing concrete and earth fill dam structures, excavation to remove the low-level outlet pipeline, excavation of footings for a new dam, excavation of borrow material, placement of concrete and earth materials for a new dam, backfill for a new low-level outlet pipeline and associated control equipment, and staging for equipment and material. Erosion and stability of construction slopes, borrow locations, and stockpiles could also impact Earth elements by increasing sediment transport to water bodies and increasing slope instability.

Ground-disturbing impacts can be mitigated by completing construction during periods when lake levels are drawn down to allow construction staging to occur "in the dry". Rock and earth materials used for embankment construction and backfill would be sourced locally, to the extent possible, from areas that are already cleared or have been disturbed in the past. Re-use of on-site sources of fill material including any demolition-related concrete would reduce the need for excavation from borrow areas and the number of haul trips to/from the site. Excess excavated material and stockpiled soils would be used to reclaim on-site borrow areas. Construction would occur in late summer and fall, when snow is not on the ground, and BMPs would be used to minimize erosion and prevent transport of sediment to nearby surface water bodies at the dam site and along the excavator ingress/egress route. Adherence to geotechnical design standards and Ecology Dam Safety Office regulations would be required to minimize stability concerns to natural and constructed slopes.

Tribal Fishery Preservation and Enhancement

The focus of this project is to ensure that there would be no adverse effect on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. The specifics of this project are not yet determined but would involve elements of restoration along the Lower Icicle Creek that could result in localized ground disturbance activities. At this stage, the primary options under consideration include the construction of facilities, such as a plumbing to create a bubble curtain, a sprayer, or other minor modifications to the Hatchery Channel spillway at LNFH to promote favorable fishing conditions in the pool at the bottom of the spillway. Depending on the extent of the disturbance, there is the potential for some short-term increase in erosion. However, as noted in Section 4.2.6, Mitigation Measures, work within Icicle Creek would require compliance with applicable local, state, and federal regulations, which would require BMPs to ensure that potential impacts would be less than significant.

Habitat Protection and Enhancement

The Habitat Protection and Enhancement Project would use heavy equipment and hand labor construction methods. Constructing engineered logjams and performing other stream restoration activities, such as anchoring large woody debris or stream channel modification, would require heavy equipment that would impact Earth elements through ground-disturbing construction activities. These activities would include excavating and placing anchors, modifying stream beds, establishing routes for ingress/egress and for hauling material, and constructing staging areas. Much of this work would be performed below ordinary high water in water bodies. Establishing riparian plantings could be performed by hand labor assisted by heavy equipment to haul material, grade topography, and remove undesirable vegetation. These activities could result in short-term erosion and sedimentation to water bodies.

Any adverse impacts would be likely minor because compliance with applicable local, state, and federal permits or approvals would require appropriate mitigation measures to reduce any potentially significant long-term impacts, such as ensuring that stream channel morphology would not adversely affected (see Section 4.2.6, Mitigation Measures).

Instream Flow Rule Amendment

The Instream Flow Rule Amendment Project is administrative in nature and does not involve construction. No short-term impacts to Earth elements would occur.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

LNFH Conservation and Water Quality Improvements Project would use heavy equipment construction methods to implement on-site re-use, effluent pump-back, and well field enhancements. These actions could impact Earth elements through ground-disturbing construction activities occurring at the hatchery site near the raceways, at the well field, and on Hatchery Island. Staging areas and access for hauling and equipment ingress/egress would mostly occur along established access routes in paved or graveled areas. Excavations and placement of fill near the raceways would mostly occur in paved areas having controlled drainage to water bodies. Drilling new wells or modifying existing ones could require equipment access to areas that may not have established access routes, but these activities are otherwise not anticipated to result in major ground disturbance. Construction of a groundwater gallery on Hatchery Island would consist of excavations below the water table, requiring dewatering, pipeline construction, backfill, and grading.

Ground-disturbing impacts would be mitigated by maximizing use of pre-existing ingress/egress and haul routes and staging areas away from water bodies. Construction would occur in the dry season and BMPs would be used to minimize erosion and prevent transport of sediment to adjacent surface water bodies.

Because this facility is owned by the USBR and operated by USFWS, an additional evaluation of the potential short-term impacts under NEPA will be completed.

Fish Passage

The Fish Passage Project would use heavy equipment construction methods to modify instream structures to improve passage, including those at LNFH and the Boulder Field. Boulder Field modification impacts to Earth elements would include ground disturbance from construction and slope instability during construction. Ground-disturbing activities would include modifying the Boulder Field using heavy equipment. This work would occur below the ordinary high water of Icicle Creek and on the bank above the creek. The hill slope between Icicle Road and Icicle Creek would be regraded to increase stability following Boulder Field modification. A water line for the City of Leavenworth would be relocated. Excavations, regrading, stockpiles, placement of fill, access routes, and staging areas could contribute to ground disturbance that results in erosion and sedimentation in the adjacent creek. Stability of temporary slopes could be impacted during construction.

Any adverse impacts would be likely minor because compliance with applicable local, state, and federal permits or approvals would require appropriate mitigation measures to reduce any potentially significant long-term impacts, such as ensuring that stream channel morphology would not adversely affected (see Section 4.2.6, Mitigation Measures).

Fish Screen Compliance

The Fish Screen Compliance Project would use heavy equipment construction methods to replace existing screens at major diversions on Icicle Creek. Impacts to Earth elements include ground disturbance from construction activities occurring near the stream bank and below ordinary high water. Ground-disturbing activities would include excavation at existing structures and footings of new structures, pouring concrete, backfill, grading, access routes for ingress/egress, and staging areas.

Ground-disturbing impacts would be mitigated by identifying pre-existing ingress/egress and haul routes and through off-site staging away from stream banks and water bodies. Work below ordinary high water in streams would occur during low water periods and in accordance with applicable regulations. Construction would occur in the dry season and BMPs would be used to minimize erosion and prevent transport of sediment to adjacent surface waters, including where construction would take place below ordinary high water.

Water Markets

The Water Markets Project does not require construction. No short-term impacts to Earth elements would occur.

4.2.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Long-term impacts to Earth elements from changing outflow patterns from the Alpine Lakes could include increased erosion of stream beds and stream banks, and increased sedimentation Icicle Creek and its tributaries. However, because flow rates released from reservoirs would be far less than natural peak flows and increased late summer flows

would restore flows to a more natural condition, there is low risk of increased erosion sedimentation. Additionally, the increased stream flow would mostly occur during the low-flow period when erosion, sedimentation, and bedload transport are least likely to occur. The long-term impacts of this project are anticipated to be less than significant.

IPID Irrigation Efficiencies

Long-term impacts to Earth elements from the IPID Irrigation Efficiencies Project could improve slope stability along canal alignments. Slope stability could decrease locally in areas having steep slopes along IPID canal alignments because of increased loading where open canal is replaced by backfill and pipeline. However, slope stability is anticipated to increase overall as a result of decreased seepage of water into the subsurface, which would result in decreased subsurface erosion. Potential impacts of increased slope load would be mitigated by adhering to geotechnical engineering practices.

COIC Irrigation Efficiencies and Pump Exchange

The long-term impacts of the COIC Irrigation Efficiencies and Pump Exchange Project would be similar to the IPID Irrigation Efficiencies with the exception of construction of a pump station near the confluence of Icicle Creek and the Wenatchee River. The new COIC pump station and intake facilities would have the potential to change instream flow dynamics that could contribute to increased potential for shoreline erosion.

Any adverse impacts would be likely minor because compliance with applicable local, state, and federal permits or approvals would require appropriate mitigation measures to reduce any potentially significant long-term impacts, such as ensuring that stream channel morphology would not be adversely affected (see Section 4.2.6, Mitigation Measures).

Domestic Conservation Efficiencies

Replacing leaking water mains and upgrading meters would have a positive impact on Earth elements. Addressing and preventing leaks can decrease underground erosion that can undermine soils as a result of catastrophic pipe failure. In addition to decreasing erosion, fixing leaking pipes can increase slope stability by decreasing soil water content in areas having unstable slopes.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project would restore water levels in Eightmile Lake to the historic maximum water surface elevation. The water surface has decreased over time due to erosion of the earthen embankment portion of the dam. Long-term impacts of restoring the maximum water surface elevation would be minimal because the shoreline consists mostly of exposed, shallow bedrock, and impacts would be similar to those experiences under past conditions.

Adhering to geotechnical design standards and Ecology Dam Safety Office regulations would mitigate stability concerns to natural and constructed slopes. Shoreline erosion could be mitigated by limiting periods when the water levels are at their peak. Lake bed erosion and instability can be mitigated by managing water level draw down rates.

Tribal Fishery Preservation and Enhancement

The purpose of this project is to protect and enhance the tribal fishery, which, depending on the specific actions, could result in long-term changes to stream channel that could increase the potential for erosion and sedimentation. Projects within Icicle Creek and near its shoreline would require multiple authorizations from local, state, and federal regulatory agencies. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce any potentially significant long-term impacts affecting shorelines (see Section 4.2.6, Mitigation Measures). These requirements would be developed once project-specific details were available.

Habitat Protection and Enhancement

Implementing actions associated with Habitat Protection and Enhancement could have long-term impacts on Earth elements. Construction of engineered logjams and stream bed modifications, and planting riparian vegetation could improve local stream morphology, reduce erosion, and protect stream banks.

Instream Flow Rule Amendment

No long-term impacts to Earth elements are anticipated from this project.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

The potential long-term adverse impacts on Earth elements could occur in areas where new facilities were constructed near Icicle Creek that could change stream morphology or bank erosion. Potential adverse impacts would likely be minor because work within the shoreline would require compliance with various local, state, and federal regulations, including NEPA, which would address the need for mitigation to reduce potential long-term impacts (see Section 4.2.6, Mitigation Measures).

Fish Passage

The Fish Passage Project could have long-term impacts to Earth elements. Modifications to Lower Icicle Creek to improve passage could change local stream morphology, increase stream erosion and sedimentation. However, work within the Icicle Creek would require multiple authorizations from local, state, and federal regulatory agencies. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce any potentially significant long-term impacts affecting erosion and sedimentation in Icicle Creek (see Section 4.18.6, Mitigation Measures).

Fish Screen Compliance

The Fish Screen Compliance Project could have long-term impacts to Earth elements. Modifying diversion structures to allow for fish screen improvements could change local stream morphology leading to increased erosion. Work within Icicle Creek would require multiple authorizations from local, state, and federal regulatory agencies. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce any potentially significant long-term impacts affecting erosion. These requirements would be developed once project-specific designs and details were available.

Water Markets

The Water Markets Project would provide instream flow benefit in reaches of Icicle Creek and the Wenatchee River, from retired water rights to the out-of-stream mitigation locations. In non-drought years, this project would provide instream flow benefit throughout Icicle Creek and the Wenatchee River. This increased streamflow could result in increased erosion of stream channels and banks in higher gradient reaches and increased sedimentation in lower gradient reaches. However, this would not be significant because streamflow increases would be far below peaks and would restore flow to more natural conditions.

4.2.3 Alternative 2

Most of the projects in Alternative 2 are common to Alternative 1, with the exception of the Alpine Lakes Optimization, Modernization, and Automation Project, which is not included in Alternative 2, and the IPID Dryden Pump Exchange Project, which is included in Alternative 2. Because of these commonalities, the overall short-term and long-term impacts to Earth elements are similar. This section provides details on the impact of the IPID Dryden Pump Exchange Project to Earth elements. Impacts of the other projects are available in Section 4.2.2, Alternative 1.

4.2.3.1 Short-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project would use heavy equipment construction methods resulting in ground disturbance associated with constructing a new pump station on the right bank of the Wenatchee River near Dryden and new pipeline alignment connecting to the PID and IID canals. Access routes would be anticipated for ingress/egress of equipment and import material, including pipe, aggregate and fill material, and concrete. One or more staging areas are likely. Grading along the alignment could increase the potential for sediment delivery to the nearby river system. Some work below ordinary high water in the Wenatchee River is anticipated.

Work within and near the Wenatchee River would require compliance with applicable local, state, and federal regulations, which would require BMPs to ensure that potential impacts would be less than significant.

4.2.3.2 Long-term Impacts

IPID Dryden Pump Exchange

The project would result in new pump station and intake facilities constructed along the right bank of the Wenatchee River. Depending on the specific location, long-term impacts could potentially affect Earth elements by increasing the potential for stream bank erosion and flooding over the long term.

Any adverse impacts would be likely minor because compliance with applicable local, state, and federal permits or approvals would require appropriate mitigation measures to reduce any potentially significant long-term impacts, such as ensuring that stream channel morphology and floodplain storage capacity are not adversely affected (see Section 4.2.6, Mitigation Measures) and that no increase in flood elevations result from the proposed project.

4.2.4 Alternative 3

Alternative 3 has many of the same projects and thus many of the same impacts of Alternative 2. Under this alternative, the Eightmile Lakes Storage Restoration Project would be replaced with Legislative Changes Creating OCPI Authority for Alternative 3, which is not anticipated to have any short- or long-term impacts to Earth elements.

4.2.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

No short-term impacts to Earth elements are anticipated from this project.

4.2.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

No long-term impacts to Earth elements are anticipated from this action.

4.2.5 Alternative 4

Alternative 4 has many of the same projects as Alternative 1, with the addition of three storage enhancement projects, and the removal of the Eightmile Lake Storage Restoration Project. Construction-related impacts are expected for all three storage enhancement projects, with the primarily long-term impacts including erosion and sedimentation associated with increased instream flows. However, as discussed under Alternative 1, increased streamflow would be much lower than peak flow, and increasing late summer streamflow would result in more natural flow conditions. The impacts to Earth elements resulting from Alternative 4 are expected to be less than significant.

4.2.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

Short-term impacts to Earth elements and mitigation measures for the Eightmile Lake Storage Enhancement Project would be the similar to for the Eightmile Lake Storage Restoration Project, as described in Section 4.2.2.1. However, the facilities would be larger and so the area of disturbance, the volumes of earthwork, and other construction impacts would be greater.

In addition, as noted in Section 4.2.6, Mitigation Measures, work within and around the lakes would require compliance with applicable local, state, and federal regulations, which would require BMPs to ensure that potential impacts would be less than significant.

Upper Klonaqua Lake Storage Enhancement

With Upper Klonaqua Lake Storage Enhancement Project being at the conceptual stage, it is unclear if heavy equipment or hand labor construction methods would be used. However, given the magnitude of the project, it is likely that heavy construction equipment would be required.

The resulting ground disturbance associated with this project would include bedrock excavation of an outlet tunnel or clearing to install a siphon to allow for additional releases from Upper Klonaqua Lake to Lower Klonaqua Lake. Additional disturbance could be caused by clearing and excavation required for borrow/placement of fill for a head gate control structure, a small enclosure housing control equipment, and diesel pumps for drawing down lake levels for construction. Tunnel cuttings would be disposed on-site. If a pipeline is not constructed within the tunnel, erosion would occur during initial discharge operations along the bottom of the outlet tunnel and in the outlet channel transporting sediments to Lower Klonaqua Lake. Bedrock topography would be impacted by construction of a new tunnel and disposal of cuttings. Stability of bedrock could be impacted by tunnel excavation.

Ground-disturbing impacts can be mitigated by completing construction after Upper Klonaqua Lake levels are pumped down the majority of construction staging to occur on the lake bed as opposed to upland and shoreline areas. Use of on-site sources of fill material including any demolition-related concrete would minimize the need for establishing borrow areas and the number of haul trips to/from the site. Excess excavated material and stockpiled soils could be used to reclaim on-site borrow areas. Construction would occur in the dry season and BMPs would be used to minimize erosion. Adhering to geotechnical design standards and Ecology Dam Safety Office regulations would mitigate slope stability concerns.

In addition, as noted in Section 4.2.6, Mitigation Measures, work within and around the lakes would require compliance with applicable local, state, and federal regulations, which would require BMPs to ensure that potential impacts would be less than significant.

Upper and Lower Snow Lakes Storage Enhancement

Short-term impacts and mitigation measures for Upper and Lower Snow Lakes Storage Enhancement Project would be similar to those for the Eightmile Lake Storage Restoration project, except that there is no ancient landslide impounding the lake. Heavy construction equipment would likely be required for construction of these improvements, similar to what would be required for the Eightmile Lake Storage Restoration project.

In addition, as noted in Section 4.2.6, Mitigation Measures, work within and around the lakes would require compliance with applicable local, state, and federal regulations, which would require BMPs to ensure that potential impacts would be less than significant.

4.2.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would result in water levels that are higher than historical levels, leading to long-term impacts on Earth elements. Increasing lake levels could increase bank erosion potential and decrease stability of upland slopes and the ancient landslide mass impounding the west end of the lake. However, this impact is expected to be less than significant because of the bedrock structure of the shoreline. Any potential decreased stability to the landslide mass at the west end of the lake would be mitigated through adhering to geotechnical design standards and Ecology Dam Safety Office regulations would mitigate stability concerns to natural and constructed slopes.

The project would also allow for the lake to be drawn down below existing lake levels to an elevation of 4,619 feet, which is approximately 24.4 feet lower than the existing low. This change would result in the exposure of slightly more lake bed, mainly in the later summer month and early fall up to the point when the water would no longer be drawn down, generally around the end of September. The additional draw down is not expected to adversely affect Earth elements by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity

Upper Klonaqua Lake Storage Enhancement

The Upper Klonaqua Lake Storage Enhancement Project would result in lake levels that are drawn down below the historical range, which would have long-term impacts on Earth elements. Drawing the lake down further than currently practiced could cause increased lake bed erosion and decreased stability of lake bed slopes. However, these impacts would be unlikely and less than significant because of the bedrock structure of the shoreline and lake bed at Upper Klonaqua Lake.

Drawing the lake down further than currently practiced could cause turbidity in stream. However, because draw down of the lake would occur over a period of a couple of months, it is expected that increased turbidity would be less than substantial.

Upper and Lower Snow Lakes Storage Enhancement

The Upper and Lower Snow Lakes Storage Enhancement Project would result in water levels that are higher than historical levels, which would have long-term impacts on Earth elements. Increasing lake levels could increase bank erosion. However, this impact is considered less than significant given that the lake beds and shorelines are composed of bedrock. Drawing the lake down further than currently practiced could cause turbidity in stream. However, because draw down of the lake would occur over a period of a couple of months, it is expected that increased turbidity would be less than substantial.

4.2.6 Alternative 5

Most of the projects in Alternative 5 are common to Alternative 1, with the exception of the IPID Irrigation Efficiencies, which is replaced by the IPID Full Piping and Pump Exchange Project. Because of these commonalities, the overall short-term and long-term impacts to Earth elements are similar. This section provides details on the impact of the IPID Full Piping and Pump Exchange Project to Earth elements. Impacts of the other projects are available in Section 4.2.2, Alternative 1.

4.2.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

The IPID Full Piping Pump Exchange Project would use heavy equipment construction methods resulting in ground disturbance associated with constructing pump stations at three locations on the Wenatchee River and new pipeline alignment connecting to the PID and IID canals. Open canals would be replaced with pressurized pipeline. Access routes would be anticipated for ingress/egress of equipment and import material, including pipe, aggregate and fill material, and concrete. One or more staging areas are likely. Grading along the alignment could increase the potential for sediment delivery to the nearby river system. Some work below ordinary high water in the Wenatchee River is anticipated.

Work within and near the Wenatchee River would require compliance with applicable local, state, and federal regulations, which would require BMPs to ensure that potential impacts would be less than significant.

4.2.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

The project would result in three new pump stations and intake facilities constructed along the Wenatchee River. Depending on the specific location, long-term impacts could potentially affect Earth elements by increasing the potential for stream bank erosion and flooding over the long term.

Any adverse impacts would be likely minor because compliance with applicable local, state, and federal permits or approvals would require appropriate mitigation measures to reduce any potentially significant long-term impacts, such as ensuring that stream

channel morphology and floodplain storage capacity are not adversely affected (see Section 4.2.7, Mitigation Measures) and that no increase in flood elevations result from the proposed project.

4.2.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.2.7.1 Short-term Impacts

Short-term impacts to Earth elements related to increased erosion would be mitigated by complying with the terms and conditions of local, state, and federal regulations and project-specific permits and approvals, including local building, grading, state stormwater construction permits, Shoreline Management Act shoreline permits, HPAs, and CWA Section 404 permits and their associated Section 401 Water Quality Certificates, among others. Common permit conditions are likely to include working in a manner to minimize soil disturbance, implementing BMPs to control erosion and prevent transport of sediment to surface water bodies, and, to the extent possible, completing work in the summer and fall when water levels are low and the potential for impact is reduced.

Short-term impacts related to slope stability would be minimized through adherence to geotechnical design standards and Ecology Dam Safety Office Regulations.

4.2.7.2 Long-term Impacts

Long-term impacts on Earth elements would be mitigated by complying with the terms and conditions of local, state, and federal regulations and project-specific permits and approvals, as described above.

4.3 Surface Water

This section describes the potential short- and long-term impacts of the Program Alternatives on surface water quantity. The short-term impacts are related to construction impacts, with long-term impacts being impacts resulting from the operation of projects. The primary long-term impact to surface water associated with the Icicle Strategy is increased instream flows. These instream flow changes are summarized in Table 4-1. Greater detail on changes to surface water are noted in the subsections below. Impacts affecting water quality are presented in Section 4.5, Water Quality and impacts to water rights and use are presented in Section 4.6, Water Use.

Table 4-1
Instream Flow Changes

Alternative	Instantaneous Change (cfs)	Annual Change (ac-ft)
No-action	32	18,094
Alternative 1	88	28,458
Alternative 2	83	24,478
Alternative 3	70	23,978
Alternative 4	131	34,585
Alternative 5	195	55,458

Notes: Instantaneous water quantities are expressed in cfs and represent the amount of water moving downstream at a moment in time. Annual water quantity is expressed in ac-ft and represent the instantaneous quantity accrued over a year. Instantaneous increases would occur in the summer.

4.3.1 No-action Alternative

4.3.1.1 Short-term Impacts

Under the No-action Alternative, various entities and agencies would undertake individual actions that could result in short-term impacts on water quality in the Icicle Creek Watershed project area. This is anticipated to entail construction of water diversion modifications, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure at the Alpine Lakes including the restoration of the Eightmile Lake Dam, and improvements to existing irrigation systems to support agricultural reliability.

In-water, streambank, and lakeshore work would likely include the modification of existing features, construction of new water diversion and flow control structures, various types of fish passage improvement work, and improvements to irrigation canal and pipe systems. The modification of existing structures would occur at the Alpine Lakes as gate infrastructure and outlet works are improved and the Eightmile Lake Dam is repaired to working conditions. Work would likely require the placement of temporary cofferdams in water bodies to isolate work areas and could also involve the temporary diversion of stream flow or construction dewatering.

These impacts would be temporary, and the duration and timing are currently unknown.

4.3.1.2 Long-term Impacts

The No-action Alternative would provide some instream flow benefit. Projects that are likely to move forward would provide up to an estimated 32 cfs of instream flow benefit in Reach 3 and 4. Up to 20 cfs of this increased streamflow will be available year-round, in Reach 3 and 4. Approximately 11 cfs of this instream flow benefit would be available during the irrigation season, when flows are often at their lowest, in Reach 3, 4 and 5.

While construction and upgrades at the IPID dam sites would likely occur, releases would occur on a rotational basis and under drought-year scenarios, which is consistent with the current operation schedule. Water releases would not be optimized for instream flows and fish benefit, meaning there would not be an additional 30 cfs of flow benefit to lower Icicle Creek in Reaches 1, 2, 3, 4, and 5 during most years.

While the IPID Irrigation Efficiencies Project and IPID Dryden Pump Exchange Project might be implemented under the No-action Alternative, the focus and project goals would be primarily for agricultural reliability, and instream flow benefit might not occur. This would be a lost opportunity to increase streamflow during the irrigation season by 10 and 25 cfs, respectively.

Although some type of reconstruction of the Eightmile Lake dam would likely occur under the No-action Alternative, it is unclear what the scale of the reconstruction would be, and it is unlikely that water would be made available to instream flow and new uses. This would be a lost opportunity to increase stream flow by 12.6 cfs in Reach 1.

4.3.2 Alternative 1

Alternative 1 is expected to increase instream flows in Icicle Creek by up to 88 cfs or 28,458 acre-feet, with smaller benefits in tributaries to Icicle Creek depending on project location. The duration of flow improvement would primarily be during the irrigation season, with emphasis in the late summer/early fall time period. Some projects may also include year-round benefit where adaptation to low wintertime instream flows is possible. Short-term impacts discussed are related to construction activities and would include the use of cofferdams and dewatering.

4.3.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Construction activities at the dam sites would include work on gates and outlet tunnels, and installation of solar panels, actuators, flow monitoring equipment, and other new equipment. Lakes would need to be drawn down for construction activities, which would provide flow benefit in Prospect, Leland, Klonaqua, French, Colchuck, Mountaineer, and Eightmile Creek, as well as Reaches 1 through 5 of Icicle Creek. These impacts are not considered new, as they are part of the current conditions and operations at the lakes, which are drawn down at least once every five years for maintenance activities.

Dewatering during construction would not likely be required.

IPID Irrigation Efficiency

Under this project, the Comprehensive Water Conservation Plan would be updated, and irrigation efficiency upgrades would be implemented, as recommended in the plan. The update of the IPID Comprehensive Water Conservation Plan is currently under way. The recommended irrigation efficiency projects would likely involve piping and lining sections of canal and increasing on-farm application efficiency. Construction activities

would occur within the area of current canals and outside the irrigation season when the canals are dry. There are no anticipated construction impacts to surface water.

COIC Irrigation Efficiencies and Pump Exchange

This project consists of replacing the existing COIC system with a pressurized delivery system, relocating the point of diversion to a location near the confluence of the Wenatchee River and Icicle Creek, and intake facilities at that location. In general, the majority of the impacts would be similar to the IPID Irrigation Efficiencies. Construction of the COIC pump station would involve instream work below the ordinary high water on the Wenatchee River or Icicle Creek. Impacts to surface water would likely include the use of coffer dams and temporary dewatering at the construction site.

Domestic Conservation Efficiencies

The Domestic Conservation Efficiencies Project would improve domestic water use efficiency by the City of Leavenworth through pipe replacements, water meter installation, a voluntary lawn buyback program, and other water use conservation efforts. It would also improve domestic efficiency in rural Chelan County by providing conservation incentives and education. These construction activities are not anticipated to have impacts on surface water.

Eightmile Lake Storage Restoration

Eightmile Lake Storage Restoration would require demolition and reconstruction of the dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures. The lake would need to be drawn down for construction activities, which would provide flow benefit in Eightmile Creek, as well as Reaches 1 through 5 of Icicle Creek. This impact is not considered new, as it is part of the current conditions and operations at Eightmile Lake, which is drawn down at least once every five years for maintenance activities.

The use of cofferdams and dewatering could be required for some of the reconstruction work.

Tribal Fishery Preservation and Enhancement

The focus of the Tribal Fishery Preservation and Enhancement Project is to ensure that there would be no adverse effect on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. Specific projects may include installing a sprayer to provide cover for fish, or other minor modifications at the Hatchery Channel spillway. Short-term impacts would be determined during project-level review, once project location and details are known.

Habitat Protection and Enhancement

The Habitat Protection and Enhancement Project involves the restoration and enhancement of habitat in the Icicle Creek Subbasin through riparian plantings, engineered log jams, and conservation easements. Some construction may require temporary dewatering or rerouting water.

Instream Flow Rule Amendment

There are no construction activities proposed under the Instream Flow Rule Amendment Project and, therefore, no potential short-term impacts on surface water.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

The LNFH Conservation and Water Quality Improvements Project includes various elements geared toward improving water quality and hatchery rearing conditions at the LNFH. In general, construction of these elements has the potential to affect surface water, depending on the specific location and type of disturbance. Likely short-term impacts would include the use of cofferdam to temporarily reroute water, and dewatering activities for construction on the diversion intake. Because this facility is owned by the U.S. Bureau of Reclamation and operated by U.S. Fish and Wildlife Service, an evaluation of the potential short-term impacts under NEPA would be completed once the full scope of the project is determined.

Fish Passage

Removing fish passage barriers could require instream construction work and the use of cofferdams to temporarily reroute water, and dewatering activities.

Fish Screen Compliance

The installation of fish screens would require instream construction work and could require the use of cofferdams and dewatering activities.

Water Markets

There are no construction activities proposed under the Water Markets Project and therefore no potential short-term impacts on surface water.

4.3.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Implementation of the Alpine Lakes Optimization, Modernization, and Automation Project would allow for remote control releases from the lakes, providing more frequent and more precise releases of water to Icicle Creek. One objective of this project is to release water from the lakes in response to streamflow conditions. This would increase flows in Reaches 1 through 5 during low flow conditions. Additionally, this project would provide additional cold water and increase streamflow to tributaries downstream of the dam sites: Prospect, Leland, Klonaqua, French, Colchuck, Mountaineer, and Eightmile Creeks. It is anticipated that this project would add 30 cfs and 5,465 acre-feet of water to Icicle Creek and its tributaries during the late summer, when stream flow are below targets. This increase in streamflow would be within the naturally occurring range of stream flows in Icicle Creek. The timing and quantities of these flows would be a beneficial change to the riverine system. In drought-years, IPID would exercise their current water rights for irrigation use as needed.

In the Alpine Lakes, the frequency of draw-down would increase from approximately 1-in-5 years to nearly every year. During high water years, it is possible that not all storage from the lakes would be utilized to enhance streamflow. Despite the increased draw down frequency, the Automation Appraisal study found that the lakes are still expected to fully refill each spring (Aspect, 2015). These findings indicate that this project would not have a significant impact on the water quantity within the Alpine Lakes and their catchments.

IPID Irrigation Efficiencies

Improving IPID's efficiency through system upgrades is expected to increase flow during the irrigation season, which typically occurs from April through October. This period includes low flow months in late summer and early fall, as identified on the Icicle Creek hydrograph (Figure 3-2). The estimated flow benefit resulting from this project is approximately 10 cfs and 3,000 acre-feet per year. Because IPID diverts water from Icicle Creek and exports it to the Wenatchee Valley, project benefits would occur in all the reaches of Icicle Creek downstream of IPID's point of diversion at RM 5.7 (Reaches 2 through 5).

Reach benefit would continue into the Wenatchee River, to the point where return flows typically enter the system. Because IPID's irrigated lands parallel the Wenatchee River over a long distance, return flows likely occur from near RM 28 to RM 5. Benefit would diminish between these two points and end near RM 5. Figure 2-25 provides an overview of lands served by IPID and the location of increased instream flows.

COIC Irrigation Efficiencies and Pump Exchange

The COIC Irrigation Efficiencies and Pump Exchange Project is expected to increase flows in Icicle Creek from RM 4.5 to the location of the new point of diversion. This benefit would occur from approximately April through October, which includes the low flow period in late summer and early fall. The estimated benefit in Icicle Creek is 8.0 to 11.9 cfs and 2,100 to 3,500 acre-feet. The variation in this number is based on COIC's historical and future water use.

The primary source of instream flow benefit from this project is moving the COIC point of diversion from Icicle Creek to a location near the confluence of Icicle Creek and the Wenatchee River. The proposed pump station would be at one of the following locations:

- On the right bank of the Wenatchee River just upstream of the Leavenworth Road Bridge, approximately 0.8 miles upstream of its confluence with Icicle Creek
- On the right bank of the Wenatchee River on a bend in the river approximately 0.3 miles upstream of its confluence with Icicle Creek
- On the left bank of Icicle Creek on a bend in the creek approximately 0.75 miles upstream of its confluence with the Wenatchee River

Locating the pump station near Icicle Road would create an impact on Wenatchee River flows equal to the benefit to Icicle Creek flows between the new pump station and the confluence with Icicle Creek. This would be an 8.0 to 11.9 cfs reduction in flows for

approximately 0.8 miles of the Wenatchee River. The second location would result in a similar impact, but only on 0.3 miles of the Wenatchee River. The third location provide flow benefit on Icicle Creek from the historical point of diversion to the location of the new pumps station.

Domestic Conservation Efficiencies

Under the Domestic Conservation Efficiencies Project, domestic conservation would increase, and water made available through this process would be used for new domestic use. Depending on the location of conservation and new use, this project could result in some reach benefit in Icicle Creek.

Increasing domestic conservation in the City of Leavenworth and putting conserved water to new uses could result in a minor decrease in the amount of excess water, or return flow, discharged to the Wenatchee River from the City of Leavenworth's wastewater treatment plant (Figure 2-27). This would lead to slight reductions to instream flows in the Wenatchee River. However, these impacts would be offset by benefit from other projects.

Eightmile Lake Storage Restoration

Under the Eightmile Lake Storage Restoration Project, storage volumes would be restored to historical levels that occurred before Eightmile Dam partially eroded, which reduced usable storage by 900 acre-feet. This additional 900 acre-feet of water would be used for improving domestic reliability and instream flows. The primary impact of this project on surface water would occur in Eightmile Lake, Eightmile Creek, and Reach 1 of Icicle Creek.

Under this project, accessible water storage in the Eightmile catchment would be restored to 2,500 acre-feet, as depicted on the adjudicated certificate. The Eightmile Lake maximum water surface elevation would be restored to the historical spillway elevation (4,671 feet). That represents an increase of 4 feet over the current maximum operating water surface, 4,667 feet. This storage limitation is a result of erosion that has occurred over the embankment portion of the dam. Draw down would increase by 22.4 feet. Impacts to Eightmile Lake levels are presented in Figures 2-28. Based on evaluations conducted for the Eightmile Lake Storage Restoration Feasibility Study (Anchor QEA, 2017), Eightmile Lake would still be expected to fully refill each spring, even in dry years. These findings indicate that this project would not have a significant impact on the water quantity within the Eightmile catchment.

This project would provide for the release of an additional 12.6 cfs and 900 acre-feet from Eightmile Lake into its tributary, Eightmile Creek, and Reach 1 of Icicle Creek. Flows could be adaptively managed to reduce low flow impacts in late summer or winter. These increase flows would be within the natural occurring range of flows and would be beneficial.

Tribal Fishery Preservation and Enhancement

The preservation and enhancement of tribal fisheries is not expected to result in long-term impacts on surface water in Icicle Creek, its tributaries, or the Wenatchee River.

Habitat Protection and Enhancement

The Habitat Protection and Enhancement Project includes activities such as grading and installing engineered logjams with the goal of creating better ecological conditions in Icicle Creek. Long-term impacts of installing habitat improvement projects may include alteration of stream velocity and characteristics in Icicle Creek. There are no anticipated long-term impacts on the quantity of water in Icicle Creek resulting from this project.

Instream Flow Rule Amendment

The long-term impacts of amending the Instream Flow Rule is decreased streamflow in Icicle Creek by 0.4 cfs. It is unclear at this time where reach impacts would occur, although they would likely appreciate from Reach 1 to Reach 5. These impacts are expected to be offset by instream flow benefit provided by other projects.

There are no long-term streamflow impacts anticipated in the Wenatchee River because amending the Instream Flow Rule would move part of the Wenatchee Reserve into Icicle Creek. This would be a net neutral impact to the Wenatchee River.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

The LNFH Conservation and Water Quality Improvements Project would likely impact surface water by increasing flow between RM 4.5 and 2.7 (Reaches 3 and 4). Anticipated impacts are up to 20 cfs and 14,454 acre-feet increase in flows year-round. This would include the low-flow periods experienced in Icicle Creek in late summer and early fall, as well as the winter (see Figure 3-2). These increased flows would be beneficial to Icicle Creek. However, flow benefit would not be measured at the Ecology Gage in Reach 5, which is the control point for the Instream Flow Rule, because operations at LNFH are primarily non-consumptive and benefits would not occur downstream of the hatchery outfall.

Fish Passage

Altering instream structures to improve fish passage is not anticipated to have long-term impacts on surface water.

Fish Screen Compliance

Compliance with current fish screening regulations is not expected to result in long-term impacts on surface water.

Water Markets

The Water Markets Project is expected to have a net neutral impact on surface water in years when the Instream Flow Rule is not met, and interruptible water users would be ordered to turn off. This is because the water market would provide mitigation in those instances to allow interruptible water users to continue irrigating. Depending on where

senior water rights are retired to seed the water bank, there may be a reach benefit in Icicle Creek. However, this benefit is expected to be offset by withdrawals downstream in the Wenatchee River Watershed.

In years when the Instream Flow Rule is met, the water bank would not be used as mitigation to offset interruptible water users, and instream flow benefits would occur in Icicle Creek and the Wenatchee River. The increase in streamflow would be 3.4 cfs and 1,000 acre-feet. These benefits would occur during the irrigation season, including the critical low flow period of late summer to early fall.

4.3.3 Alternative 2

The overall expected surface water impact associated with Alternative 2 is an increase of up to 83 cfs and 24,478 acre-feet in instream flow in Icicle Creek, with smaller benefits in tributaries to Icicle Creek depending on project location. Alternative 2 would result in implementation of many of the same projects included in Alternative 1, with the exception that the IPID Dryden Pump Exchange Project would also be included and the Alpine Lakes Optimization, Modernization, and Automation Project would not be included. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. The impacts of all other Alternative 2 projects are discussed under Alternative 1.

4.3.3.1 Short-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project includes the construction of a pump station to divert water to IPID from the Wenatchee River and would involve instream work on the Wenatchee River. Impacts to surface water would likely include the use of cofferdams and dewatering at the construction site.

4.3.3.2 Long-term Impacts

IPID Dryden Pump Exchange

The primary long-term impact of implementing the IPID Dryden Pump Exchange Project is increased streamflow in Icicle Creek, Peshastin Creek, and the Wenatchee River. This pump station would reduce IPID's diversion on Icicle Creek by as much as 25 cfs. The instream flow benefit from this project would occur during the irrigation season, which typically occurs from April through October. This period includes low flow months in late summer and early fall, as identified on the Icicle Creek hydrograph (Figure 3-2). These increased flows would benefit Icicle Creek downstream of IPID's point of diversion at RM 5.7 in Reaches 2 through 5. Releases from ALWS storage would still be required to sustain diversion quantities at the new pump station location. The benefit would continue into the Wenatchee River to the location of the new pump station near RM 16.2. Reach benefits can be seen in Figure 2-43.

There would also be additional benefit to Peshastin Creek, as water currently diverted by IPID from this creek would also be replaced by this project.

4.3.4 Alternative 3

The overall expected surface water impact associated with Alternative 3 is an instream flow benefit of up to 70 cfs and 23,978 acre-feet in Icicle Creek, with smaller benefits in tributaries to Icicle Creek depending on project location. Alternative 3 would result in implementation of many of the same projects included in Alternative 2, with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 would also be included and the Eightmile Lake Storage Restoration Project would not be included. This section describes the specific short- and long-term impacts associated with Legislative Change Creating OCPI Authority for Alternative 3 Project. The impacts of all other Alternative 3 projects are discussed under Alternative 1 and Alternative 2.

4.3.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

The Legislative Change Creating OCPI Authority Project does not have a construction component. Consequently, there are no anticipated short-term impacts.

4.3.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

Under the Legislative Change Creating OCPI Authority for Alternative 3 Project, the small number of out-of-stream uses proposed by the IWG cannot be perfectly matched with the much larger instream flow benefit made available if the standard for impairment is perfectly in-time. Under current state law, meeting the domestic Guiding Principle with water made available slightly out-of-time would impair existing rights.

The IWG could seek and the Legislature could grant an OCPI waiver of impacts to the instream flow rule from junior domestic uses given the greater instream flow benefit aggregated under Alternative 3. If Legislative approval to waive impairment was not forthcoming, Alternative 3 could not move forward because Ecology's OCPI authority is too limited to address long-term impacts.

4.3.5 Alternative 4

The overall expected surface water impact associated with Alternative 4 is a benefit to instream flows of up to 131 cfs and 34,585 acre-feet in Icicle Creek, with smaller benefits in tributaries to Icicle Creek depending on project location. Alternative 4 would result in implementation of many of the same projects included in Alternative 1, with the exception that the Eightmile Lake Storage Enhancement, Upper Klonaqua Lake Storage Enhancement, and Upper and Lower Snow Lakes Storage Enhancement Projects would be included, and the Eightmile Lake Storage Restoration Project would not be included. This section describes the specific short- and long-term impacts associated with the

storage enhancement projects. The impacts of all other projects are discussed under Alternative 1.

4.3.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would require demolition and reconstruction of the dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures. The lake would need to be drawn down for construction activities, which would provide flow benefit in Eightmile Creek as well as Reaches 1 through 5 of Icicle Creek.

The use of cofferdams and dewatering may be required for some work.

Upper Klonaqua Lake Storage Enhancement

The Upper Klonaqua Lake Storage Enhancement Project would require developing a conveyance structure between Upper and Lower Klonaqua Lakes. This may require in-water work and the use of cofferdams, and dewatering may be required for some work near outlet tunnels. However, this project is conceptual at this stage, and exact impacts of construction activities on surface water is unknown.

Upper and Lower Snow Lakes Storage Enhancement

The Upper and Lower Snow Lakes Storage Enhancement Project would require demolition and reconstruction of the dam at Upper and Lower Snow Lakes, installing a new low-level outlet, and constructing new impoundment and water control structures. The lakes would need to be drawn down for construction activities, which would provide flow benefit in Snow Creek as well as Reaches 2 through 5 of Icicle Creek.

The use of cofferdams and dewatering may be required for some work near outlet tunnels.

4.3.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Under the Eightmile Lake Storage Enhancement Project, storage levels would be increased above historical levels. This additional water would be used for improving domestic reliability and instream flows.

Under this project, water storage in the Eightmile catchment would increase by 1,000 acre-feet over the storage volume listed in IPID's water right for the lake. Eightmile's lake level would rise 11 feet above the historic spillway level and draw down would increase by 22.4 feet below the current low level outlet. Impacts to Eightmile Lake levels are presented in Figure 2-44.

This project would provide for the release of up to an additional 17.9 cfs and 1,000 acre-feet, relatively to the storage allowed by IPID's water right, from Eightmile Lake into its tributary, Eightmile Creek, and Reach 1 of Icicle Creek. There would be additional flow

benefit in Reaches 2 through 5 of Icicle Creek. Flows would be adaptively managed to reduce low flow impacts in late summer. These flows would be within the naturally occurring flow range and would benefit the riverine system.

Upper Klonaqua Lake Storage Enhancement

Building a conveyance system between Upper Klonaqua Lake and Lower Klonaqua Lake would allow for these lakes to be drawndown, making more water available in the Icicle Creek Subbasin. This would lead to increased stream flows in Icicle Creek Reaches 1 through 5. Streamflow would also increase in Klonaqua Creek and French Creek. This project is currently in the conceptual stage. Additional impacts on surface water would be identified after more detailed information is available on this project.

Upper and Lower Snow Lakes Storage Enhancement

Under the Upper and Lower Snow Lakes Storage Enhancement Project, storage levels would be increased by 1,079 acre-feet. This additional water would be used for improving domestic reliability and instream flows. The primary impact of this project on surface water would occur in Upper Snow Lake, Snow Creek, and Reaches 2 through 5 of Icicle Creek.

Under this project, water storage in the Snow Lakes catchment would increase by 1,079 acre-feet. The maximum storage level in Upper Snow Lake's level would rise 5 feet and draw down would increase by 3 feet. Impacts to Upper and Lower Snow Lake levels are presented in Figure 2-46.

This project would provide for the release of an additional 18 cfs (maximum) and 1,079 acre-feet from Upper and Lower Snow Lake into Snow Creek and Reach 2 through 5 of Icicle Creek. Flows could be adaptively managed to reduce low flow impacts in late summer and would be beneficial to the riverine ecosystem.

4.3.6 Alternative 5

The overall expected surface water impact associated with Alternative 5 is an increase of up to 195 cfs and 55,458 acre-feet in instream flow in Icicle Creek. Alternative 5 would result in implementation of many of the same projects included in Alternative 1, with the exception that the IPID Irrigation Efficiencies Project would be replaced by the IPID Full Piping and Pump Exchange. This section describes the specific short- and long-term impacts associated with the IPID Full Piping and Pump Exchange Project. The impacts of all other Alternative 5 projects are discussed under Alternative 1.

4.3.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

The IPID Full Piping and Pump Exchange Project includes the construction of three pump station to divert water to the IPID from the Wenatchee River and would involve instream work on the Wenatchee River. Impacts to surface water would likely include the use of cofferdams and dewatering at each pump station construction site.

4.3.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

The primary long-term impact of implementing the IPID Full Piping and Pump Exchange Project is increased streamflow in Icicle Creek and Peshastin Creek. In Icicle Creek, stream flow would be increased by as much as 117 cfs. These pump stations would allow for complete removal of IPID's diversion on Icicle Creek and Peshastin Creeks. However, IPID would still rely on releases from storage reservoirs in the ALWS to sustain water supply at the new pumped diversion locations on the Wenatchee River. The instream flow benefit from this project would occur during the irrigation season, which typically occurs from April through October. This period includes low flow months in late summer and early fall, as identified on the Icicle Creek hydrograph (Figure 3-2). These increased flows would benefit Icicle Creek downstream of IPID's point of diversion at RM 5.7 in Reaches 2 through 5. The benefit would continue into the Wenatchee River to the location of the new pump stations. Reach benefits can be seen in Figure 2-49.

There would also be additional benefit to Peshastin Creek, as water currently diverted by IPID from this creek would also be replaced with Wenatchee River water by this project.

4.3.7 Mitigation Measures

4.3.7.1 Short-term Impacts

Potential short-term impacts to surface waters are related to use of a cofferdam, rerouting water, and construction dewatering to support construction of the various project actions. These impacts are one time in nature for each project discussed above and are expected to occur only through the duration of active in-water construction work, likely for a few weeks or months. Dewatering to support construction would fall under the State Construction Stormwater General Permit, which contains BMP requirements for management and discharge of dewatering water. Additional BMPs or conditions for dewatering may be imposed under county grading permits, shoreline permits, or through NEPA review, depending on the project action and whether the project location is under state or federal jurisdiction.

4.3.7.2 Long-term Impacts

Long-term impacts to surface water resources are primarily related to increased stream flow in Icicle Creek and its tributaries. Additional surface water resource impacts include increased frequency of drawing down the Alpine Lakes. These potential impacts are not considered significant. The frequency of draw down is not anticipated to impact refill scenarios for the Alpine Lakes and is not expected to create new impacts on surface water resources. Permitting of trust water related to increased stream flow would be subject to Ecology water right permitting. The Ecology water right permitting process would include review of the potential for impairment to existing water rights, including the Instream

Flow Rule, and would include the opportunity for mitigation should the potential for impairment be identified.

4.4 Groundwater

This section describes potential short- and long-term impacts to groundwater expected under each alternative, with a focus on potential changes in the timing and quantity of groundwater resources. Potential impacts to groundwater quality are discussed in Section 4.5, Water Quality.

4.4.1 No-action Alternative

4.4.1.1 Short-term Impacts

Under the No-action Alternative, various entities and agencies would undertake individual actions that could result in short-term impacts on water quality in the Icicle Creek Watershed project area. This is anticipated to entail construction of water diversion modifications, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure at the Alpine Lakes including the restoration of the Eightmile Lake Dam, and improvements to existing irrigation systems to support agricultural reliability.

Potential impacts would primarily be associated with projects that require construction in or near water bodies that would require dewatering of groundwater. Additionally, groundwater development activities associated with LNFH projects would involve pumping of groundwater to test the capacity of new wells or a groundwater collector gallery.

These impacts would be short-term in nature and are expected to have no significant impact on groundwater.

4.4.1.2 Long-term Impacts

Long-term impacts under the No-Action Alternative include reduced seepage and increased groundwater pumping that would result from domestic and irrigation conservation projects and groundwater development at LNFH.

Potential long-term impacts to groundwater that could result from implementing domestic conservation and irrigation efficiency project would be reduced recharge from leakage along the City of Leavenworth, IPID, and COIC conveyance systems and from reduced return flows near the mouth of Icicle Creek and along the Wenatchee River.

Given the high transmissivity of the sand and gravel alluvial aquifer along the Wenatchee River and the high degree of hydraulic continuity between the river and groundwater (refer to Section 3.4, Groundwater Resources), reduction in recharge resulting from conservation

is not expected to significantly affect groundwater elevations in these areas. Groundwater discharge to surface water of Icicle Creek and the Wenatchee River could be reduced in proportion to the water efficiency savings; however, this reduction in groundwater discharge would be offset by the reduction in surface water diversion from Icicle Creek, approximately 32 cfs under the No-action Alternative. Potential impacts to groundwater resources under these projects are not considered significant.

Under the No-action Alternative, projects at LNFH will likely proceed. The effluent pump-back system and wellfield improvements to enhance groundwater supply under the LNFH Conservation and Water Quality Improvements Project each have the potential to impact groundwater resources near the LNFH facility through increased groundwater recharge and withdrawals. However, the impacts of wellfield improvements at LNFH would not be greater than historically when wells were operating at full capacity. Water conservation efforts under this project (e.g., onsite water re-use) also have the potential to impact groundwater resources through reduced groundwater pumping or surface water diversions needed to meet LNFH water demands.

Previous investigations of the LNFH groundwater supply and pilot testing and evaluation of the pump-back system have confirmed the strong hydraulic connection between groundwater at the facility and surface water in Hatchery Channel when hydrated. Hydrating the Hatchery Channel via the effluent pump-back system would increase groundwater recharge and water levels in the adjacent aquifer. This in turn would support higher pumping rates from LNFH wells completed in this aquifer than could be sustained without the pump-back. Additional groundwater withdrawal capacity could be achieved by installing additional wells or a shallow groundwater collector on Hatchery Island. If implemented, impacts to groundwater from the well field improvements and effluent pump-back are expected to largely cancel out, with increased groundwater withdrawals offset by increased recharge from the pump-back system. Further, by reducing total LNFH water use through increased efficiency (water re-use), total surface water diversions and groundwater withdrawals would be reduced relative to current conditions, maintaining more water instream and in the adjacent alluvial aquifer to support instream flows and groundwater levels.

Based on these considerations, no significant impacts to groundwater resources were identified for this project.

4.4.2 Alternative 1

Under Alternative 1, expected short-term impacts include construction dewatering and pumping groundwater to test the capacity of new wells or a groundwater collector. Long-term impacts include increased groundwater recharge near Icicle Creek, decreased groundwater recharge near areas of canal lining and piping, and increased groundwater use.

4.4.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Construction activities associated with this project would be limited to upland areas around the lakes and would likely not require dewatering during construction. No potential short-term impacts to groundwater resources were identified for this project.

IPID Irrigation Efficiencies

Potential construction activities associated with the IPID Irrigation Efficiencies Project include the conversion of irrigation canals to pipelines and the lining of irrigation canals with concrete. Assuming the canals and pipelines are located above the local water table, construction dewatering is not expected to be required and no potential short-term impacts to groundwater resources were identified for this project.

COIC Irrigation Efficiencies and Pump Exchange

Potential construction activities associated with this project include the conversion of irrigation system to pipelines and construction of a new COIC surface water intake and pump station. Potential groundwater impacts from implementing these actions include construction dewatering as needed during pump station construction. Duration of these impacts would be limited to the period of active dewatering during construction.

Domestic Conservation Efficiencies

Potential construction activities associated with the Domestic Conservation Efficiencies Project include detection and replacement of leaking conveyance pipes and installation of water meters. Potential groundwater impacts from implementing these actions include construction dewatering as needed during pipe replacement. Duration of these impacts would be limited to the period of active dewatering during construction. No potential short-term impacts to groundwater resources were identified for installation of water service meters or other conservation efforts.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project would involve demolishing the existing dam and low-level outlet pipeline, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures. Construction activities would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down. Limited construction dewatering of groundwater could be required during installation of the new outlet pipeline. Duration of these impacts would be limited to the period of active dewatering during construction.

Tribal Fishery Preservation and Enhancement

The focus of Fishery Preservation and Enhancement Project is to ensure that there would be no adverse effect on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. This project includes monitoring of fishery effectiveness and potential implementation of actions to improve the resource. Specific project actions for implementation have not been finalized but could include small-scale construction actions

to promote favorable fishing conditions in the pool at the bottom of the LNFH spillway. Construction dewatering is not expected to be required and no potential short-term impacts to groundwater resources were identified for this project.

Habitat Protection and Enhancement

The Habitat Protection and Enhancement Project includes stream restoration and protection projects to improve habitat in the Icicle Creek Subbasin. Construction activities associated with these projects would include grading, vegetation planting and removal, and placement of logs and rocks in riparian areas. Some dewatering of groundwater during construction could be needed. Duration of these impacts would be limited to the period of active dewatering during construction.

Instream Flow Rule Amendment

Under the Instream Flow Rule Amendment Project approximately 0.4 cfs of water reserved under the rule for future out-of-stream uses in the Wenatchee River would be reallocated to the Icicle Creek Subbasin, allowing for continued groundwater development. This would likely lead to more well construction than would occur under the current rule. Short-term impacts to groundwater associated with this project would be limited to withdrawals during well construction and testing.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project includes reducing LNFH's surface water use and improving the reliability and capacity of groundwater supply. Specific project actions could include onsite re-use, an effluent pump-back system to hydrate the Hatchery Channel and augment groundwater levels at nearby groundwater production wells, and wellfield enhancements. Potential short-term impacts to groundwater could include temporary dewatering during construction activities and pumping of groundwater to test the capacity of new wells or a groundwater collector gallery. Duration of these impacts would be limited to the period of active dewatering during construction or active pumping to test new wells.

Because this is a federal facility, an additional evaluation of the potential short-term impacts to groundwater under NEPA would be completed once the full scope of the project is determined.

Fish Passage

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek as well as instream modifications to the Boulder Field near RM 5.6. Construction dewatering is not expected to be required at the Boulder Field but would likely be needed to improve the instream structures. Duration of dewatering impacts would be limited to the period of active dewatering during construction.

Fish Screen Compliance

The Fish Screen Compliance Project involves replacing fish screens at three different diversions on Lower Icicle Creek. Construction activities could include building a temporary cofferdam and dewatering on the downstream side to accommodate screen replacement. Duration of dewatering impacts would be limited to the period of active dewatering during construction.

Water Markets

There are no construction activities proposed under the Water Markets Project and therefore no potential short-term impacts on groundwater are expected.

4.4.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Under this project, management and releases of stored water at the Alpine Lakes would be automated and optimized to improve instream flows. This would result in some changes in how lake levels are managed. Lake levels would be drawn down every year instead of rotating 1-in-5-year basis. The high and low lake levels and the general pattern of releases would be adapted to fish needs in the particular water year.

Modifying the storage and release operations could have minor effects on groundwater levels in soils adjacent to the lakes. For example, if Alpine Lakes Optimization, Modernization, and Automation allows lake levels to be maintained higher later in the season, then groundwater levels near the lakes would also be higher during the late season than under current operations. This in turn would lead to an increase in groundwater discharge to the lakes and outlet creeks during the later summer and early fall months. Conversely, if the lakes were drawn down earlier in the season than under current operations, then groundwater levels and associated late season discharge to surface water near the lakes would be reduced. In either event, these effects are expected to be very minor relative to the overall groundwater and surface water budgets for the Icicle Creek Subbasin.

Although the cycling of storage and releases may be increased to each lake every year instead of rotating, the impacts to groundwater, including groundwater discharge to surface water, would be within the variation already occurring within the system as currently managed. Based on this observation, potential impacts to groundwater resources under this project are not considered significant.

IPID Irrigation Efficiencies

Under the IPID Irrigation Efficiencies Project, IPID's water management plan would be updated with a goal of identifying opportunities for irrigation efficiency upgrades and infrastructure improvements to reduce water diversions from Icicle Creek. Activities could include canal piping or lining and on-farm efficiency upgrades.

The primary effect of this project would be to reduce surface water diversions from Icicle Creek, resulting in increased instream flows downstream from the diversion. Potential

long-term impacts to groundwater could result from reduced recharge from leakage along the IPID conveyance system and from reduced irrigation return flows in the IPID service area near the mouth of Icicle Creek and along the Wenatchee River.

Given the high transmissivity of the sand and gravel alluvial aquifer along the Wenatchee River and the high degree of hydraulic continuity between the river and groundwater (refer to Section 3.4, Groundwater Resources), reduction in recharge resulting from IPID irrigation efficiencies is not expected to significantly affect groundwater elevations in these areas. Groundwater discharge to surface water of Icicle Creek and the Wenatchee River could be reduced in proportion to the water efficiency savings; however, this reduction in groundwater discharge would be more than offset by the reduction in surface water diversion from Icicle Creek that would be realized through this project. As such, potential impacts to groundwater resources under this project are not considered significant.

COIC Irrigation Efficiencies and Pump Exchange

Potential project actions related to the COIC irrigation system include irrigation efficiency upgrades and infrastructure improvements like those considered for IPID (e.g., system piping and on-farm efficiency upgrades) as well as a source exchange option to move COIC's diversion from Icicle Creek downstream to a location near the confluence of the Icicle Creek and the Wenatchee River.

COIC's service area is along Icicle Creek, extending to the Wenatchee River. Effects of improved irrigation system efficiencies would be similar to those expected for IPID improvements—a reduction in groundwater recharge along the conveyance system and within the service area, an associated reduction in groundwater discharge to surface waters, and an overall increase in instream flows as reduced diversions offset reduced groundwater discharge.

Assuming no other on-farm irrigation efficiencies, the potential source exchange project would not alter the amount of groundwater recharge from irrigation return flows within the COIC service area. The source exchange would reduce diversions from Icicle Creek, allowing higher flows to remain instream and slightly increasing creek stage. The higher creek stage would support slightly higher groundwater elevations in the adjacent alluvial aquifer, although groundwater elevations would be expected to remain within historical ranges, and these impacts are not considered significant.

Domestic Conservation Efficiencies

The Domestic Conservation Efficiencies Project would improve domestic water use efficiency by the City of Leavenworth through pipe replacements, water meter installation, a voluntary lawn buyback program, and other water use conservation efforts. It would also improve domestic efficiency in rural Chelan County by providing conservation incentives and education. The overall effects of increased domestic water use efficiency are targeted to other domestic uses as the City of Leavenworth and Chelan County grow, so in general, increased efficiency is expected to reduce groundwater recharge as leaking pipes are replaced and irrigation and septic return flows decline with

declining water use. Potential impacts to groundwater resources from increased domestic conservation efforts are expected not to be significant.

Eightmile Lake Storage Restoration

Under this project, the Eightmile Lake Dam would be restored to the historical and permitted levels, increasing the useable storage capacity. Full storage elevations would be increased to match the historical spillway elevation (4,671 feet). That is about 4 feet higher than the current full operating water surface in the lake, which has been limited by erosion of the embankment portion of the dam to 4,667 feet. Other changes to the dam and lake operations would allow about 22.4 more feet of draw down to release water relative to current operations.

Groundwater elevations in soils adjacent to the lake are expected to rise and fall with changes in lake elevation. Given the increase in full elevation and the greater planned draw down, the range of groundwater elevations adjacent to the lake would likely exceed the range of elevations (high and low) experienced under recent lake operations, although elevations would be within the historical maximum range when the dam was at full capacity.

Potential impacts to groundwater adjacent to the lake are important to the Icicle Creek Subbasin to the extent that the groundwater discharges to and supports surface water levels and flows in Eightmile Lake and Eightmile Creek downstream to Icicle Creek. Filling the lake to higher levels would increase groundwater storage near the lake early in the season. As the lake is drawndown through the summer, groundwater would be released from storage and would discharge to the lake and headwaters of Eightmile Creek and support surface water flows. Overall, changes to groundwater near Eightmile Lake under this project are expected to have minor but beneficial impacts to the Icicle Creek Subbasin.

Tribal Fishery Preservation and Enhancement

The preservation and enhancement of tribal fisheries is not expected to change groundwater levels. No long-term impacts to groundwater resources were identified for this project.

Habitat Protection and Enhancement

Improving habitat in Icicle Creek by installing engineered logjams is expected to slow down stream, which could increase groundwater storage. These impacts are expected to be less than significant.

Instream Flow Rule Amendment

Under the Instream Flow Rule Amendment Project, approximately 0.4 cfs of water reserved under the rule for future out-of-stream uses in the Wenatchee River would be reallocated to the Icicle Creek Subbasin. There would be no net change in the reserve available under the rule, but there would likely be more water well construction and groundwater pumping in the Icicle Creek Subbasin than would occur under the current

rule, with a similar decrease in future groundwater development in the mainstem Wenatchee River Watershed. Long-term impacts to groundwater associated with this project action would include future groundwater withdrawals in the Icicle Creek Subbasin.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

The effluent pump-back system and wellfield improvements to enhance groundwater supply under the LNFH Conservation and Water Quality Improvements Project each have the potential to impact groundwater resources near the LNFH facility through increased groundwater recharge and withdrawals. However, the impacts of wellfield improvements at LNFH would not be greater than historically when wells were operating at full capacity. Water conservation efforts under this project (e.g., onsite water re-use) also have the potential to impact groundwater resources through reduced groundwater pumping or surface water diversions needed to meet LNFH water demands.

Previous investigations of the LNFH groundwater supply and pilot testing and evaluation of the pump-back system have confirmed the strong hydraulic connection between groundwater at the facility and surface water in Hatchery Channel when hydrated. Hydrating the Hatchery Channel via the effluent pump-back system would increase groundwater recharge and water levels in the adjacent aquifer. This in turn would support higher pumping rates from LNFH wells completed in this aquifer than could be sustained without the pump-back. Additional groundwater withdrawal capacity could be achieved by installing additional wells or a shallow groundwater collector on Hatchery Island. If implemented, impacts to groundwater from the well field improvements and effluent pump-back are expected to largely cancel out, with increased groundwater withdrawals offset by increased recharge from the pump-back system. Further, by reducing total LNFH water use through increased efficiency (water re-use), total surface water diversions and groundwater withdrawals would be reduced relative to current conditions, maintaining more water instream and in the adjacent alluvial aquifer to support instream flows and groundwater levels.

Based on these considerations, no significant impacts to groundwater resources were identified for this project. However, because this is a federal facility, additional evaluation of the potential long-term impacts under NEPA would be completed once the full scope of the project is determined.

Fish Passage

No long-term impacts to groundwater resources were identified for this project.

Fish Screen Compliance

No long-term impacts to groundwater resources were identified for this project.

Water Markets

No significant long-term impacts to groundwater resources were identified for the Water Markets Project. If a water market is supplied by a groundwater right acquisition, historical groundwater diversions from that right would cease. If that right allowed currently interruptible rights to avoid curtailment, then some proportionate groundwater use would increase.

4.4.3 Alternative 2

This alternative includes the same projects as Alternative 1, with the exception that the Alpine Lakes Optimization, Modernization, and Automation project is not included and the IPID Dryden Pump Exchange Project is added. The discussion of short- and long-term impacts focuses on impacts associated with the IPID Dryden Pump Exchange Project. The impacts of all other Alternative 2 projects are discussed under Alternative 1.

4.4.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Under the IPID Dryden Pump Exchange Project, a new pump station would be constructed along the Wenatchee River near Dryden to augment water supply in the IPID canals. Potential groundwater impacts include construction dewatering as needed during pump station construction. Duration of these impacts would be limited to the period of active dewatering during construction.

4.4.3.2 Long-term Impacts

IPID Dryden Pump Exchange

Assuming no other on-farm irrigation efficiencies, the potential pump exchange project would not alter the amount of groundwater recharge from irrigation return flows within the IPID service area. However, the source exchange would reduce diversions from Icicle Creek, allowing higher flows to remain instream and slightly increasing creek stage. The higher creek stage would support slightly higher groundwater elevations in the adjacent alluvial aquifer, although groundwater elevations would be expected to remain within historical ranges. These impacts are not considered significant.

4.4.4 Alternative 3

This alternative includes the same projects as Alternative 2, with the exception that the Eightmile Lake Storage Restoration Project is removed and the Legislative Change Creating OCPI Authority for Alternative 3 Project is added. The discussion of short- and long-term impacts focuses on impacts associated with Legislative Change Creating OCPI Authority for Alternative 3 Project. The impacts of all other Alternative 3 projects are discussed under Alternative 1 and Alternative 2.

4.4.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

No short-term impacts to groundwater resources were identified for this project.

4.4.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

Under the Legislative Change Creating OCPI Authority Project, the small amount of out-of-stream uses cannot be perfectly matched with the much larger instream flow benefit made available if the standard for impairment is perfectly in-time. The IWG could seek and the Legislature could grant an OCPI waiver for impacts to the instream flow rule. If granted, this would provide for decreased flows and corresponding decreases in groundwater to the creek. However, given the greater instream flow benefit aggregated under Alternative 3, these impacts are expected to be very minor.

4.4.5 Alternative 4

This alternative includes the same projects Alternative 1, but includes Eightmile Lake Storage Enhancement, Upper Klonaqua Lake Storage Enhancement, and Upper and Lower Snow Lakes Storage Enhancement Projects. The discussion of short- and long-term impacts focuses on impacts associated with these projects. The impacts of all other Alternative 4 projects are discussed under Alternative 1 and Alternative 2.

4.4.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

Short-term impacts for the Eightmile Lake Storage Enhancement are similar to those described for Eightmile Lake Storage Restoration Project. Specifically, limited construction dewatering may be required during installation of the new outlet pipeline. The duration of these impacts would be limited to the period of active dewatering during construction.

Upper Klonaqua Lake Storage Enhancement

The Upper Klonaqua Lake Storage Enhancement Project includes installing infrastructure to increase draw down in the lake and expand achievable storage releases. Short-term impacts for this project are similar to those expected for the Eightmile Lake Storage Restoration project. Specifically, limited construction dewatering may be required during installation of the new outlet pipeline. The duration of these impacts would be limited to the period of active dewatering during construction.

Upper and Lower Snow Lakes Storage Enhancement

The Upper and Lower Snow Lakes Storage Enhancement Project includes raising the dam height on Upper Snow Lake to increase storage capacity and changing reservoir operations to allow more draw down during releases. Limited construction dewatering may be required during installation of the new outlet pipeline. The duration of these impacts would be limited to the period of active dewatering during construction.

4.4.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Long-term impacts to groundwater resources under the Eightmile Lake Storage Enhancement Project are expected to be the similar to those identified for the Eightmile Lake Storage Restoration Project discussed in Section 4.4.2. Filling the lake to higher levels would increase groundwater storage near the lake early in the summer. As the lake is drawn down through the summer, groundwater would be released from storage and would discharge to the lake and headwaters of Eightmile Creek and support surface water flows. Overall, changes to groundwater near Eightmile Lake under this project are expected to have be very minor but beneficial impacts to the Icicle Creek Subbasin.

Upper Klonaqua Lake Storage Enhancement

Long-term impacts to groundwater resources under the Upper Klonaqua Lake Storage Enhancement Project would be similar to impacts expected under the Eightmile Lake Storage Enhancement Project. Increasing draw down in the lake to allow greater storage release would result in more late summer groundwater discharge to Upper Klonaqua Lake and its outlet creek. As the lake is allowed to fill over the winter and spring, groundwater adjacent to the lake would be recharged from surface water and groundwater levels would recover. Overall, changes to groundwater near Upper Klonaqua Lake under this project are expected to have minor but beneficial impacts to the Icicle Creek Subbasin.

Upper and Lower Snow Lakes Storage Enhancement

Long-term impacts to groundwater resources under the Upper and Lower Snow Lakes Storage Enhancement Project would be similar to impacts expected under the Eightmile Lake Storage Enhancement Project. Increasing the dam height and full pool elevation of the lake would increase groundwater storage near the lake early in the summer. As the lake is drawn down through the summer, groundwater would be released from storage and would discharge to the lake and headwaters of Snow Creek and support surface water flows. Overall, changes to groundwater near Upper Snow Lake under this project are expected to have minor but beneficial impacts to the Icicle Creek Subbasin.

4.4.6 Alternative 5

This alternative includes the same projects as Alternative 1, with the exception that the IPID Irrigation Efficiency Project has been replaced by the IPID Full Piping and Pump Exchange. The discussion of short- and long-term impacts focuses on impacts associated with the IPID Full Piping and Pump Exchange Project. The impacts of all other Alternative 5 projects are discussed under Alternative 1.

4.4.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

Under the IPID Full Piping and Pump Exchange Project, three new pump stations would be constructed along the Wenatchee River near Leavenworth, Dryden, and Monitor to replace the IPID diversion on Icicle and Peshastin Creek. Potential groundwater impacts include construction dewatering as needed during pump station and piping construction. Duration of these impacts would be limited to the period of active dewatering during construction.

4.4.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

Piping IPID would likely result in a reduction in groundwater recharge along the conveyance system and within the service area, an associated reduction in groundwater discharge to surface waters, and an overall increase in instream flows as reduced diversions offset reduced groundwater discharge.

Assuming no other on-farm irrigation efficiencies, the potential source exchange project would not alter the amount of groundwater recharge from irrigation return flows within the IPID service area. The source exchange would reduce diversions from Icicle Creek, allowing higher flows to remain instream and slightly increasing creek stage. The higher creek stage would support slightly higher groundwater elevations in the adjacent alluvial aquifer, although groundwater elevations would be expected to remain within historical ranges, and these impacts are not considered significant.

4.4.7 Mitigation Measures

4.4.7.1 Short-term Impacts

Short-term impacts to groundwater are expected to be related to temporary construction dewatering to support implementation of the various project actions and construction and testing of groundwater supply wells. These impacts are expected to be localized and to occur only through the duration of active construction work or well testing. Dewatering to support construction would fall under the State Construction Stormwater General Permit, which contains BMP requirements for management and discharge of dewatering water. Additional BMPs or conditions for dewatering could be imposed under Chelan County grading permits, shoreline permits, or through NEPA review, depending on the project and whether the project location is under state or federal jurisdiction.

Water well construction is governed by Chapter 173-160 WAC *Minimum Standards for Construction and Maintenance of Wells* and would require filing a Notice of Intent to construct a well with Ecology. Well testing for non-permit exempt wells would likely

require a preliminary permit from Ecology, which would specify testing durations, rates, and monitoring requirements.

4.4.7.2 Long-term Impacts

Long-term impacts to groundwater resources include indirect effects from actions intended to improve flows and reliability of water in Icicle Creek and direct effects from actions related to groundwater withdrawals and supply improvements. Actions with indirect effects on groundwater quantity include changes in storage and operations of the Alpine Lakes, irrigation district improvements and pump exchanges to reduce diversions from Icicle Creek, water conservation measures by LNFH, and domestic water conservation efforts. These actions are expected to affect groundwater by increasing surface water quantities and levels, thereby increasing groundwater storage in adjacent soils, and conversely by reducing return flows from domestic and irrigation conveyance and uses, groundwater quantities would be reduced.

The Instream Flow Rule amendment and the LNFH groundwater augmentation actions are expected to have direct effects on groundwater quantity. The Instream Flow Rule amendment to reallocate water reserves from the mainstem Wenatchee River to the Icicle Creek Subbasin would directly reduce groundwater quantity in the Icicle Creek Subbasin via increased withdrawals while increasing groundwater in the Wenatchee River mainstem relative to the current rule. Groundwater augmentation at LNFH would maintain or increase groundwater elevations near the hatchery and support hatchery groundwater production.

The potential long-term impacts are not considered significant and are expected to partially offset each other (e.g., reduced groundwater recharge from domestic water conservation efforts may be offset by reduced pumping in the Wenatchee River Watershed following a rule amendment). Additionally, long-term impacts are not expected to alter groundwater elevations or quantities to the degree that they fall outside historical ranges in the Icicle Creek Watershed project area. Ecology water right permitting would be required for non-permit-exempt groundwater wells and would include an evaluation of the potential for withdrawals to impair other groundwater or surface water rights, including instream flows. Water right decisions would include the opportunity for mitigation should the potential for impairment be identified.

4.5 Water Quality

This section describes the potential short- and long-term impacts that could affect the resources identified in Section 3.5, Water Quality, from construction and operation related to the No-action Alternative and Program Alternatives.

4.5.1 No-action Alternative

4.5.1.1 Short-term Impacts

Potential impacts would primarily be associated with projects that require construction in or near water bodies and could include short-term increases in sedimentation and turbidity, changes in water temperature, and increased risk of contamination from such activities as concrete placement, use of construction equipment, and dewatering of groundwater. These impacts would be localized to specific areas of disturbance at the seven Alpine Lakes, Icicle and Peshastin Creeks, and the Wenatchee River. could include the modification of existing features, construction of new water diversion and flow control structures, various types of fish passage improvement work, and improvements to irrigation canal and pipe systems. Work would likely require the placement of temporary cofferdams in water bodies to isolate work areas and could also involve the temporary diversion of stream flow. Such activities could cause local, temporary increases in turbidity in the affected water bodies and could increase erosion potential from adjacent areas. Increases in turbidity and sedimentation could in turn lead to short-term increases in water temperature and decreases in available dissolved oxygen.

Placement of cast-in-place concrete either instream or in adjacent areas could increase the potential for water to meet uncured concrete, which could affect the pH of the water. The use of mechanized equipment for construction would also increase the potential for water contamination through the inadvertent release of fuel or other vehicle fluids (e.g., oil, grease, antifreeze, hydraulic fluids).

Activities involving ground disturbance near waterways are also likely to encounter groundwater. Exposed groundwater and groundwater dewatering can lead to increased risk of contamination similar to that described above from increased turbidity and potential spills.

Applicable permits would require appropriate mitigation measures to reduce impacts on water quality, such as restricting in-water access to periods of low flows and species-specific in-water work windows and implementing construction BMPs designed to reduce the potential for erosion and inadvertent contamination from vehicle fluids (Section 4.5.7, Mitigation Measures). Therefore, the No-action Alternative would not be expected to result in short-term violations of the water quality standards that would adversely affect designated uses in the Icicle project area as described in Section 3.5, Water Quality. Short-term impacts on water quality would be less than significant and are unlikely to result in violation of the water quality standards associated with the designated uses within the Icicle project area.

4.5.1.2 Long-term Impacts

Long-term impacts under the No-action Alternative are anticipated to be largely beneficial for water quality, especially water temperature, because many projects would seek to improve instream flows during the late summer. Implementation of projects at the

Alpine Lakes would also result in some changes in lake levels. Compared to existing conditions, the frequency in fluctuations in lake levels would increase. Lake levels at Eightmile Lake would also be able to reach higher or lower levels compared to existing conditions; however, this variation would remain within the levels historically achieved at the lake. Long-term water quality impacts include less than significant increases in erosion potential and turbidity in the lakes and associated creeks as a result of the changes in lake level management.

In the long term, projects implemented under the No-action Alternative that contribute to increased instream flows along Icicle Creek and the Wenatchee River would also contribute to some increase in shallow groundwater recharge that would also be generally beneficial. However, because instream flow enhancement projects would not generally be coordinated with other activities in the Icicle project area and few projects would be implemented, these benefits are not anticipated to be as great as they would be under the other Program Alternatives. Potential long-term water quality benefits from such projects are also expected to be more localized, providing only minor overall benefits within the larger Icicle Creek Subbasin.

4.5.2 Alternative 1

Implementation of Alternative 1 has the potential to result in both increased adverse and beneficial impacts on water quality compared with the No-action Alternative because there would be greater likelihood that multiple projects would be implemented, and the scale of certain efforts would likely be greater. Compliance with the Guiding Principles addresses water quality in general by improving instream flows, sustainability at the LNFH, and Icicle Creek aquatic and riparian habitat. The following subsections describe the short- and long-term impacts that would likely occur under Alternative 1.

4.5.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

In the short term, this project has relatively limited potential to affect water quality at the Alpine Lakes. Construction activities would involve replacing existing flow control structures and installing automation equipment and would mostly affect upland areas. These activities would not require dewatering of groundwater and are therefore not expected to have the potential to adversely affect groundwater quality.

Some limited work would occur within the lake shorelines but within dry areas of the lake margins once lakes are drawn down at the end of the summer. This would include the replacement of existing water control gates at each of the five lakes, reconstruction of impoundment structures and upgrades of spillways where needed, and the demolition and reconstruction of the gate tower at Colchuck Lake. The latter of these would involve either the installation of a pre-cast concrete, rock masonry, or plastic pipe riser structure. The inlet pipe at Colchuck Lake may also need to be slip lined or repaired, which could require limited excavation and fill placement in the lake bottom. Work along the

shoreline could include some limited vegetation removal and soil disturbance for construction access, and installation of equipment (e.g., solar panels, antennas) and water control equipment enclosures.

Minor water quality impacts associated with these types of activities could include temporary increases in turbidity and sedimentation both in the lakes and their receiving waters. As compared to existing conditions, there would also be an increased risk of water contamination from fuels and other fluids used in gasoline or diesel-powered equipment (e.g., generators), the placement of uncured concrete (if used), and from human waste generated by workers.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include requiring all in-water work to be performed in the dry and implementing construction BMPs designed to reduce the potential for erosion and inadvertent water contamination (Section 4.5.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on water quality would be less than significant and would be unlikely to result in violation of the water quality standards associated with the designated uses assigned to the Wenatchee River and its tributaries.

IPID Irrigation Efficiencies

The IPID Irrigation Efficiencies Project could cause short-term impacts on water quality if efficiency projects are implemented that require work in or adjacent to existing irrigation canals with potential to release flow back into the Wenatchee River or its tributaries through spillways. However, it is anticipated that any ground-disturbing work required to complete these projects would be completed during the off season, when the irrigation canals and spillways are completely dewatered.

Potential construction work under this plan that could affect surface water quality includes converting irrigation canals to pipelines, replacing or abandoning pipelines, and lining of irrigation canals with concrete. Water quality impacts that could occur from such work could include temporary increases in turbidity, increased erosion potential from disturbed areas along canal banks, re-suspension of contaminated sediments from canal substrates by excavation activities, and an increased risk of contamination from activities such as raw concrete placement and construction equipment usage. Because most of this work would occur when the canals are dry, the opportunity for these types of water quality impacts to occur would be minimized. As noted in Section 4.4, Groundwater, the irrigation canals are expected to be located above the water table, meaning there is also limited potential to adversely affect groundwater quality in the short term.

Work within irrigation canals or spillways that reconnect to waters of the United States or State of Washington could require a CWA Section 404 Permit and associated Section 401

Water Quality Certification. Work in other portions of the irrigation system could require local review and authorization.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include restricting work to periods when the irrigation canals are dewatered, restricting in-water access to periods of low flows, and implementing BMPs designed to reduce the potential for erosion and inadvertent water contamination from construction equipment and other sources (Section 4.5.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on water quality would be less than significant and would be unlikely to result in violation of the water quality standards associated with the designated uses assigned to the Wenatchee River and its tributaries.

COIC Irrigation Efficiencies and Pump Exchange

Under the COIC Irrigation Efficiencies and Pump Exchange Project, canal and lateral to pipeline conversion would occur in or adjacent to existing irrigation systems that return flow back into the Wenatchee River or its tributaries through spillways and could cause some short-term impacts on water quality in those water bodies. However, similar to the IPID Efficiencies Project, it is anticipated that any ground-disturbing work required to complete efficiency projects would be completed during the off season when the irrigation canals and spillways are completely dewatered, and encountering groundwater is not likely.

Impacts could include temporary increases in turbidity, increases in erosion potential from disturbed areas along canal banks, re-suspension of contaminated sediments from canal substrates during excavation activities, and increases in the risk of contamination from the placement of raw concrete and the use of construction equipment in or near waterways. These potential impacts are expected to be minimized by local, state, and federal permit requirements and through the required implementation of standard construction BMPs.

Construction of a new pump station under this project would require both in-water and riverbank work on the Wenatchee River or Icicle Creek. Such activities could result in many of the same construction-related short-term impacts on water quality described above and would also include the potential for short-term impacts on groundwater. Because Ecology's current Water Quality Assessment (Ecology, 2016) records multiple Category 5 water quality impairment listings for the Wenatchee River, including five for polychlorinated biphenyls, five for 4,4'-DDE, and one for endosulfan, any excavation work in the river to construct the intake for the COIC pump station would need to address the potential presence of these and other contaminants in the substrate. As long as construction activities comply with required permit terms and conditions, including those in the Water Quality Certification that would be required by Ecology, it is unlikely that

this project would result in violations of the water quality standards associated with the designated uses of the affected water bodies. Short-term impacts on water quality would not be significant.

Domestic Conservation Efficiencies

The Domestic Conservation Efficiencies Project does not involve any instream or stream bank construction work. Therefore, it is not expected to result in any short-term impacts on water quality.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project would involve construction activities that could result in short-term impacts on water quality at Eightmile Lake and its receiving waters (Eightmile Creek and Icicle Creek). Construction activities could affect water quality of the lake primarily by increasing the potential for erosion or sediment disturbance that could lead to increased turbidity. Increased turbidity can occur as the result of either direct disturbance, for example the result of in-water work, or from runoff of sediment-laden stormwater into receiving waterways. Construction activities would also involve the use of chemicals, such as fuel, cement, and solvents, that could adversely affect water quality if accidentally spilled and subsequently entered water bodies.

While most construction equipment (potentially including a small tracked excavator) and materials would likely be flown into the Eightmile Lake Storage Restoration Project site via helicopter, IPID is considering the option of walking in a larger tracked excavator or a spider excavator. The trail to access the project site requires several stream crossings and parallels several potential wetlands (Figure 3-10). Potential water quality impacts would include increased turbidity in any streams that would be crossed by machinery, increased erosion potential in areas where soils or vegetation would be disturbed, and an increased risk of water contamination from inadvertent fuel and vehicle fluid leaks and spills.

Construction activity would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down and immediately downstream of the dam within Eightmile Creek. Demolition of the existing dam, installation of new piping, and construction of the new impoundment and water control structures would result in ground disturbance and could potentially cause a temporary increase in turbidity in both Eightmile Lake and Eightmile Creek. Some groundwater dewatering may be required for construction of the pipe inlet. Construction work would also increase the potential for erosion at the project site and the potential for surface and groundwater contamination from vehicle fluids and from the placement of concrete and grout. The extended presence of workers on the site would present similar risks of water contamination from human waste as occurs as the result of recreationalists that visit the area.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include requiring that the lake be drawn down to the lowest level feasible prior to

work near or below the ordinary high water mark of the lake, requiring that the lake be dewatered using temporary cofferdams or other measures so that the work area is separated and protected from the lake and stream, and implementing construction BMPs designed to reduce the potential for erosion and inadvertent contamination from vehicle fluids, uncured concrete, human waste, and other sources (Section 4.5.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on water quality would be less than significant and would be unlikely to result in violation of the water quality standards associated with the designated uses assigned to the Wenatchee River and its tributaries.

Tribal Fishery Preservation and Enhancement

The focus of the Tribal Fishery Preservation and Enhancement Project is to ensure that there would be no adverse effect on tribal, as well as non-tribal, fishing as a result of implementing other projects as part of the overall Icicle Strategy. The specifics of this project are not yet determined but would involve elements of restoration along the lower Icicle Creek that could result in localized construction-related noise. At this stage, the primary options under consideration include the construction of facilities such as a bubble curtain, sprayer, or other modifications near the spillway in front of the LNFH to promote favorable fishing conditions. These activities are not expected to require groundwater dewatering.

Potential short-term water quality impacts from this project could occur if any instream or streambank work is needed to install the various project elements (e.g., spillway diversion piping, effluent discharge piping, bubble curtain, sprinklers) designed to mimic beneficial flow conditions near LNFH to support the tribal fishery in Icicle Creek. Such work could include the installation and removal of temporary cofferdams, excavation of the streambed or banks, placement of fill material and in-water structures, and the placement of cast-in-place concrete. Likely impacts would include a temporary increase in turbidity in the LNFH spillway and Icicle Creek during construction, increased potential for erosion, increased potential for the re-suspension of contaminated sediments, and the increased risk of accidental water contamination from vehicle fluids and water contact with uncured concrete. These types of impacts would most commonly occur near the construction sites and would decrease over time and distance.

Potential short-term water quality impacts associated with construction of Tribal Fishery Preservation and Enhancement Project elements would be mitigated through compliance with the terms and conditions of required local, state, and federal permits as described in Section 4.5.6, Mitigation Measures. Potential impacts would also be reduced through the implementation of standard BMPs for construction work in and around streams and rivers. Overall, potential impacts on water quality from construction activities associated with this project would be less than significant and would not result in any violations of the water quality standards associated with the designated uses assigned to Icicle Creek or the Wenatchee River.

Habitat Protection and Enhancement

Construction of in-water or streambank habitat protection and enhancement structures under the Habitat Protection and Enhancement Project could result in short-term increases in turbidity and erosion potential. No groundwater dewatering is expected. For activities located in the Wenatchee River and lower portions of Icicle Creek, re-suspension of contaminated sediments could also occur. Because all in-water work and most work along the river and stream banks would require local, state, and federal authorizations, these potential effects would be minimized by permit terms and conditions and through the required implementation of standard construction BMPs for the reduction of soil erosion and water quality degradation, as described in Section 4.5.7, Mitigation Measures. Overall, potential impacts on water quality from construction activities under this project would be less than significant and would not result in any violations of the water quality standards associated with the designated uses assigned to Icicle Creek or the Wenatchee River.

Instream Flow Rule Amendment

Short-term water quality impacts are not anticipated to occur under the Instream Flow Rule Amendment Project because it would not involve any construction work within or adjacent to any water bodies in the Icicle Creek Watershed project area.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

Proposed improvements at LNFH would require some in-water and streambank construction activities that could cause a temporary increase in turbidity and erosion potential in Icicle Creek. Modification or replacement of the existing intake screens and surface water transmission piping may require the placement (and subsequent removal) of cofferdams in the stream channel and the use of dewatering methods (e.g., pumping) to isolate work areas. Potential short-term impacts affecting groundwater could include temporary dewatering during construction activities and pumping of groundwater to test the capacity of new wells or a groundwater collector gallery. The use of construction equipment to complete these improvements would also increase the risk of water contamination from inadvertent spills or leaks of vehicle fluids.

Short-term impacts on water quality from construction of the LNFH Conservation and Water Quality Improvements Project would be minimized through compliance with the terms and conditions of required local, state, and federal permits as described in Section 4.5.7, Mitigation Measures, which would include specific requirements for the timing and duration of in-water work, erosion control, and handling of potentially contaminated sediments. Potential impacts would also be reduced through the implementation of standard BMPs for construction work in and around streams and rivers. Overall, potential impacts on water quality from construction activities are anticipated to be less than significant and not result in any violations of the water quality standards associated with the designated uses assigned to Icicle Creek or the Wenatchee River.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek as well as instream modifications to the Boulder Field near RM 5.6. All of these activities would require the installation and removal of cofferdams, construction of temporary stream bypass structures, excavation of the streambed and banks, and the placement of cast-in-place concrete; however, these activities are not expected to require any contact with groundwater resources. Such activities would result in short-term increases in sedimentation and turbidity, an increased potential for erosion, and an increased risk of accidental spills of fuel, oil, grease, antifreeze, and other fluids associated with the use of heavy equipment. Surface water contamination is also possible from placement of concrete and grout during structure modification or replacement. Water quality parameters that could be affected by these impacts include temperature, dissolved oxygen, and pH.

All of the proposed fish passage improvements under this project would require local, state, and federal authorizations that would contain project-specific terms and conditions designed to reduce adverse impacts on water quality and other natural resources as described in Section 4.5.7, Mitigation Measures. As such, potential impacts on water quality from construction activities are anticipated to be less than significant and not result in any violations of the water quality standards associated with the designated uses assigned to Icicle Creek or the Wenatchee River.

Fish Screen Compliance

The Fish Screen Compliance Project would require both in-water and shoreline work to upgrade and replace non-compliant fish screens on existing water diversion and intake structures used by LNFH and COIC, the City of Leavenworth, and IPID. Such work may require the isolation and dewatering of instream work areas using cofferdams and pumps, disturbance of streambank vegetation and soils for equipment access, and excavation of the streambed and bank for piping replacement. Construction activities would occur at ground surface and no dewatering is expected to be required. All of these actions could cause short-term increases in turbidity in Icicle Creek and an increased potential for streambank erosion. The use of construction equipment near the creek and the potential need to use cast-in-place concrete would also increase the potential for water contamination from these sources.

Potential short-term water quality impacts associated with the Fish Screen Compliance Project elements would be minimized through compliance with the terms and conditions of required local, state, and federal permits as described in Section 4.5.7, Mitigation Measures. Potential impacts would also be reduced through the implementation of standard BMPs for construction work in and around streams and rivers. Overall, potential impacts on water quality from construction activities are anticipated to be less than significant and not result in any violations of the water quality standards associated with the designated uses assigned to Icicle Creek or the Wenatchee River.

Water Markets

Short-term water quality impacts are not anticipated to occur under the Water Markets Project because it would not involve any construction work within the Wenatchee River or any of its tributaries, including Icicle Creek.

4.5.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Long-term water quality impacts resulting from the Alpine Lakes Optimization, Modernization, and Automation Project would primarily be associated with the way in which the lakes would be managed for downstream releases and are anticipated to be beneficial overall. With remote actuators in place, releases from the five managed lakes could be better timed based on flow levels in Icicle Creek, local and regional climatic conditions, and water demands of users in the basin. Rather than opening a gate in mid-summer and closing it in late fall, this project would allow for improved control of water releases throughout the year to better mimic more natural flow conditions in the system.

Currently, water is typically released from one lake each year on a rotating basis, meaning that water is released for any given lake about once every 5 years. Under the proposed project, flows could be released from up to all five lakes on an as-needed basis each year. This would provide more flexibility for how flows from the lakes could be managed and greater security that there would be more water in Lower Icicle Creek available to users, including fish, in the later summer months when instream flows are typically lower.

While all the lakes would experience some level of draw down each year (versus less frequently under existing conditions), the overall impact on water quality in the lakes is expected to be beneficial. This is because the proposed project would likely reduce the annual extent of drawdown in individual lakes, which would help reduce temperature fluctuations. In addition, the high and low lake levels would not change, and water levels would continue to be drawn down at each lake over the course of several months similar to existing conditions. Groundwater around the lakes is limited because they are mostly surrounded by rock. Therefore, this project is not anticipated to result in substantial changes to water quality related to increased turbidity in the lakes or impacts on groundwater quality.

Annual usage of all five lakes could also reduce the amount of sediment accumulation around the outlet structures when gates are closed for extended periods of time. This would result in a reduction in sediment released into receiving waters when the gates are again opened for streamflow augmentation.

Likewise, the resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months. During high-flow

years, there could also be a potential for this project to result in a reduced contribution by the lakes to peak flows that might otherwise contribute to increased erosion and flooding.

Overall, increased instream flows, particularly in the summer and fall when flows are lower, would help to lower water temperatures, increase dissolved oxygen, and improve other water quality parameters. The potential impacts are not expected to exceed the water quality standards that are important to the beneficial uses designated for Icicle Creek or the Wenatchee River.

IPID Irrigation Efficiencies

In the long term, water conservation achieved through the implementation of irrigation efficiency measures by IPID would reduce the volume of water carried by spillways that return unused water and agricultural runoff from irrigated areas to the Wenatchee River and its tributaries. This condition could have both adverse and beneficial effects on water quality in these receiving waters and further downstream in the Columbia River. The reduction in flow moving through these features would reduce the opportunity for dilution, potentially increasing the nutrient concentration of the water being discharged. Over time, however, nutrient loading in spillways might decrease as on-farm conservation strategies reduce the amount of nutrient-laden runoff that is returned to these spillways. The transport of pesticide residues and other contaminants into these features may also decrease over time for the same reason. Decreased flows in these systems could also reduce the potential for bank erosion and the transport of sediments and other contaminants into receiving waters. Aside from some changes in the quantity of groundwater recharge, no long-term changes affecting groundwater quality would occur. Overall, long-term impacts are not expected to exceed the water quality standards that are important to the beneficial uses designated for Icicle Creek or the Wenatchee River.

COIC Irrigation Efficiencies and Pump Exchange

Effects of the COIC Irrigation Efficiencies and Pump Exchange Project would be similar to those expected for the IPID Irrigation Efficiencies Project. In addition, relocating the COIC diversion would conserve water and potentially increase instream flow downstream of RM 4.5 to the Wenatchee River. This would also contribute to lowering stream temperatures and increasing dissolved oxygen in that portion of Icicle Creek.

Domestic Conservation Efficiencies

Long-term water quality impacts from the implementation of domestic conservation activities are expected to be minimal. Water conserved through this project would be made available to improve domestic supply, and domestic conservation is expected to have negligible effects on streamflow in Icicle Creek. Over the long term, implementation of domestic conservation would not cause water quality degradation such that the designated use water quality criteria for Icicle Creek and the Wenatchee River would be violated.

Eightmile Lake Storage Restoration

Operation of the proposed facilities for the Eightmile Lake Storage Restoration Project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. Because the facilities would be remotely operated by IPID, the greatest potential for impacts to water quality over the long term would occur as the result of maintenance trips to and from the lake, which are anticipated to be less than would occur under the No-action Alternative, and any changes in operations with respect to how lake levels are managed.

The frequency in fluctuations in lake levels would increase compared to existing conditions but could be similar to the No-action Alternative should this project move forward. Lake levels would also be able to reach higher or lower levels compared to existing conditions; however, this variation would remain within the levels historically achieved at the lake. Long-term water quality impacts include less than significant increases in erosion potential and turbidity in the lake and Eightmile Creek as a result of the changes in lake level management.

Groundwater immediately surrounding the lake in many cases is limited by the presence of large rocks and boulders. Lake fluctuation could potentially alter the pattern of groundwater recharge as discussed in Section 4.4, Groundwater Resources, but would generally be similar to existing natural processes and would not result in substantial changes such that groundwater quality would be significantly affected.

Downstream of the lake, water quality impacts are expected to be largely beneficial as the ability to release flow into Icicle Creek in the late summer or in drought years would increase in frequency and duration. Overall, expected water quality impacts would not result in the exceedance of the water quality criteria associated with any of the designated uses for Eightmile Lake or its receiving waters.

Tribal Fishery Preservation and Enhancement

Because the overall goal of this project is to protect and enhance the tribal fishery, it is expected that most of the impacts on water quality would be beneficial and would improve fish habitat in Icicle Creek. Long-term impacts to water quality from the Tribal Fishery Preservation and Enhancement Project could alter sedimentation and scour patterns and increase turbidity in sections of Icicle Creek as a result of changes in water flow management practices at LNFH Structures 2 and 5. Although maintenance of flows over the LNFH Hatchery Channel spillway would induce turbulence and scour, potentially increasing turbidity downstream from the spillway, the increased air entrainment resulting from this turbulence would increase dissolved oxygen levels in the stream, which would be beneficial. Overall, the proposed Tribal Fishery Preservation and Enhancement Project would not result in the exceedance of the water quality criteria associated with any of the designated uses for Icicle Creek or its receiving waters.

Habitat Protection and Enhancement

Riparian and instream habitat protection and enhancement projects are expected to improve water quality in Icicle Creek and the Wenatchee River over the long term, and no changes are proposed that would affect groundwater. Potential improvements include reduction in water temperatures from increased riparian shading and instream structures, decreased sedimentation and erosion potential from improved riparian runoff filtration and bank stabilization, and increased nutrient and dissolved oxygen concentrations from improved instream structure and fish habitat. Minor increases in turbidity may occur in certain locations (e.g., downstream of scour holes) but are expected to be within the range of natural variation. Depending on past and current land use, reconnection of floodplains in the lower reach could allow the introduction of contaminated sediment into the system during flood events and the transportation of this sediment to downstream water bodies.

Overall, the proposed habitat protection and enhancement projects would contribute to enhanced stream health, increased watershed functions, and improved water quality in the basin. This project is not anticipated to adversely affect any of the water quality criteria for designated uses in Icicle Creek or the Wenatchee River. Corresponding effects on groundwater quality are anticipated to be minimal.

Instream Flow Rule Amendment

Under the Instream Flow Rule Amendment Project, the Icicle Creek Reserve established under Chapter 173-545 WAC would be increased by 0.4 cfs. Over the long term, this amendment would ultimately result in the removal of additional water from Icicle Creek but only after habitat restoration elements are implemented. Additional water withdrawals could result in reduced instream flows, which could adversely affect water quality in portions of Icicle Creek. Reduced instream flow could lead to higher water temperatures, reduced dissolved oxygen concentrations, and increased pollutant concentrations in the stream. Corresponding effects on groundwater are anticipated to be minimal and similar to existing recharge processes. No instream flow reduction would occur in the Wenatchee River because this project would move 0.4 cfs out of the Wenatchee River Reserve specifically for Icicle Creek withdrawals.

Potential water quality impacts associated with the Instream Flow Rule Amendment Project are anticipated to be offset by the implementation of required instream flow and habitat restoration actions under this Program Alternative as well as several other projects associated with Alternative 1. The water quality benefits from habitat project implementation will exceed any water quality impacts from flow reduction of this element.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

Over the long term, the water conservation and water quality improvement elements proposed at LNFH under this project are expected to benefit water quality in Icicle Creek and the Wenatchee River and improve groundwater recharge near LNFH. Water quality

improvements at LNFH are expected through the implementation of facility upgrades and operational improvements. These actions would lead to compliance with relevant TMDLs for the Wenatchee River Watershed and would ultimately be designed to avoid additional water quality impacts in the basin.

In addition, most of the work included under this project is designed to improve water use efficiency at LNFH and to develop additional groundwater supplies such that less water would need to be diverted from Icicle Creek for hatchery operations. Such actions would potentially support higher flows in the system, which would benefit multiple water quality parameters, including temperature and dissolved oxygen content. However, the effluent pump back could impact shallow groundwater quality, particularly temperature and phosphorus. This shallow groundwater is expected to release to surface water in a relatively short timeframe. The temperature and phosphorus discharge to surface water is an already existing condition. This impact is expected to be less than significant but will be examined more during NEPA review.

Overall, improvements to the LNFH are expected to provide water quality benefits and would not adversely affect designated uses in Icicle Creek or the Wenatchee River.

Fish Passage Improvements

Over time, the Fish Passage Improvement Project could result in increased fish populations in portions of Icicle Creek where access was previously restricted; however, no long-term changes in water quality would be expected and no changes are proposed that would affect groundwater quality.

These types of water quality impacts would most likely occur during periods of low flow and would likely be mitigated by the other projects proposed under Alternative 1 that are designed to increase instream flows. Overall, this project is not anticipated to adversely affect any of the water quality criteria for designated uses in Icicle Creek or the Wenatchee River.

Fish Screen Compliance

Once the Fish Screen Compliance Project is completed, there is a potential for minor impacts to water quality related to increased fish in Icicle Creek similar to the long-term impacts related to the Fish Passage Improvements Project described above.

Water Markets

Implementation of the Water Markets Project could alter water use in Icicle Creek and thereby affect water quantity and quality in the system. This project would provide mitigation water to interruptible agricultural water users during years when the instream flow rule is not met and provide instream flow benefit in years that mitigation would not be needed. During years when mitigation is not needed, the increase in instream flows from the unexercised water rights could be beneficial for multiple water quality parameters, including temperature and dissolved oxygen, while potentially causing minor increases in turbidity. Effects would depend on the location, volume, and sources of the

flow increases. The Water Markets Project is not expected to have an adverse impact on designated uses in Icicle Creek or the Wenatchee River. Corresponding effects on groundwater are anticipated to be minimal and similar to existing recharge processes.

4.5.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. Compliance with the Guiding Principles addresses water quality in general by improving instream flows, sustainability at the LNFH, and Icicle Creek aquatic and riparian habitat. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Other project impacts are discussed under Alternative 1 and impacts of not implementing projects under the No-action Alternative.

4.5.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction of a new IPID Dryden Pump Exchange would require both in-water and riverbank work on the Wenatchee River, including the placement and removal of instream cofferdams, removal of streamside vegetation, excavation of the streambed and bank, and dewatering groundwater in the construction zone. These activities could result in short-term impacts on water quality including temporary increases in turbidity, sedimentation, and the potential re-suspension of contaminated sediments. Increased risk of contamination from the placement of raw concrete and the use of construction equipment in or near waterways, including potential short-term impacts on groundwater, would also occur. Construction of the proposed delivery facilities could also result in similar water quality impacts in the PID Canal. However, it is anticipated that delivery facilities would be constructed in the off-season when the canal is completely dewatered, which would reduce or eliminate potential impacts to waters conveyed in the PID Canal to spillways that discharge water back to the Wenatchee River or its tributaries.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include restricting work to periods when the irrigation canals are dewatered, restricting in-water access to periods of low flows, and implementing BMPs designed to reduce the potential for erosion and inadvertent water contamination from construction equipment and other sources (Section 4.5.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on water quality would be less than significant and are unlikely to result in violation of the water quality standards associated with the designated uses assigned to the Wenatchee River and its tributaries.

4.5.3.2 Long-term Impacts

IPID Dryden Pump Exchange

Potential long-term impacts on water quality from the IPID Dryden Pump Exchange Project are expected to be largely beneficial. By installing the pump station downstream from IPID's current diversion, IPID could reduce the volume of water withdrawn from their existing diversions on Icicle Creek, augmenting late summer streamflow in the creek below RM 5.7 by 25 cfs. There would also be stream flow benefit in the Wenatchee River from its confluence with Icicle Creek. Increasing streamflow during this period would have positive effects on instream water temperatures and dissolved oxygen content. The project would also augment streamflow in Peshastin Creek below the IPID diversion at RM 2.4. In addition, other elements of this project would enable the more efficient delivery of irrigation water, which could reduce withdrawals from the system. Overall, long-term impacts are not expected to exceed the water quality standards that are important to the beneficial uses designated for Icicle Creek or the Wenatchee River. Corresponding effects on groundwater are anticipated to be minimal and similar to existing recharge processes.

4.5.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 Project needed to allow for permitting additional domestic supplies would be included while the Eightmile Lake Storage Restoration Project would not. This section describes the specific short- and long-term impacts associated with the legislative change. Compliance with the Guiding Principles addresses water quality in general by improving instream flows, sustainability at the LNFH, and Icicle Creek aquatic and riparian habitat. The short- and long-term impacts of all other projects proposed under Alternative 3 are discussed under Alternative 1 and Alternative 2. Water quality impacts from not implementing the Eightmile Lake Storage Restoration Project are discussed under the No-action Alternative.

4.5.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

The proposed legislative change to OCPI to address domestic use and instream flow impacts is a legislative change that would not involve any construction work. As such, it would not cause any short-term impacts on water quality.

4.5.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

If the proposed Legislative Change Creating OCPI Authority Project were enacted, there could be potential conflicts with instream flow allocations. Under the proposed changes, junior domestic water rights could be exercised even when the instream flow rule is not

met, resulting in potential adverse impacts on water quality as a result of low flow conditions. Water quality parameters that could be affected include temperature, dissolved oxygen, and concentrations of nutrients and contaminants. Potential changes affecting groundwater quality are not expected. Depending on the instream conditions at the time domestic rights are exercised, water quality standards for some of the other uses designated for Icicle Creek (e.g., aquatic life uses, recreation) may not be able to be met and could violate the antidegradation regulations. However, Alternative 3 provides up to 70 cfs of instream flow benefit, but given the timing of the project benefits, perfect in-time flow mitigation would not be available.

4.5.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1 with the exception that the Eightmile Lake, Upper Klonaqua, and Upper and Lower Snow Lakes Storage Enhancement Projects would be included. Compliance with the Guiding Principles addresses water quality in general by improving instream flows, sustainability at the LNFH, and Icicle Creek aquatic and riparian habitat. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.5.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

Short-term impacts on water quality from the Eightmile Lake Storage Enhancement Project would primarily be associated with construction and are similar in type and mechanism to the short-term water quality impacts identified for the Eightmile Lake Storage Restoration Project (Section 4.5.2.1, Alternative 1, Eightmile Lake Storage Restoration), but longer in duration and greater in extent.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include requiring all in-water work to be performed in the dry and implementing construction BMPs designed to reduce the potential for erosion and inadvertent contamination from vehicle fluids, uncured concrete, human waste, and other sources (Section 4.5.6, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on water quality would be less than significant and are unlikely to result in violation of the water quality standards associated with the designated uses assigned to the Wenatchee River and its tributaries.

Upper Klonaqua Lake Storage Enhancement

Short-term impacts on water quality from the Upper Klonaqua Lake Storage Enhancement project would be primarily related to construction activities and are similar in type and mechanism to those discussed for the Eightmile Lake Storage Enhancement Project.

Specific construction activities that could result in water quality impacts include the transportation of construction equipment and materials to the project site; draw down of the lakes to isolate in-water work areas; groundwater dewatering during installation of the new outlet and pipeline; demolition of the existing dams and water control structures; removal of vegetation, excavation, and fill placement to install new low-level outlet piping; and the placement of concrete and other materials to construct new dam. Water quality impacts that could result from these activities include short-term increases in turbidity, water temperature, erosion potential, and the risk of contamination from vehicle fluids and uncured concrete.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include requiring all in-water work to be performed in the dry and implementing construction BMPs designed to reduce the potential for erosion and inadvertent contamination from vehicle fluids, uncured concrete, human waste, and other sources (Section 4.5.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on water quality would be less than significant and are unlikely to result in violation of the water quality standards associated with the designated uses assigned to the Wenatchee River and its tributaries.

Upper and Lower Snow Lakes Storage Enhancement

Short-term impacts on water quality from the Upper and Lower Snow Lakes Storage Enhancement Project would be primarily related to construction activities and are similar in type and mechanism to those discussed for the Eightmile Lake Storage Enhancement Project except no groundwater dewatering would be needed.

Specific construction activities that could result in water quality impacts include the transportation of construction equipment and materials to the project site; draw down of the lakes to isolate in-water work areas; demolition of the existing dams and water control structures; removal of vegetation, excavation, and fill placement to install new low-level outlet piping; and the placement of concrete and other materials to construct new dams. Water quality impacts that could result from these activities include short-term increases in turbidity, water temperature, erosion potential, and the risk of contamination from vehicle fluids and uncured concrete.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include requiring all in-water work to be performed in the dry and implementing construction BMPs designed to reduce the potential for erosion and inadvertent contamination from vehicle fluids, uncured concrete, human waste, and other sources (Section 4.5.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on water quality would be less than significant and are unlikely to result in

violation of the water quality standards associated with the designated uses assigned to the Wenatchee River and its tributaries.

4.5.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. The greatest potential for impacts on water quality over the long term would occur as the result of disturbance during maintenance and changes in operations with respect to how lake levels are managed that might influence increased erosion and turbidity.

Because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative. However, this project would result in the ability to maintain the lake at higher than historical levels compared to existing conditions and the No-action Alternative.

Under existing conditions, the maximum fill height of the lake is approximately 4,667 feet because the embankment portion of the dam has deteriorated. If the dam height is increased to enhance storage, the lake would be able to fill to a new high-water surface of 4,682 feet. Under this project, lake levels would be managed to rise beginning in the late fall and would continue to approximately 4,677 feet to the height of a notch in the proposed dam. The lake would remain at this height until stop logs are placed in the notch in the early summer. Placement of the stop logs would allow the lake level to continue to rise to the spillway elevation of 4,682 feet. The lake would stay at this level for less than a month in the early summer, after which time IPID would begin drawing down the lake by releasing water.

Compared with existing conditions and the No-action Alternative, this means that an additional area of shoreline would be under water. Shoreline areas up to 4,671 feet have been historically inundated, but areas above 4,671 feet to 4,682 feet have not been inundated. The additional area would be under water for a little less than a month each summer. The project would also allow for the lake to be drawn down below existing lake levels to an elevation of 4,619 feet, which is approximately 24.4 feet lower than the existing low. This change would result in the exposure of slightly more lake bed, mainly in the later summer months and early fall up to the point when the water would no longer be drawn down, generally around the end of September. The additional draw down is not expected to result in increased erosion by comparison, because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

Groundwater immediately surrounding the lakes in many cases is limited by the presence of large rocks and boulders. Lake fluctuation could potentially alter the pattern of groundwater recharge as discussed in Section 4.4, Groundwater Resources, but would

generally be similar to existing natural processes and would not result in substantial changes such that groundwater quality would be significantly affected.

Likewise, the resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months. There could also be a potential for this project to result in a reduced contribution by the lakes to peak flows that might otherwise contribute to increased erosion and flooding. Even though flows in Icicle Creek would be increased compared to existing conditions, as discussed in Section 4.3, Surface Water Resources, instream flow targets under this project would remain within existing high and low flow rates. Potential effects on fish, wildlife, aesthetics, and recreation are discussed in Sections 4.7, Fish; 4.9, Wildlife; 4.11, Aesthetics; and 4.15, Recreation. Overall, potential long-term impacts on water quality are not expected to conflict with the designated uses assigned to Icicle Creek or the Wenatchee River.

Upper Klonaqua Lake Storage Enhancement

Potential long-term impacts to shorelines of Klonaqua Lake would be similar to those described under the Eightmile Lake Storage Enhancement Project (Section 4.5.5.2, Long-term Impacts, Eightmile Lake Storage Enhancement). Potential benefits would mainly occur in Icicle Creek and would include an increased ability to augment stream flow in the late summer or during drought years, with flow augmentation primarily benefitting Reach 1.

The frequency in fluctuations in lake levels in Upper Klonaqua Lake would increase compared to existing conditions and the No-action Alternative. Lake levels would also be drawn down further compared to existing conditions.

The high lake level in Upper Klonaqua Lake would not change. The lake would still refill and outlet naturally through an existing channel to Lower Klonaqua Lake during most of the year. However, the new facilities would allow for the lake to be drawn down an additional 20 to 50 feet and allow for access to an additional 1,146 to 2,448 acre-feet of storage. The draw down would likely occur over a couple of months in the late summer. The additional draw down is not expected to adversely affect water quality by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

Groundwater immediately surrounding the lakes in many cases is limited by the presence of large rocks and boulders. Lake fluctuation could potentially alter the pattern of groundwater recharge as discussed in Section 4.4, Groundwater Resources, but would generally be similar to existing natural processes and would not result in substantial changes such that groundwater quality would be significantly affected.

Likewise, the resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months. During high-flow

years, there could also be a potential for this project to result in a reduced contribution by the lakes to peak flows that might otherwise contribute to increased erosion and flooding.

Even though flows in Icicle Creek would be increased compared to existing conditions, as discussed in Section 4.3, Surface Water Resources, instream flow targets under this project would remain within existing high- and low-flow rates. Potential effects on fish, wildlife, aesthetics, and recreation are discussed in Sections 4.7, Fish; 4.9, Wildlife; 4.11, Aesthetics; and 4.15, Recreation. Overall, potential long-term impacts to water quality are not expected to conflict with the designated uses assigned to Icicle Creek or the Wenatchee River.

Upper and Lower Snow Lakes Storage Enhancement

Potential long-term impacts to shorelines would be similar to those described under the Eightmile Lake Storage Enhancement Project (Section 4.5.5.2, Long-term Impacts, Eightmile Lake Storage Enhancement). Potential benefits would mainly occur in Icicle Creek and would include an increased ability to augment stream flow in the late summer or during drought years, with flow augmentation primarily benefitting the section of Icicle Creek in Reaches 2 through 5.

The proposed enhancement project would increase the high-water storage levels in both Upper and Lower Snow Lakes by 5 feet compared with existing high levels. This change would result in the inundation of some upland vegetation that has grown along the shoreline areas between the current and proposed high lake levels, most likely occurring in the fall through the early summer when releases would be likely to begin. The project would also allow for the Lower Snow Lake to be drawn down 3 feet below the current lake level, which would result in the exposure of slightly more lake bed. The additional draw down is not expected to adversely affect water quality by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

Groundwater immediately surrounding the lakes in many cases is limited by the presence of large rocks and boulders. Lake fluctuation could potentially alter the pattern of groundwater recharge as discussed in Section 4.4, Groundwater Resources, but would generally be similar to existing natural processes and would not result in substantial changes such that groundwater quality would be significantly affected.

Likewise, the resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months. During high-flow years, there could also be a potential for this project to result in a reduced contribution by the lakes to peak flows that might otherwise contribute to increased erosion and flooding.

Even though flows in Icicle Creek would be increased compared to existing conditions, as discussed in Section 4.3, Surface Water Resources, instream flow targets under this project would remain within existing high and low flow rates. Potential effects on fish, wildlife, aesthetics, and recreation are discussed in Sections 4.7, Fish; 4.9, Wildlife; 4.11,

Aesthetics; and 4.15, Recreation. Overall, potential long-term impacts on water quality are not expected to conflict with the designated uses assigned to Icicle Creek or the Wenatchee River.

4.5.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange project would be included.

4.5.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange Project

Construction of the new IPID Full Piping and Pump Exchange Project includes removal of existing diversion facilities and construction of new pump stations and intake facilities. The work would require both in-water and riverbank work on the Wenatchee River, including the placement and removal of instream cofferdams, removal of streamside vegetation, excavation of the streambed and bank, and dewatering groundwater in the construction zone. The project also involves fully replacing the existing IPID canal systems with a pressurized pipe delivery system, which would require ground disturbance throughout the system. The existing intakes on Icicle and Peshastin Creeks would also be removed or abandoned. These activities could result in short-term impacts on water quality including temporary increases in turbidity, sedimentation, and the potential re-suspension of contaminated sediments. Increased risk of contamination from the placement of raw concrete and the use of construction equipment in or near waterways, including potential short-term impacts on groundwater, would also occur.

Conversion of the IPID conveyance system to pipelines could also result in similar water quality impacts in the IPID canal system. However, it is anticipated that any work to these features would be done in the off-season when the canals are dewatered, which would reduce or eliminate potential impacts to waters conveyed in the IPID system that discharge water back to the Wenatchee River or its tributaries.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include restricting work to periods when the irrigation canals are dewatered, restricting in-water access to periods of low flows, and implementing BMPs designed to reduce the potential for erosion and inadvertent water contamination from construction equipment and other sources (Section 4.5.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on water quality would be less than significant and are unlikely to result in violation of the water quality standards associated with the designated uses assigned to the Wenatchee River and its tributaries.

Because Ecology's current Water Quality Assessment (Ecology, 2016) records multiple Category 5 water quality impairment listings for the Wenatchee River, including five for polychlorinated biphenyls, five for 4,4'-DDE, and one for endosulfan, any excavation work in the river to construct the pump stations would need to address the potential presence of these and other contaminants in the substrate. As long as construction activities comply with required permit terms and conditions, including those in the Water Quality Certification that would be required by Ecology, it is unlikely that this project would result in violations of the water quality standards associated with the designated uses of the affected water bodies. Short-term impacts on water quality would not be significant.

4.5.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange Project

Potential long-term impacts on water quality from the IPID Full Piping and Pump Exchange Project are expected to be largely beneficial. By installing the pump station downstream from IPID's current diversion, IPID could reduce the volume of water withdrawn from their existing diversions on Icicle Creek and Peshastin Creek, with more water instead being drawn from the Wenatchee River. This project would increase stream flow in both Icicle and Peshastin Creeks. Increasing streamflow during this period would have positive effects on instream water temperatures and dissolved oxygen content. In addition, other elements of this project would enable the more efficient delivery of irrigation water, which could reduce withdrawals from the system. Overall, long-term impacts are not expected to exceed the water quality standards that are important to the beneficial uses designated for Icicle Creek or the Wenatchee River. Corresponding effects on groundwater are anticipated to be minimal and similar to existing recharge processes.

4.5.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.5.7.1 Short-term Impacts

Short-term impacts on water quality would be mitigated by complying with the terms and conditions of local, state, and federal water quality regulations and project-specific permits, including local building, grading, and stormwater construction permits; state stormwater permits; SMA shoreline permits; HPAs; and CWA Section 404 permits and their associated Section 401 Water Quality Certifications, among others.

Local approvals could include building and grading permits and other construction-related authorizations for construction work within the limits of a municipality or county. Construction projects could also require a Construction Stormwater General Permit from Ecology. Projects involving work along shorelines or banks of lakes and streams would

potentially require some type of shoreline permit under the state's SMA, which is administered by either local entities (e.g., City of Leavenworth, Chelan County) or Ecology. Projects that would use, divert, obstruct, or otherwise change the natural flow or bed of any water of the state require an HPA authorization from WDFW under the Washington State Hydraulic Code.

In addition to these state and local permits, any work that would involve the placement of dredged or fill material below the ordinary high water mark (OHWM) of a water of the United States (e.g., streams, rivers, lakes, wetlands) would require authorization from the USACE, Seattle District, under Section 404 of the CWA. Projects requiring a Section 404 Permit would also need a Water Quality Certification from Ecology under Section 401 of the CWA, which certifies that a project will comply with state water quality standards and other aquatic resources protection requirements under Ecology's authority.

Common permit conditions are likely to include specific in-water work restrictions, worksite isolation procedures, and post-construction restoration requirements designed to avoid and minimize impacts on multiple types of natural resources, including water quality. In addition, contractors would be required to prepare and implement a spill prevention, control, and countermeasure plan and develop and implement a temporary erosion and sediment control plan prior to the commencement of construction activities.

During construction, BMPs to control, isolate, and contain stormwater runoff, erosion, fluids from construction equipment, and uncured concrete would also be used to further minimize potential impacts on water quality. Turbid or contaminated dewatering water would be treated prior to discharge as necessary to comply with the requirements of the Washington Administrative Code, HPA, construction NPDES permit, and/or the local grading permit. Contracts for construction projects would also include site-specific restoration requirements to ensure that all disturbed areas are appropriately stabilized and routinely monitored following the completion of construction.

4.5.7.2 Long-term Impacts

Local long-term effects on water quality are possible for some of the projects, but they would be mitigated with both local measures and net benefits from changes in the operations of the system. Water quality impacts could further be mitigated through evaluations that consider site-specific characteristics to aid in design and selection of individual projects.

In most cases, the potential for long-term water quality impacts would be mitigated by applicable permit requirements for the construction and operation of the project. Project design and permitting would occur within the existing TMDL implementation framework. Water quality monitoring throughout the system would be used to document the effectiveness of the various flow augmentation, water conservation, and habitat enhancement projects. Long-term adaptive management plans and monitoring would also be beneficial for maintaining and enhancing water quality. Lake operational practices

related to the timing and volume of storage releases can be structured to mitigate water quality impacts.

All long-term operational activities that relate to individual projects would require monitoring and approval to meet local, state, or federal regulatory requirements for water quality. Ecology is the lead agency in charge of administering and enforcing the various rules and regulations governing water use and water quality in the State of Washington. Ecology's Water Quality Program is responsible for reviewing plans before construction to ensure all state and local water quality standards and requirements are met.

4.6 Water Use

4.6.1 No-action Alternative

4.6.1.1 Short-term Impacts

Under the No-action Alternative, various agencies and other entities would continue to undertake individual actions to restore and enhance fish and aquatic resources in the Icicle Creek Watershed project area, but those actions would not be part of a coordinated program implemented with the support of the IWG. Actions implemented by individual agencies and entities could include construction of diversion improvements, irrigation system upgrades, LNFH improvements, and fish passage work.

Project construction could temporarily impact water supply, especially for construction work on or near a point of diversion. These projects could be timed and coordinated to minimize these impacts. Generally, short-term, construction related impacts to water use would be less than significant.

4.6.1.2 Long-term Impacts

Under the No-action Alternative, some water quantity issues may be eased, while some would likely persist.

Several projects aimed at out-of-stream uses may persist under the No-action Alternative. These would likely include improvements to irrigation reliability by implementing piping and lining efforts, and maintenance and improvements at IPID's alpine lakes infrastructure. However, the timing and magnitude of these projects will likely be different under the No-action Alterative.

Some domestic conservation is likely to occur under the No-action Alternative, and the instream flow rule might be amended if sufficient habitat improvements occur. This would allow for improved domestic supply. However, this increased supply would not meet projected demand through 2050 particularly for rural residents.

While it is expected that COIC and LNFH would continue to pursue water conservation to improve instream flow, there would only be modest progress made towards meeting the flows prescribed in the rule. Additionally, stream flow goals set for Reach 4 would consistently fail to reach to goals set by the IWG.

4.6.2 Alternative 1

Implementation of Alternative 1 has the potential to result in greater short-term impacts on use compared with the No-action Alternative because there would be higher likelihood that projects would be constructed, which could temporarily impact water use at construction projects near diversions. Alternative 1 would also improve water use conditions over the No-action Alternative. Long-term benefits would include increased water available for instream and out-of-stream uses, including water to meet growth projections. The following sections describe the short- and long-term impacts that would occur under Alternative 1.

4.6.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Construction activities associated with the Alpine Lakes Optimization, Modernization, and Automation Project would involve replacing existing gates and installing solar panels, actuators, flow monitoring equipment, and other new equipment. This work would occur when the lakes are drawn down in late summer. Construction related impacts to water use could occur for construction projects near points of diversion, which would impact the ability to divert water. Construction associated with this project is not near an out-of-stream diversion. No short-term impacts to water use are expected to result from this project.

IPID Irrigation Efficiencies

Construction activities associated with the IPID Irrigation Efficiencies Project include the conversion of irrigation canals to pipelines, on-farm efficiency upgrades, and other traditional irrigation efficiency projects. Construction on the irrigation infrastructure could result in impacts to IPID water use. However, construction activities on water distribution infrastructure would likely occur outside the irrigation season to minimize effects on water use.

COIC Irrigation Efficiencies and Pump Exchange

Construction activities associated with the COIC Irrigation Efficiencies and Pump Exchange Project include a new surface water intake and pump station as well as piping existing canals and laterals. These construction activities could result in impacts to COIC water use. However, these construction actives would likely occur in a manner so as to not affect COIC's water deliveries.

Domestic Conservation Efficiencies

Construction activities associated with the Domestic Conservation Efficiencies Project would include pipe replacement and meter installations. Additionally, some landscape modification could occur. These construction activities would be staged to minimize any impacts on water delivery to domestic customers.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project would involve demolishing the existing dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures. Construction activities would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down. Construction related impacts to water use could occur for construction projects near points of diversion, which would impact the ability to divert water. Construction associated with this project is not near an out-of-stream diversion. No short-term impacts to water use are expected to result from this project.

Tribal Fishery Preservation and Enhancement

The focus of this project is to ensure that there would be no adverse effect on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. While to details of this project are not fully known, it is unlikely any construction activities would prevent a water use from diverting water from Icicle Creek. No short-term effects on what use have been identified.

Habitat Protection and Enhancement

Habitat protection and enhancement proposed under this project could involve grading, planting and thinning vegetation, and hauling and placing logs, rock, soil, and other materials. While to details of this project are not fully known, it is unlikely any construction activities would prevent a water use from diverting water from Icicle Creek. No short-term effects on what use have been identified.

Instream Flow Rule Amendment

There are no construction activities proposed under this project and therefore no potential short-term impacts on water use.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project includes various elements geared toward improving water quality and hatchery rearing conditions at the LNFH. Reconstruction of the facilities intake structure could impact the facilities water use. Alterative water sources or temporary points of diversion would need to be identified prior to construction.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek, as well as instream modifications to the Boulder Field near RM 5.6. Work at the Boulder Field may have short-term impacts

to IPID and the City of Leavenworth's diversion points. Construction activities would need to be coordinated with IPID and the City of Leavenworth to ensure service would not be interrupted.

Fish Screen Compliance

This project would involve replacing fish screens at three different diversions on Lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Under this project, screens and associated infrastructure would be improved to bring all three intakes up to compliance with state and federal laws. This construction work would occur at active water diversions and could result in short-term disruptions to water use. Construction schedules would need to be coordinated with diverters to minimize any potential impacts.

Water Markets

There are no construction activities proposed under the Water Markets Project and therefore no potential short-term impacts on water use.

4.6.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Operation of the proposed facilities for the Alpine Lakes Optimization, Modernization, and Automation Project would involve a more efficient and flexible system for releasing flows from the lakes. This project would provide an additional 30 cfs and 5,465 acre-feet per year to the Icicle Creek System. This water would be managed exclusively for instream flow benefit during non-drought years. This would affect summer instream flows and likely increase the frequency when the flows prescribed in the Wenatchee Instream Flow Rule for Icicle Creek are met.

In drought years, IPID would continue operating these lakes for irrigation of lands within their service area. This project would improve operation so the district could more accurately and responsively release water from the lakes for their operational needs. The Snow Lake systems would continue to be operated by USFWS for streamflow benefit and for the operation of their diversion on Icicle Creek.

This project is not anticipated to have any negative long-term impacts on Icicle Creek diversionary rights. The resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months. To protect this water instream, a change authorization or a new secondary use permit authorizing instream flows as a beneficial use for these storage rights would need to be issued for each lake. Issuance of these water rights would require analysis of beneficial use, impairment of senior users, potential detriment to the public interest, and water availability.

IPID Irrigation Efficiencies

Many elements of the IPID Irrigation Efficiencies Project include pipelines or canal improvements. The anticipated effect of this project is a decrease in IPID's water demand, and, consequently, a reduction in the amount of water diverted by the district from Icicle Creek. The reduction in demand is anticipated to increase stream flows in Icicle Creek and the Wenatchee River by 10 cfs and 3,000 acre-feet per year, from the historical point of diversion at Icicle Creek RM 7.5 to the historical point of return flows on the Wenatchee River.

This project is not anticipated to have any negative long-term impacts on Icicle Creek diversionary rights. The resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system.

COIC Irrigation Efficiencies and Pump Exchange

A new COIC pump station and intake facilities would be constructed on the Wenatchee River or Lower Icicle Creek. Moving the point of diversion would require a water right change authorization.

This project would increase flows by up to 11.9 cfs and 3,500 acre-feet per year on Icicle Creek.

Domestic Conservation Efficiencies

Implementing the Domestic Conservation Efficiencies Project would include improved leak detection, metering, a voluntary lawn buyback program, conservation incentives, and conservation-oriented rate structure. Conserved water would be used to provide service to more ERUs within the City of Leavenworth service area and for rural domestic users.

Domestic conservation is not anticipated to affect instream flows or other water uses in the Icicle Creek Subbasin or in the Wenatchee River Watershed, where the City well field is located. Conserved water within the City of Leavenworth will help meet future municipal demand.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project involves restoring the Eightmile Lake Dam to its historical high water mark. This would provide an additional 900 acre-feet per year of storage in the Icicle Creek Subbasin over current conditions. This water would be utilized for instream flows and domestic use. The effects of this project on water use are related to these two uses.

The additional storage water would provide increased stream flow from Eightmile Lake Dam downstream to either RM 7.5 or RM 0, depending on where domestic and municipal water would be diverted. Providing additional water for instream flow would increase water use security for out-of-stream users who are junior to the instream flow rule. The resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a

beneficial increase in flows during the summer months. To protect this water instream, a new secondary use permit would need to be issued for instream flows as a beneficial use for the storage right. Issuance of this water right would require analysis of beneficial use, impairment of senior users, potential determent to the public interest, and water availability.

This water would also be used to provide for rural domestic and City of Leavenworth demand through 2050, which would also require a secondary use permit. This would increase the City of Leavenworth water right and water potentially available to other domestic uses without having impact on instream flows or affecting other water users in the Icicle Creek Subbasin. City of Leavenworth has expressed interest in taking available water resulting from this project from its Wenatchee River well fields, which would require a water right permitting action.

Tribal Fishery Preservation and Enhancement

The purpose of this project is to protect and enhance the tribal, as well as non-tribal, fishery. There are no anticipated long-term negative effects to water use associated with this project.

Habitat Protection and Enhancement

The purpose of this project is to protect and enhance habitat within the Lower Icicle Creek corridor, which is not anticipated to have long-term effects to water use.

Instream Flow Rule Amendment

Under the Instream Flow Rule Amendment Project, the City of Leavenworth's water reserve from Icicle Creek would be increased to support future domestic water supply demands projected through 2050. Over the long term, this amendment would ultimately result in the removal of additional water (up to 0.4 cfs) from Icicle Creek for domestic use, which would reduce stream flow in Icicle Creek. This is offset by the addition of water from other projects as part of this alternative. Additionally, this shifts a portion of the existing reserve from the Wenatchee River to Icicle Creek as contemplated by the original watershed planning effort, with no net increase for the basin. Additionally, streamflow and habitat restoration efforts, as required by WAC 173-545-090(1)(d)(iv), are expected to offset these long-term effects.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project consists of several proposals to improve instream water conservation and water quality at LNFH. The water conservation component is the most likely to have long-term effects on water use. Through implementing operational changes to reduce LNFH demand, more water would be left instream from RM 4.5 to RM 2.7. This would increase stream flow in Reaches 3 and 4 by up to 20 cfs and 14,454 acre-feet year-round. Because of the non-consumptive nature of the LNFH water right, the instream flow benefit would not extend past the hatchery outfall at RM 2.7. Additionally, restored

groundwater use to historical permitted levels would create increased balance in hatchery water use between its surface and groundwater sources.

Fish Passage Improvements

This project involves modifying passage barriers in Icicle Creek to improve fish passage. While potential short-term impacts have been identified for construction at the Boulder Field, no long-term effects to water use are anticipated as a result of this project.

Fish Screen Compliance

The Fish Screen Compliance Project is not anticipated to have long-term effects on water use.

Water Markets

The Water Markets Project would create a water market on Icicle Creek and downstream on the Wenatchee River. This would result in fallowing senior agricultural lands, placing the water right into the TWRP, and issuing mitigated permits to downstream interruptible agricultural users that is offset by the retired use. The effects on water use would include increased stream flow and water resources for fish from the historical point(s) of diversion to the new points of diversion. This would likely include several reaches in Icicle Creek examined by the IWG, as well as in the Wenatchee River. Additionally, it would convert irrigators whose use was not permitted during water-short years into uninterruptible water users. Senior water rights that might be purchased and retired for a water bank have not been identified, so specific reach benefits to instream flow are unknown at this time.

4.6.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would be included and the Alpine Lakes Optimization, Modernization, and Automation Project would not be included. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Other project impacts are discussed under Alternative 1 and impacts of not implementing projects are discussed under the No-action Alternative.

4.6.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction of a new pump station under this project would likely not affect water use.

4.6.3.2 Long-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project would result in new pump exchange and intake facilities on the Wenatchee River. These intake facilities would decrease diversion on both Icicle Creek and Peshastin Creek by using Wenatchee River water to supply

irrigation demand instead. This would result in a 25 cfs and 1,484 acre-feet per year increase in flows in Icicle Creek and the Wenatchee River from Icicle Creek RM 7.5 to Wenatchee RM 16.5. This would provide additional water resources for fish benefit and increased flow in Reaches 1 through 5 on Icicle Creek. Additionally, this project would likely increase the frequency when the flows prescribed in the Wenatchee Instream Flow Rule for Icicle Creek are met during summer months.

This project is not anticipated to have any negative long-term impacts on Icicle Creek, Peshastin Creek, or Wenatchee River diversionary rights. The resulting downstream changes in flows in these systems would be within the natural variation already occurring within the system.

4.6.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 Projects would also be included while the Eightmile Lake Storage Restoration Projects would not. This section describes the specific short- and long-term impacts associated with the Legislative Change Creating OCPI Authority for Alternative 3 Projects. Other project impacts are discussed under Alternative 1 and 2 and impacts of not implementing projects are discussed under the No-action Alternative.

4.6.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

There are no construction activities proposed under this project and therefore no potential short-term impacts with the potential to affect water use.

4.6.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

If the proposed Legislative Change Creating OCPI Authority Project were enacted, there could be potential conflicts with instream flow allocations. Under the proposed changes, junior domestic water rights could be exercised even when the Instream Flow Rule is not met. This is particularly true for the winter months when flows often fall short of those prescribed in the Wenatchee Instream Flow Rule for Icicle Creek and no in-kind mitigation is available; although, these changes would be generally adverse for instream flow water rights established by WAC 173-545-060. Because these impacts are primarily anticipated for winter months, it is not anticipated to increase interruption of other water rights junior to the Instream Flow Rule.

This project would increase the amount of water available to the City of Leavenworth and provide for future residential and commercial growth within the City of Leavenworth's service area.

4.6.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1. The Eightmile Lake Storage Restoration Project would be replaced with the Eightmile Lake Storage Enhancement Project, and the Upper Klonaqua and Upper and Lower Snow Lakes Storage Enhancement Projects would also be included. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.6.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would involve demolishing the existing dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures that would allow for an increase in the accessible storage at Eightmile Lake to 3,500 acre-feet. Construction activities would not likely affect water use.

Upper Klonaqua Lake Storage Enhancement

This project's construction activities would require the construction of a low-level outlet from Upper Klonaqua Lake to Lower Klonaqua Lake using one of the three conceptual connection options discussed in Chapter 2. Construction activities are not anticipated to affect water use.

Upper and Lower Snow Lakes Storage Enhancement

Construction activities related to this project are not anticipated to affect water use.

4.6.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Under existing conditions, the maximum fill height of the lake is approximately 4,667 feet because the embankment portion of the dam has deteriorated. After the dam is enhanced, the lake would be able to fill to a new high water surface of 4,682 feet. These changes would increase the accessible storage to 3,500 acre-feet, which is 1,000 acre-feet more than currently permitted by IPID's water right. This additional storage water would be used for instream flows and domestic use.

The additional storage water would provide increased stream flow from Eightmile Lake Dam downstream to either RM 7.5 or RM 0, depending on where domestic and municipal water would be diverted. The resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months. To protect this water instream, a new secondary use permit would need to be issued for instream flows as a beneficial use for the storage right. Issuance of this water right would require analysis of beneficial use, impairment of senior users, potential detriment to the public interest, and water availability.

This water would also be used to provide for rural domestic and City of Leavenworth demand through 2050, which would also require a secondary use permit. This would increase the City of Leavenworth water right and water potentially available to other domestic uses without having impact on instream flows or affecting other water users in the Icicle Creek Subbasin. City of Leavenworth has expressed interest in taking available water resulting from this project from its Wenatchee River well fields, which would require a water right permitting action.

It is not anticipated that this project would have any other long-term effects on water use in the basin.

This activity would require a new storage permit and additional secondary use permits, as discussed in Section 4.6.6, Mitigation Measures.

Upper Klonaqua Lake Storage Enhancement

Potential long-term impacts to water use would be similar to those described under the Eightmile Lake Storage Enhancement Project. This project could provide up to 2,448 acre-feet of additional discharge from the Klonaqua Lake system. This additional storage water would be used for instream flows and domestic use.

The additional storage water would provide increased stream flow from Eightmile Lake Dam downstream to either RM 7.5 or RM 0, depending on where domestic and municipal water would be diverted. The resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months. To protect this water instream, a new secondary use permit would need to be issued for instream flows as a beneficial use for the storage right. Issuance of this water right would require analysis of beneficial use, impairment of senior users, potential detriment to the public interest, and water availability.

This water would also be used to provide for rural domestic and City of Leavenworth demand through 2050, which would also require a secondary use permit. This would increase the City of Leavenworth water right and water potentially available to other domestic uses without having impact on instream flows or affecting other water users in the Icicle Creek Subbasin. City of Leavenworth has expressed interest in taking available water resulting from this project from its Wenatchee River well fields, which would require a water right permitting action.

It is not anticipated that this project would have any other long-term effects on water use in the basin.

This activity would require a new storage permit and additional secondary use permits, as discussed in Section 4.6.6, Mitigation Measures.

Upper and Lower Snow Lakes Storage Enhancement

Potential long-term impacts to water use would be similar to those described under the Eightmile Lake Storage Enhancement Project (4.6.5.2, Long-term Impacts). Increased storage capacity in the Snow Lakes system would be 1,079 acre-feet. This additional storage water would be used for instream flows and domestic use.

The additional storage water would provide increased stream flow from Upper Snow Lake Dam downstream to either RM 7.5 or RM 0, depending on where domestic and municipal water would be diverted. The resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months. To protect this water instream, a new secondary use permit would need to be issued for instream flows as a beneficial use for the storage right. Issuance of this water right would require analysis of beneficial use, impairment of senior users, potential detriment to the public interest, and water availability.

This water would also be used to provide for rural domestic and City of Leavenworth demand through 2050, which would also require a secondary use permit. This would increase the City of Leavenworth water right and water potentially available to other domestic uses without having impact on instream flows or affecting other water users in the Icicle Creek Subbasin. City of Leavenworth has expressed interest in taking available water resulting from this project from its Wenatchee River well fields, which would require a water right permitting action

It is not anticipated that this project would have any other long-term effects on water use in the basin.

This activity would require a new storage permit and additional secondary use permits, as discussed in Section 4.6.6, Mitigation Measures.

4.6.6 Alternative 5

Alternative 5 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Full Piping and Pump Exchange Project would replace IPID Irrigation Efficiencies project. This section describes the specific short- and long-term impacts associated with the IPID Full Piping and Pump Exchange Project. Other project impacts are discussed under Alternative 1.

4.6.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

Construction of new pump stations under this project would likely not affect water use in the short-term. Construction of piping would occur outside the window of the irrigation season and would not impact water use.

4.6.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

The IPID Full Piping and Pump Exchange Project would result in new pump stations and intake facilities on the Wenatchee River. These intake facilities would remove IPID's diversions on both Icicle Creek and Peshastin Creek by using Wenatchee River water to supply irrigation demand instead. This would result in a 117 cfs and 30,000 acre-feet per year increase in flows in Icicle Creek and the Wenatchee River from Icicle Creek RM 5.7 to the pump stations located in Leavenworth, Dryden, and Cashmere. This would provide additional water resources for fish benefit and increased flow in Reaches 1 through 5 on Icicle Creek. Additionally, this project would likely increase the frequency when the flows prescribed in the Wenatchee Instream Flow Rule for Icicle Creek are met during summer months.

This project is not anticipated to have any negative long-term impacts on Icicle Creek, Peshastin Creek, or Wenatchee River diversionary rights. The resulting downstream changes in flows in these systems would be within the natural variation already occurring within the system. This project would require water right change authorization to move the points of diversion from their historical locations to the proposed pump stations.

4.6.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.6.7.1 Short-term Impacts

Short-term impacts on water use is expected to be relatively limited. Specific mitigation measures would include coordination with water users whose infrastructure could be limited by construction activities.

4.6.7.2 Long-term Impacts

Long-term impacts on water use primarily relate to instream flows, reduced return flows, increased domestic use, and water right change authorizations. Nearly all of the projects require either a new or changed water right authority under Chapters 90.03 and 90.44 RCW. These statutes require no impairment to senior water rights, no detriment to the public interest, beneficial use, and availability. Meeting these criteria would mitigate potential effects on water use.

4.7 Fish

This section describes the potential short- and long-term impacts that could affect the resources identified in Section 3.7, Fish, from construction and operation related to the No-action Alternative and Program Alternatives. Impacts on special-status species are addressed in Section 4.10, Threatened and Endangered Species.

4.7.1 No-action Alternative

4.7.1.1 Short-term Impacts

Projects likely to occur under the No-Action Alternative would likely result in short-term impacts that could affect aquatic habitat such as would occur from activities within the Alpine Lakes at the existing dam or from work within or adjacent to Icicle Creek or the Wenatchee River, such as might occur from dewatering of instream habitat, potential disturbance and displacement of juvenile salmonids and resident species, disturbance of shoreline habitat, increased water temperatures, sedimentation, fish passage obstruction, and potential for accidental spills of hazardous materials (i.e., uncured cement, fuel, hydraulic fluid). Short-term impacts affecting water quality are addressed in Section 4.5, Water Quality.

The agencies or entities implementing projects under the No-action Alternative would be required to comply with applicable local, state, and federal environmental review requirements as described in Section 5.2, Table 5-2. In the event of any potential adverse impacts, project applicants would be required to implement appropriate mitigation measures to reduce impacts on aquatic species, such as minimizing potential disturbance of aquatic habitat, including possibly excluding species from work areas or implementing any necessary timing restrictions for construction work (Section 4.7.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on fish would not be significant.

4.7.1.2 Long-term Impacts

The long-term impacts under the No-action Alternative are generally anticipated to be beneficial due largely to obligations that the USFWS has at LNFH to improve fish passage through hatchery structures, improve water diversion intake screening, maintain instream flow in the historical channel, and support the tribal and sport fisheries in Icicle Creek. In addition, conservation projects, irrigation improvements, and restoration projects implemented individually by other agencies and entities would provide a long-term benefit to fish and aquatic habitat through increased flow.

Currently, LNFH operators have observed an increase in fish mortality at LNFH (Irving, pers. comm.), which has been attributed in part to improved fish passage and decreased water supply into the hatchery. To address these issues, LNFH has reduced fish densities

at the hatchery and increased flushing and chemical treatment. Improving water quality and quantity as part of the planned LNFH improvements would further help to reduce these impacts. While these measures are also expected to be implemented under the No-Action Alternative, the potential for this impact would likely remain.

In addition, because instream flow and fish habitat enhancement projects would not generally be coordinated with other activities in the Icicle project area, the benefits are not anticipated to be as great as they would under the other Program Alternatives. For example, proposed modifications at the Alpine Lakes would not result in management of the lakes for the benefit of fish. Depending on the specific location and extent of long-term changes affecting aquatic habitat, there is a potential for some projects to result in localized adverse impacts.

4.7.2 Alternative 1

4.7.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

As discussed in Section 3.7, Fish, the Alpine Lakes do not appear to have naturally occurring fish populations. The lakes typically have low temperatures (8°C to 15°C in summer) (Dion et al., 1976) and low nutrient inputs that naturally limit fish metabolism, growth, and the development of food resources for fish. Because of the high altitude and cold temperatures, these lakes have low productivity levels and lack fish passage that would naturally support fish populations.

Several of the lakes have been artificially stocked with trout species that contribute to the recreational high lakes fishery, although none of the project lakes have been stocked or managed for these fish in recent years. Fish present in these lakes are likely descendants of stocked fish and most likely include cutthroat trout (*Oncorhynchus clarkii*), rainbow trout (*O. mykiss*), and lake trout (*Salvelinus namaycush*).

Most of the work would occur in upland areas. Some limited work would occur within the lake shorelines but within the dry areas on the lake margins when the lakes are drawn down at the end of the summer. As discussed in Section 4.5, Water Quality, construction is not anticipated to result in significant water quality impacts and would, therefore, not be expected to adversely affect fish or aquatic invertebrates. However, construction activities would result in increased noise that could affect these species, depending on the type of activity and whether these species were located in close proximity.

As noted in Section 4.14, Noise, the majority of construction activities would result in relatively minor noise increases associated primarily with hand-held tools. Normal fish behavior, such as foraging or use of refuge areas within the lakes, would not likely be adversely affected because fish would be able to move to other areas of the lake during construction. These activities are generally consistent with routine operation and

maintenance activities that have occurred and would otherwise continue under the No-action Alternative.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include limiting in-water work, excluding aquatic species from in-water work areas, and implementing construction timing restrictions (Section 4.7.7, Mitigation Measures).

IPID Irrigation Efficiencies

Construction activities associated with the IPID Irrigation Efficiencies Project include the conversion of irrigation canals to pipelines, replacing or abandoning pipelines, lining of irrigation canals with concrete, and on-farm application efficiency upgrades. These activities are unlikely to adversely affect fish because the work would be done in the off-season when the irrigation canals are dry, and away from where these species may be found. As noted in Section 4.5, Water Quality, there would also be relatively limited potential for water quality impacts that could adversely affect aquatic habitat related to these activities.

COIC Irrigation Efficiencies and Pump Exchange

The COIC Irrigation Efficiencies and Pump Exchange Project includes conversion of irrigation canals and laterals to pipelines and construction of the new pump station along Icicle Creek or the Wenatchee River. Short-term impacts that could adversely affect fish and aquatic invertebrates include direct disturbance associated with work near or in water and any associated temporary impacts on aquatic habitat.

Canal work is unlikely to adversely affect fish because the work would be done in the dry during the off-season when the irrigation system is dry, and away from where these species may be found. As noted in Section 4.5, Water Quality, there would also be relatively limited potential for water quality impacts that could adversely affect aquatic habitat related to these activities.

Construction of the COIC pump station would require in-water work along lower Icicle Creek or the Wenatchee River and has a higher potential to adversely affect fish and aquatic invertebrates. Potential impacts include increased risk of disturbance or harm from construction activities such as from installation of a cofferdam, increased potential for harm from noise and vibration, increased risks of water quality impacts adversely affecting aquatic habitat, and temporary loss of aquatic habitat during dewatering for in-water construction. Depending on the location and extent of these activities and the number and type of fish or aquatic invertebrates likely to be affected, short-term impacts could be significant.

Work within waters of the United States or State of Washington or within irrigation canals or spillways that reconnect to these waters would require a CWA Section 404

Permit and associated Section 401 Water Quality Certification; work in other portions of the irrigation system could require local review and authorization.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include limiting in-water work, excluding aquatic species from in-water work areas, and implementing construction timing restrictions (Section 4.7.7, Mitigation Measures.

Domestic Conservation Efficiencies

Construction activities proposed under the Domestic Conservation Efficiencies Project include pipeline replacement and meter installation. These activities are unlikely to adversely affect fish because the work would be done in the dry and away from where these species may be found. As noted in Section 4.5, Water Quality, there would also be relatively limited potential for water quality impacts that could adversely affect aquatic habitat related to these activities.

Eightmile Lake Storage Restoration

As noted previously, the Alpine Lakes typically have low temperatures (8°C to 15°C in summer) (Dion et al., 1976) and low nutrient inputs that limit fish metabolism and growth, and the development of food resources for fish. Because of high altitude and cold temperatures, Eightmile Lake has low productivity levels and lacks fish passage that would naturally support fish populations; however, as noted in Section 3.7, Fish, Eightmile Lake was stocked most recently in 2005 and descendants of these stocked fish may exist in this lake, most likely cutthroat trout, rainbow trout, and lake trout.

Construction activities would occur primarily in the dry lake margins in the later summer when the lake is drawn down and in Eightmile Creek immediately downstream of the dam. As discussed in Section 4.5, Water Quality, these activities are not anticipated to result in significant water quality impacts and would therefore not be expected to adversely affect fish or aquatic invertebrates. However, construction activities would result in increased noise that could affect these species, depending on the type of activity and whether these species were located in close proximity.

As noted in Section 4.14, Noise, most construction activities would result in relatively minor noise increases and normal fish behavior such as foraging or use of refuge areas within the lakes would not likely be adversely affected because fish would be able to move to other areas of the lake =. However, construction could involve some blasting. Blasting can directly harm fish and aquatic invertebrates from increases in noise and vibration. Depending on the species that may be within close proximity when blasting occurs, there is a potential for those species to be affected.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures

could include limiting in-water work, excluding aquatic species from in-water work areas, and implementing construction timing restrictions (Section 4.7.7, Mitigation Measures).

Tribal Fishery Preservation and Enhancement

The focus of this project is to ensure that there would be no adverse effect on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. The specifics of this project are not yet determined, but would involve elements of restoration along lower Icicle Creek that could result in streambank and in-water construction. At this stage, the primary options under consideration include the construction of facilities, such as plumbing to create a bubble curtain, sprayer, or other minor modifications to the LNFH, to promote favorable fishing conditions in the pool at the bottom of the spillway.

Potential short-term impacts on fish and aquatic invertebrates would occur mainly as a result of work in or within close proximity to water. Potential impacts include increased risk of disturbance or harm from construction activities such as from installation of a cofferdam, increased potential for harm from noise and vibration, increased risks of water quality impacts adversely affecting aquatic habitat, and temporary loss of aquatic habitat during dewatering for in-water construction. Depending on the location and extent of these activities and the number and type of fish or aquatic invertebrates likely to be affected, short-term impacts could be significant.

These types of activities would require authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to address these impacts (Section 4.7.6, Mitigation Measures).

Habitat Protection and Enhancement

Habitat protection and enhancement proposed under this project could involve grading, planting and thinning vegetation, and hauling and placing logs, rock, soil, and other materials along lower Icicle Creek. Potential short-term impacts on fish and aquatic invertebrates would occur mainly as a result of work in or within close proximity to water.

Potential impacts include increased risk of disturbance or harm from construction activities such as installation of a cofferdam, increased potential for harm from noise and vibration, increased risks of water quality impacts adversely affecting aquatic habitat, temporary loss of aquatic habitat during dewatering for in-water construction, and potential loss of riparian habitat. Depending on the location and extent of these activities and the number and type of fish or aquatic invertebrates likely to be affected, short-term impacts could be significant.

These types of activities would require authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to address these impacts (Section 4.7.7, Mitigation Measures).

Instream Flow Rule Amendment

There are no construction activities proposed under this project and therefore no potential short-term impacts on fish or aquatic invertebrates.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project includes various elements geared towards improving water quality and hatchery rearing conditions at the LNFH. Many of these activities would occur within the existing hatchery, although some in-water work would also be required. In general, construction of these elements has the potential to affect fish, depending on the specific location and type of disturbance.

Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential short-term impacts under the NEPA would be completed once the full scope of the project is determined. Similar to the construction activities described above, various authorizations are likely to be required that would ensure that potential impacts would be avoided, minimized, or compensated as noted in Section 4.7.7, Mitigation Measures.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek, as well as instream modifications to the Boulder Field near RM 5.6. This work would result in disturbances along the streambank and within Icicle Creek that could potentially affect fish and aquatic invertebrates.

Potential impacts include increased risk of disturbance or harm from construction activities such as installation of a cofferdam, increased potential for harm from noise and vibration, increased risks of water quality impacts adversely affecting aquatic habitat, and temporary loss of aquatic habitat during dewatering for in-water construction. Depending on the location and extent of these activities and the number and type of fish or aquatic invertebrates likely to be affected, short-term impacts could be significant.

These types of activities would require authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to address these impacts (Section 4.7.7, Mitigation Measures).

Fish Screen Compliance

This project involves replacing fish screens at three different diversions on lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Under this project, screens and associated infrastructure would be improved to bring all three intakes up to compliance with state and federal laws. This work would result in disturbances along the streambank and within Icicle Creek.

Potential impacts include increased risk of disturbance or harm from construction activities such as installation of a cofferdam, increased potential for harm from noise and vibration, increased risks of water quality impacts adversely affecting aquatic habitat, and temporary loss of aquatic habitat during dewatering for in-water construction. Depending on the location and extent of these activities and the number and type of fish or aquatic invertebrates likely to be affected, short-term impacts could be significant.

These types of activities would require authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to address these impacts (Section 4.7.7, Mitigation Measures).

Water Markets

There are no construction activities proposed under the Water Markets Project and therefore no potential short-term impacts on fish or aquatic invertebrates.

4.7.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from the affected lakes. Over the long-term the greatest potential for affecting fish and aquatic invertebrates would be related to changes in how the lakes are managed and the resulting changes in flows in lower Icicle Creek.

Under this project, the frequency in fluctuations in lake levels would increase compared to existing conditions because some portion of each lake would likely be drawn down every year instead of relying on draw down of only one or two lakes per year; however, the high and low lake water levels at the lakes would not change. Operation of the proposed project would also potentially result in less draw down at any one lake because releases would be spread across all lakes and releases would be optimized to meet instream and water supply needs in lower Icicle Creek. Lake level variation would largely remain within the same parameters as existing conditions.

Accumulation of organic inputs and nutrient cycles in the lakes that support the aquatic food web are not expected to substantially change as a result of re-operation of the lakes. Although lakes could be affected each year compared to every few years, the changes in

lake levels (e.g., highs and lows) would be consistent with existing operations and the current seasonal pattern of change.

Additional flows released from these lakes would also be more evenly spread out across receiving streams that flow into Icicle Creek and eventually the Wenatchee River. With more efficient operation of the lakes, flow releases to lower Icicle Creek could be better targeted to the periods when they are needed. In general, this would mean that there would be lower contributions to flows early in the season and there would be higher contributions, estimated at up to 30 cfs over 92 days, when flows are low later in the summer (Skalicky et. al. 2013).

The potential impacts associated with increased flows would generally be beneficial with respect to fish and aquatic invertebrates because flows would be returned to more natural conditions. The benefits are mainly associated with increasing aquatic habitat in lower Icicle Creek in the later summer months and improving fish passage to the upper reaches (above the Boulder Field at RM 5.6) of Icicle Creek and its tributaries. These benefits are generally anticipated to extend to any listed critical habitat and essential fish habitat within Icicle Creek and its tributaries and the Wenatchee River.

Rearing juvenile steelhead trout (*O. mykiss*) have been chosen to generally represent how flow changes are expected to affect aquatic habitat mainly because this species is present year-round when others are not and juvenile rainbow trout or steelhead have been observed in all reaches of Icicle Creek. Assuming that the full 30 cfs was achieved in late summer, the WUA per 1,000 linear feet of stream, a measure of aquatic habitat area, could increase by as much as 24 percent for juvenile steelhead in the historical channel (RM 3.9 to 2.7) compared to existing conditions (Skalicky et al., 2013). The historical channel currently experiences the lowest flows in Icicle Creek compared to other reaches downstream of RM 9 because of diversion of water from this reach for LNFH and irrigators, with an average of 63 cfs in September (IFC, 2016). Flow-habitat relationships have not been evaluated upstream of RM 9. Specific changes in the amount of available habitat resulting from this project would vary depending on the species, the month of the year, general flow conditions, and the affected stream reach; however, in general, increased flow in the late summer would correspond to increased aquatic habitat.

Because flow releases from the lakes would be better regulated in the spring and early summer months, it is not anticipated that additions from the lakes would exacerbate natural extreme high-flow conditions in spring and early summer. Instead of water from one or two lakes being released for the duration of the irrigation season and contributing to peak flows, releases would be controlled remotely and would occur only as needed to support continued irrigation withdrawals that might otherwise conflict with minimum instream flow targets intended to protect aquatic habitat.

Elevated flows in Icicle Creek are also expected to improve fish passage through obstructions in Icicle Creek during late summer and fall, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout (*S. confluentus*) by allowing

access to high quality habitat in the upper reaches of Icicle Creek. Potential impacts associated with improved fish passage can result in increased genetic mixing and increased competition between different species or distinct populations of the same species. These impacts are described in greater detail under Section 4.7.2.2, Long-term Impacts, Fish Passage Improvements; however, improving fish passage is generally considered to be beneficial overall.

There remains uncertainty around how the proposed patterns of release would affect resident fish in receiving tributaries immediately downstream of the lakes but upstream of Icicle Creek. Compared to existing conditions, all of these streams would receive water released from the lakes each year instead of every few years; however, the releases would likely be more intermittent compared to a steady release.

Increasing instream flows in downstream tributaries, including Icicle Creek, over the summer and fall could also alter the hydrology in areas in which upstream-migrating salmon currently tend to gather, which may alter the distribution pattern of fish and affect fishing opportunities on a localized basis. There is uncertainty at this time whether increasing instream flow would cause fish to distribute themselves more broadly or in different areas than they currently do. Potential impacts would be addressed in part by efforts to be completed under the Tribal Fishery Preservation and Enhancement Project as described in greater detail in Chapter 2.

As part of the overall Icicle Strategy, the Guiding Principles require flows to be managed to benefit aquatic species and minimize adverse impacts. An example of a strategy under consideration is prioritizing the timing of releases relative to potential impacts on downstream aquatic habitat. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.7.7, Mitigation Measures.

IPID Irrigation Efficiencies

In the long-term, the IPID Irrigation Efficiencies Project would contribute an estimated 10 cfs to instream flows in Reaches 2 through 5 and in the Wenatchee River to the point of historical return flows (approximately RM 5). Improving irrigation system efficiency is intended to benefit all fish in Icicle Creek, including ESA-listed spring-run Chinook salmon (*O. tshawytscha*), steelhead, and bull trout, by allowing more water to remain in the creek downstream of the IPID and COIC irrigation diversions from May through September.

Rearing juvenile steelhead have been chosen to generally represent how flow changes are expected to affect aquatic habitat mainly because this species is present year-round when others are not and juvenile rainbow trout or steelhead have been observed in all reaches of Icicle Creek. With respect to the IPID Irrigation Efficiencies, the WUA for juvenile steelhead could increase by as much as 9 percent in the historical channel. Implementation could increase habitat area in September and expand the benefit earlier in

the season in mid- to late July. Specific changes in availability of habitat resulting from this project would vary depending on the species, the month of the year, general flow conditions, and the affected stream reach; however, in general, increased flow in the later summer would correspond to increased habitat.

Elevated flows in Icicle Creek are also expected to improve fish passage through obstructions in Icicle Creek during summer, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout by allowing access to high-quality habitat in the upper reaches of Icicle Creek. Potential impacts associated with improved fish passage can result in increased genetic mixing and increased competition between different species or distinct populations of the same species. These potential impacts are described in greater detail under Section 4.7.2.2, Long-term Impacts, Fish Passage Improvements, but are generally considered to be beneficial overall.

As part of the overall Icicle Strategy, efforts to characterize the impacts of the managed flows on fish species are ongoing. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.7.7, Mitigation Measures.

COIC Irrigation Efficiencies and Pump Exchange

Under the COIC Irrigation Efficiencies and Pump Exchange Project, installing pipelines would occur in areas that have already been developed with irrigation infrastructure and would not result in long-term adverse impacts on fish from operation and maintenance activities. However, the COIC pump station would create a permanent change in the near-field hydraulics and levels of vibration on lower Icicle Creek or on the Wenatchee River, depending on where it is located. In addition, the new facilities would result in limited loss of riparian vegetation.

As noted in Section 4.8, Vegetation, compliance with applicable regulations would minimize the potential impacts on habitat and ecosystem functions and values associated with siting and operating the proposed facilities and would help reduce potential adverse impacts on fish and aquatic invertebrates. Overall, the new facilities are anticipated to represent a net benefit over the current facilities because they would be designed according to the current NMFS guidelines to ensure fish-friendly irrigation diversion operations, for example by providing intake screens that would be designed to prevent entrainment of juvenile fish.

Improving irrigation system efficiency and changing the location of the point of diversion is intended to benefit all fish in Icicle Creek, including ESA-listed spring-run Chinook salmon (*O. tshawytscha*), steelhead, and bull trout, by allowing more water to remain in the creek downstream of the current COIC irrigation diversions. In the long term, this project would contribute to beneficial increases in instream flows in Icicle Creek from RM 4.5 to its confluence with the Wenatchee River. Instream flow increases are expected to be between 8.0 cfs and 11.9 cfs.

Rearing juvenile steelhead have been chosen to generally represent how flow changes are expected to affect aquatic habitat mainly because this species is present year-round when others are not and juvenile rainbow trout or steelhead have been observed in all reaches of Icicle Creek. With respect to the COIC Irrigation Efficiencies and Pump Exchange Project, the WUA for juvenile steelhead could increase by as much as 17 percent in the historical channel. Specific changes in availability of habitat resulting from this project would vary depending on the species, the month of the year, general flow conditions, and the affected stream reach; however, in general, increased flow in the later summer would correspond to increased habitat.

Under existing conditions, water is diverted from Icicle Creek at the existing COIC/LNFH diversion at RM 4.5. Under average and low-flow conditions, withdrawals by COIC most typically result in an adverse impact on fish habitat. Extreme high-flow conditions that occur in spring and early summer may reduce habitat value for resident fish that must seek refuge from high velocity flows. An increase to instream flow during the early part of the irrigation season could contribute to a minor reduction in WUA of approximately 1 percent (Granger, 2017); however, this would present a negligible impact to fish that are already adapted to naturally elevated flow during this time of year. Additionally, the timing of increased flows would improve outmigration conditions for salmonids.

Elevated flows in Icicle Creek are also expected to improve fish passage through obstructions in Icicle Creek during summer, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout by allowing access to high-quality habitat in the upper reaches of Icicle Creek. Potential impacts associated with improved fish passage can result in increased genetic mixing and increased competition between different species or distinct populations of the same species. These impacts are described in greater detail under Section 4.7.2.2, Long-term Impacts, Fish Passage Improvements, but are generally considered to be beneficial overall.

As part of the overall Icicle Strategy, efforts to characterize the impacts of the managed flows on fish species are ongoing. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.7.7, Mitigation Measures.

Domestic Conservation Efficiencies

The implementation of the Domestic Conservation Efficiencies Project for the City of Leavenworth and rural users in the Icicle Creek Subbasin would not have a direct impact on fish populations or aquatic resources within Icicle Creek or the Wenatchee River. Water made available through domestic conservation upgrades would go to new domestic uses. This increased efficiency could reduce return flows from the City of Leavenworth, which would decrease flows in the Wenatchee River downstream of the Leavenworth Wastewater Treatment Plant. However, this decreased flow is expected to be minimal.

Eightmile Lake Storage Restoration

This project would result in the restoration of Eightmile Lake Dam to allow for storage of water in Eightmile Lake to the original spillway elevation (4,671 feet) and construction of an inflow pipeline that would facilitate draw down of the lake. These changes would provide the ability to store and release more water, consistent with historical operations at the lake and the volume allowed by the IPID water right (2,500 acre-feet). While the changes in the maximum lake level would be consistent with historical operations, this would represent a change compared to existing conditions as discussed further below. Over the long term, the greatest potential for impacts affecting fish and aquatic invertebrates would be related to the relative changes in lake levels and the resulting changes in flows in lower Icicle Creek.

With this project, the lake would be able to reach the restored height of 4,671 feet, allowing for 4 additional feet of storage compared to existing conditions. This means the surface area of the lake would be restored to cover approximately 3.6 additional acres, which would last for about 1 month in the early summer before IPID begins to draw down the lake. Under this project, the lake would also be able to be drawn down by an additional 22.4 feet compared to current operations, occurring in the late summer or early fall before natural precipitation and runoff begin to recharge the lake.

Compared with existing conditions, re-operation of the lake area would result in an increase in habitat for resident fish in the early summer and a decrease in late summer. The extent of the decrease in aquatic habitat would depend on how far the lake is drawn down each year.

During draw down, shallow water areas would become disconnected from shorelines that have more vegetation and wood accumulation. This would reduce the area available for cover and foraging, although deeper water refugia towards the center of the lake would remain. As noted previously, productivity of the Alpine Lakes is low and the ability to support existing fish populations is also likely to be low. Over time, reductions in habitat area could further reduce the capacity of the lakes to support existing trout populations.

Restoration of the dam would also result in the ability to release up to 9.5 additional cfs from the lake relative to existing conditions. Increased flows would be released from the dam into Eightmile Creek, which flows into Icicle Creek. Increased flows would occur from the point of release at Eightmile Lake Dam down to the IPID diversion at RM 5.7.

The potential impacts associated with increased flows would generally be beneficial with respect to fish and aquatic invertebrates. The benefits are mainly associated with increasing aquatic habitat in lower Icicle Creek in the later summer months and improving fish passage to the upper reaches (above the Boulder Field at RM 5.6) of Icicle Creek and its tributaries.

Rearing juvenile steelhead have been chosen to generally represent how flow changes are expected to affect aquatic habitat mainly because this species is present year-round when

others are not and juvenile rainbow trout or steelhead have been observed in all reaches of Icicle Creek. Assuming that a full 12.6 cfs is achieved in late summer, the WUA per 1,000 linear feet of stream could increase by as much as 9 percent for juvenile steelhead in the historical channel. Specific changes in availability of habitat resulting from this project would vary depending on the species, the month of the year, general flow conditions, and the affected stream reach; however, in general, increased flow in the later summer would correspond to increased habitat.

Elevated flows in Icicle Creek are also expected to improve fish passage through obstructions in Icicle Creek during late summer and fall, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout by allowing access to high-quality habitat in the upper reaches of Icicle Creek. Potential impacts associated with improved fish passage can result in increased genetic mixing and increased competition between different species or distinct populations of the same species. These impacts are described in greater detail under Section 4.7.2.2, Long-term Impacts, Fish Passage Improvements; however, improving fish passage is generally considered to be beneficial overall.

There remains uncertainty around how the proposed patterns of release would affect resident fish in receiving tributaries immediately downstream of the lakes but upstream of Icicle Creek. Compared to existing conditions, all of these streams would receive water released from the lakes each year instead of every few years; however, the releases would likely be more intermittent compared to a steady release.

Increasing instream flows in downstream tributaries, including Icicle Creek, over the summer and fall could also alter the hydrology in areas in which upstream-migrating salmon currently tend to gather, which may alter the distribution pattern of fish and affect fishing opportunities on a localized basis. There is uncertainty at this time whether increasing instream flow would cause fish to distribute themselves more broadly or in different areas than they currently do. Potential impacts would be addressed in part by efforts to be completed under the Tribal Fishery Preservation and Enhancement Project as described in greater detail in Chapter 2.

As part of the overall Icicle Strategy, the Guiding Principles require flows to be managed to benefit aquatic species and minimize adverse impacts. An example of a strategy under consideration is prioritizing the timing of releases relative to potential impacts on downstream aquatic habitat. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.7.7, Mitigation Measures.

Tribal Fishery Preservation and Enhancement

The intent of the Tribal Fishery Preservation and Enhancement Project is to ensure that other projects implemented as part of the Icicle Strategy do not have negative effects on tribal fisheries and tribal treaty and federally protected harvest rights. As noted in Section 3.23, Indian Trust Assets and Fishing Harvest, tribal harvest targets unlisted Carson-stock

spring-run Chinook salmon and coho salmon (*O. kisutch*) returning to LNFH, with Usual and Accustomed fishing areas adjacent to and downstream of LNFH. Currently, the plunge pool immediately downstream of the LNFH Hatchery Channel spillway is a popular harvest area where fish returning to LNFH tend to collect. Hatchery-reared salmon find refuge in the deep scour pool and turbulent conditions created by large volumes of water spilling out of the Hatchery Channel.

Over the long term, this project would result in long-term benefits to fish and fish habitat that are primarily related to restoration actions to ensure that overall fish populations or fishing conditions are not adversely affected by the Icicle Strategy. These improvements are likely to increase the useable area for all fishes in the affected areas, improving conditions for LNFH-reared salmon that are targeted in fisheries, as well as leading to increases in the numbers of other native fish.

Habitat Protection and Enhancement

As noted previously, this project is intended to result in long-term improvements in habitat and ecosystem functions and values that would be beneficial to fish and aquatic invertebrates. As noted above, any work within sensitive areas would require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts, such as compensating for the permanent loss of any sensitive areas (Section 4.7.7, Mitigation Measures). These requirements would be developed once project-specific details are available.

Instream Flow Rule Amendment

Under the Instream Flow Rule Amendment Project, the Icicle Creek Reserve established under Chapter 173-545 WAC would be increased by 0.4 cfs. Over the long term, this amendment would ultimately result in the removal of 0.4 cfs from Icicle Creek annually, which could adversely affect water quantity and quality in portions of Icicle Creek and thus could adversely affect dependent fish and aquatic invertebrates. No instream flow reduction would occur in the Wenatchee River because this project would move 0.4 cfs out of the Wenatchee River Reserve.

Potential impacts associated with the Instream Flow Rule Amendment are anticipated to be offset by the implementation of required instream flow and habitat restoration actions under this Program Alternative, as well as several other projects associated with Alternative 1.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

Over the long term, LNFH Conservation and Water Quality improvements are intended to benefit fish reared at LNFH and resident fish that use Icicle Creek. A BiOp was issued by NMFS in 2015 and included recommendations that would improve the sustainability of LNFH to support production of spring-run Chinook salmon and protect wild salmon

and trout listed under the ESA, including Wenatchee stock spring-run Chinook salmon, Wenatchee stock summer-run steelhead, and bull trout. This project would bring LNFH in compliance with guidelines established in the 2015 BiOp to protect wild and hatchery fish in Icicle Creek. These improvements would likely occur under the No-action Alternative; however, inclusion of this project within the Icicle Strategy would allow for coordination of LNFH projects with other IWG projects, maximizing and potentially expediting the benefits for fish in Icicle Creek.

Salmon reared in the LNFH would benefit from more reliable operations and upgraded facilities. Resident and migratory fish that use Icicle Creek would experience habitat benefits related to improvements in water quality from effluent treatment actions and in-water quantity from water use efficiency actions.

It is estimated that water use efficiency improvements could conserve up to 20 cfs depending on the specific measures put in place. The amount conserved would remain in Icicle Creek and would contribute to increased instream flows between the LNFH diversion at RM 4.5 and the hatchery water return at RM 2.5.

Fish and aquatic invertebrates would generally benefit from these increases. Major focal fish that would be affected include adult steelhead spawning, adult and juvenile steelhead migration, bull trout migration, and lamprey migration. The historical channel may provide some incubation and rearing to steelhead; however, these activities are less common under the current condition. Other fish uses that could be affected after flow is increased in the historical channel are bull trout rearing; rainbow trout rearing; coho spawning; and spring-run Chinook salmon, summer-run Chinook salmon, mountain whitefish (*Prosopium williamsoni*), largescale sucker (*Catostomus macrocheilus*), and bridgelip sucker (*C. columbianus*) spawning and rearing. Specific changes in habitat resulting from this project would vary depending on the species, the month of the year, general flow conditions, and the affected stream reach; however, in general, increased flow in the later summer would correspond to increased habitat.

Because this facility is owned by Reclamation and operated by the USFWS, an evaluation of the potential impacts under NEPA would be completed once the full scope of the project is determined. Compliance with applicable local, state, and federal regulations would further address any potentially significant impacts on fish and aquatic invertebrates. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and no net loss of ecological functions and values (Section 4.7.7, Mitigation Measures).

Fish Passage Improvements

Although the details of the Fish Passage Improvements Project are not yet determined, in general, the intent is to improve fish passage to the upper reaches of Icicle Creek. As noted in Section 3.7, Fish, while fish passage above LNFH does occur under some flow conditions, it is generally considered to be limited, particularly above the Boulder Field at RM 5.6. Currently, low numbers of anadromous steelhead and Chinook salmon can pass

through the Boulder Field; biologists recently observed two redds, and one juvenile anadromous Chinook salmon was observed upstream of the Boulder Field (WDFW, 2016). It is unlikely that coho salmon (*O. kisutch*) can ascend the Boulder Field.

Opening a large area (over 20 miles) of relatively high quality habitat upstream of these barriers is expected to result in overall benefits to native stocks of anadromous fish, including ESA-listed upper Columbia spring-run Chinook, upper Columbia summer-run steelhead, as well as unlisted summer-run Chinook and reintroduced coho salmon. The upper Icicle Creek is relatively productive. For example, the habitat supports approximately 480 resident rainbow trout per kilometer that are between 4 to 12 inches in size that grow well as juveniles (Gayeski, 2015). These observations and modeled habitat potential suggest that improving passage in upper and lower Icicle Creek would greatly increase the capacity of habitat to sustain greater numbers of anadromous fish and generally contribute to an increase in these populations.

In addition, anadromous adults returning farther upstream from the ocean would spawn, die, and decay in the upper watershed where they were previously not able to reach in large numbers. They would bring large amounts of marine-derived nutrients to this area, generally providing benefits that have been absent from this system. The delivery of marine-derived nutrients by salmon carcasses is a natural process that supports food-webs and enhances riparian forest growth in Pacific Northwest streams. However, this process would also increase the potential for water-borne pathogens to be brought upstream by spawning salmon and steelhead. Diseases transmitted by these fish could negatively affect other resident salmonids, including rainbow trout, westslope cutthroat trout (*O. clarki lewisi*), and bull trout, as well as fish at the LNFH.

If productivity in these upper reaches is limited by suitable spawning and rearing habitats, nutrients, and food availability, competition between anadromous and resident fish for resources may reduce productivity for resident populations, including rainbow trout and bull trout, while increasing productivity of anadromous stocks. In addition, large subadult and adult bull trout are known to be effective predators on juvenile fish. More abundant anadromous juvenile salmon and steelhead may benefit the bull trout that prey on them, but anadromous stocks attempting to recolonize the upper watershed may be limited by the resident bull trout population.

Mixing of resident fish with anadromous fish may also contribute to some hybridization. It is possible that previously isolated rainbow trout could spawn with migratory steelhead, changing the genetic makeup of *O. mykiss* groups in the upper watershed. Whether a change in genetic diversity would ultimately benefit *O. mykiss* or reduce their ability to adapt to diverse conditions in the upper watershed is unknown.

Depending on how Structures 2 and 5 near LNFH are operated, there is a potential for fish passage improvements at LNFH to adversely affect fish distribution that supports fishing, particularly tribal fishing that occurs at the LNFH plunge pool. This could occur because, depending on the timing of how fish passage near LNFH is managed, some additional fish

could be allowed or encouraged to move into the historical channel away from the plunge pool. There are also concerns that changing flows as the result of changes in operation of Structure 2 may result in conditions where fish are no longer attracted to or congregate in the plunge pool.

Currently, passage through Structure 5 is limited in spring and early summer during periods of broodstock collection (mid-May through June) to capture and prevent passage of hatchery fish to areas farther upstream. If Structure 5 is opened after broodstock collection goals are met to improve overall fish passage, some later-arriving LNFH spring-run Chinook salmon may stray into the historical channel and into the upstream reaches, away from typical tribal harvest areas. USFWS coordinates with WDFW, NMFS, the Confederated Tribes and Bands of the Yakama Nation, and the Confederated Tribes of the Colville Reservation on the timing of the adjustments for broodstock collection to minimize potential impacts on tribal fishing. This would continue as part of the development of this project.

In addition, if adjustments are made at Structure 2 to redirect flows into the historical channel to restore habitat for fish, the resulting reduction in flow to the Hatchery Channel may reduce attraction flow to the plunge pool near the hatchery ladder compared to the existing operations. However, recently, when no adjustments were made to divert water to the Hatchery Channel at Structure 2, no significant straying of hatchery origin spring-run Chinook salmon into the historical channel was observed and no noticeable loss of fishing opportunities was observed (Anglin, 2013). Implementation of activities as part of the Tribal Fishery Preservation and Enhancement Project would further help to ensure there are no significant impacts on tribal fishing.

As noted previously, this project would require compliance with various local, state, and federal regulations, including CWA and ESA compliance. If needed, additional mitigation measures would be developed during project-level permitting to minimize potentially significant adverse impacts as discussed in Section 4.7.7, Mitigation Measures.

Fish Screen Compliance

The Fish Screen Compliance Project involves replacing fish screens at three different diversions on lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Under this project, screens and associated infrastructure would be improved to bring all three intakes up to compliance with state and federal laws.

Improvements to fish screens are intended to provide a long-term benefit to fish. Under existing conditions, juvenile steelhead, rainbow trout, and bull trout have been entrained at these locations. For example, from 2009 and 2013, the number of *O. mykiss* removed from the LNFH water intake system ranged from 30 to 63 per year (excluding winter and spring months because of ice and debris buildup) (Hall et al., 2014). From 2005 to 2013, a total of 31 subadult bull trout or bull trout/brook trout hybrids were entrained and sampled for genetic analysis. With this project, these impacts would be reduced and would likely benefit other native aquatic species that could become entrained.

Water Markets

The implementation of Water Markets would not have a direct impact on fish populations or aquatic resources within Icicle Creek or the Wenatchee River. Fish may benefit indirectly over time from more efficient allocation and better reliability of the water supply for agricultural uses and allowing for the protection of instream flows for fish.

4.7.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would also be included while the Alpine Lakes Optimization, Modernization, and Automation project would not. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Other projects proposed under this Alternative are discussed under Alternative 1. In addition, consistent with the Guiding Principles, the selection of projects under this Program Alternative would seek to meet minimum instream flow targets and generally improve aquatic habitat.

4.7.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction activities associated with this project include construction of new IPID Dryden Pump Exchange facilities. Short-term impacts that could adversely affect fish and aquatic invertebrates include direct disturbance associated with work near or in water and any associated temporary impacts on aquatic habitat.

Construction of these facilities would require in-water work along the Wenatchee River, which has the potential to adversely affect fish and aquatic invertebrates. Potential short-term impacts would occur mainly as a result of work in or within close proximity to water. Potential impacts include increased risk of disturbance or harm from construction activities, including exclusion of these species from in-water work areas, increased potential for harm from noise and vibration, increased risks of water quality impacts adversely affecting aquatic habitat, and temporary loss of aquatic habitat during dewatering for in-water construction. Depending on the location and extent of these activities and the number and type of fish or aquatic invertebrates likely to be affected, short-term impacts could be significant.

Work within waters of the United States or State, which includes the Wenatchee River, would require a CWA Section 404 Permit and associated Section 401 Water Quality Certification. Compliance with applicable local, state, and federal regulations would require implementation of BMPs and if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include limiting in-water work, excluding aquatic species from in-water work areas, and implementing construction timing restrictions (Section 4.7.7, Mitigation Measures.

4.7.3.2 Long-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project would create a permanent change in the near-field hydraulics and levels of noise and vibration on the Wenatchee River, depending on where the pump station is located. In addition, the new facilities would result in the loss of some riparian vegetation. However, as noted above, compliance with applicable regulations would minimize the potential impacts on habitat and ecosystem functions and values associated with siting and operating the proposed facilities. This would help to reduce potential adverse impacts on fish and aquatic invertebrates in the long term.

Generally speaking, the overall impacts associated with this project are expected to be beneficial because instream flows would increase between the current IPID diversion (RM 5.7) and the new pump station location on the Wenatchee River. The benefit could be as much as 25 cfs in the late summer compared to the existing condition.

This project is intended to benefit all fish in Icicle Creek, including ESA-listed spring-run Chinook salmon, steelhead, and bull trout, by replacing diversions from Icicle Creek with water pumped to irrigation canals from the Wenatchee River. Increased flows in Icicle Creek would likely improve fish passage through obstructions in Icicle Creek during summer, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout by allowing access to high-quality habitat in the upper reaches of Icicle Creek.

Rearing juvenile steelhead have been chosen to generally represent how flow changes are expected to affect aquatic habitat mainly because this species is present year-round when others are not. Assuming that a full 25 cfs is achieved in late summer, the WUA per 1,000 linear feet of stream could increase by approximately 29 percent in the historical channel. Specific changes in habitat resulting from this project would vary depending on the species, the month of the year, general flow conditions, and the affected stream reach; however, in general, increased flow in the later summer would correspond to increased habitat.

The IPID Dryden Pump Exchange Project would also allow more water to remain in Peshastin Creek, which is a smaller tributary to the Wenatchee River where late summer low flows impact fish passage and habitat below the PID Diversion below RM 2.4. The project would benefit native fish in Peshastin Creek with relatively small additional adverse impact to fish in the Wenatchee River.

Elevated flows in Icicle Creek are also expected to improve fish passage through obstructions in Icicle Creek during summer, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout by allowing access to high-quality habitat in the upper reaches of Icicle Creek. Potential impacts associated with improved fish passage could result in increased genetic mixing and increased competition between different species or distinct populations of the same species. These impacts are described

in greater detail under Section 4.7.2.2, Long-term Impacts, Fish Passage Improvements, but are generally considered to be beneficial overall.

As part of the overall Icicle Strategy, efforts to characterize the impacts of the managed flows on fish species are ongoing. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.7.7, Mitigation Measures.

4.7.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 Project would also be included while the Eightmile Lake Storage Restoration Project would not. This section describes the specific short- and long-term impacts associated with the legislative change project. Other proposed projects under Alternative 3 can be reviewed in Alternative 1 and Alternative 2. Consistent with the Guiding Principles, the selection of projects under this Program Alternative would seek to meet minimum instream flow targets and generally improve aquatic habitat.

4.7.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

There are no construction activities proposed under this project and therefore no potential short-term impacts on fish or aquatic invertebrates.

4.7.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

If the proposed Legislative Change Creating OCPI Authority Project were enacted to allow impacts on the Instream Flow Rule when out-of-time mitigation where not available, there could be potential conflicts with instream flow allocations that could adversely affect fish and aquatic invertebrates. Under the proposed changes, junior domestic water rights could be exercised even when the Instream Flow Rule is not met, resulting in potential adverse impacts on riparian vegetation and any associated wetlands because of low-flow conditions.

4.7.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1. The Eightmile Lake Storage Restoration Project would be replaced with the Eightmile Lake Storage Enhancement Project. The Upper Klonaqua and Upper and Lower Snow Lakes Storage Enhancement Projects would also be included. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative. In addition, consistent with the

Guiding Principles, the selection of projects under this Program Alternative would seek to meet minimum instream flow targets and generally improve aquatic habitat.

4.7.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

As noted previously, there are no native populations of fish in the Alpine Lakes; however, some remnant fish associated with past recreational stocking activities remain, most likely cutthroat trout, rainbow trout, and lake trout. Construction activities have the potential to adversely affect these species, depending on the extent of the activity.

Construction activities would occur primarily in the dry lake margins in the later summer when the lake is drawn down. As discussed in Section 4.5, Water Quality, construction is not anticipated to result in significant water quality impacts and would therefore not be expected to adversely affect fish or aquatic invertebrates. However, construction activities would result in increased noise that could affect these species, depending on the type of activity and whether these species were located in close proximity.

As noted in Section 4.14, Noise, the majority of construction activities would result in relatively minor noise increases and normal fish behavior such as foraging or use of refuge areas within the lakes is not likely to be adversely affected because fish would be able to move to other areas of the lake during construction. However, construction could involve some blasting. Blasting can directly harm fish and aquatic invertebrates from increased noise and vibration. Depending on the species that may be within close proximity when blasting occurs, there is a potential for those species to be affected.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include limiting in-water work, excluding aquatic species from in-water work areas, and implementing construction timing restrictions (Section 4.7.7, Mitigation Measures).

Upper Klonaqua Lake Storage Enhancement

The potential impacts on fish and aquatic invertebrates during construction would be similar to those that would occur related to the Eightmile Lake Storage Enhancement Project (Section 4.7.5.1, Short-term Impacts). As noted previously, there are no native populations of fish in the Alpine Lakes; however, some remnant fish associated with past recreational stocking activities remain, most likely cutthroat trout, rainbow trout, and lake trout. Construction activities have the potential to adversely affect these species, depending on the extent of the activity.

Construction activities would occur primarily in the dry lake margins in the later summer when the lake is drawn down. As discussed in Section 4.5, Water Quality, construction is not anticipated to result in significant water quality impacts and would therefore not be expected to adversely affect fish or aquatic invertebrates. However, construction

activities would result in increased noise that could affect these species, depending on the type of activity and whether these species were located in close proximity.

As noted in Section 4.14, Noise, the majority of construction activities would result in relatively minor noise increases and normal fish behavior such as foraging or use of refuge areas within the lakes is not likely to be adversely affected because fish would be able to move to other areas of the lake. However, construction could involve some blasting. Blasting can directly harm fish and aquatic invertebrates from increased noise and vibration. Depending on the species that may be within close proximity when blasting occurs, there is a potential for those species to be affected.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include limiting in-water work, excluding aquatic species from in-water work areas, and implementing construction timing restrictions (Section 4.7.7, Mitigation Measures).

Upper and Lower Snow Lakes Storage Enhancement

The potential impacts on fish and aquatic invertebrates during construction would be similar to those that would occur related to the Eightmile Lake Storage Enhancement Project (Section 4.7.5.1, Short-term Impacts). There would be limited in-water work and no permanent loss of aquatic habitat.

Construction activities would occur primarily in the dry lake margins in the later summer when the lake is drawn down. As discussed in Section 4.5, Water Quality, potential short-term impacts on water quality would not be significant and are not expected to adversely affect fish or aquatic invertebrates in the short term. However, construction activities would also result in increased noise that could adversely affect fish and other aquatic species.

As noted in Section 4.14, Noise, the majority of construction activities would result in relatively minor noise increases and normal fish behavior such as foraging or use of refuge areas within the lakes is not likely to be adversely affected because fish would be able to move to other areas of the lake during construction. Construction could involve some blasting. Blasting can directly harm fish and aquatic invertebrates from increased noise and vibration. Depending on the species that may be within close proximity when blasting occurs, there is a potential for those species to be affected.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include limiting in-water work, excluding aquatic species from in-water work areas, and implementing construction timing restrictions (Section 4.7.7, Mitigation Measures).

4.7.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would involve demolition of the existing structure and construction of a taller dam at Eightmile Lake (spillway elevation of 4,682 feet), and construction of an inflow pipeline that would facilitate draw down of the lake. These changes would provide the ability to store and release more water (up to 3,500 acre-feet), which would represent an increase over the historical operation and the volume currently allowed by the IPID water right (up to 2,500 acre-feet). It would also represent a change compared to existing conditions and the No-action Alternative as discussed further below. Over the long term, the greatest potential for impacts affecting fish and aquatic invertebrates would be related to the relative changes in lake levels and the resulting changes in flows in lower Icicle Creek.

Under this project, the lake would be able to reach a new maximum height of 4,682 feet for 11 additional feet of storage compared to existing conditions. This means the surface area of the lake would be restored to cover approximately 13.6 additional acres, which would last for about 1 month in the early summer before IPID begins to draw down the lake. Under this project the lake would also be able to be drawn down by an additional 24.4 feet, occurring in the late summer or early fall before natural precipitation began to recharge the lake.

Compared with existing conditions, re-operation of the lake area would result in an increase in habitat for resident fish in the early summer and a decrease in late summer. The extent of the decrease in aquatic habitat would depend on how far the lake is drawn down each year.

During draw down, shallow water areas would become disconnected from shorelines that have more vegetation and wood accumulation. This would reduce the area available for cover and foraging, although deeper water refugia toward the center of the lake would remain. As noted previously, productivity of the Alpine Lakes is low and the ability to support existing fish populations is also likely to be low. Over time, reductions in habitat area could further reduce the capacity of lakes to support existing trout populations.

Restoration of the dam would also result in the ability to release up to an additional 17.9 cfs from the lake relative to existing conditions. Increased flows would be released from the dam into Eightmile Creek, which flows into Icicle Creek. Increased flows would occur from the point of release at Eightmile Lake Dam down to the IPID diversion at RM 5.7.

The potential impacts associated with increased flows would generally be beneficial with respect to fish and aquatic invertebrates. The benefits are mainly associated with increasing aquatic habitat in lower Icicle Creek in the later summer months and improving fish passage to the upper reaches (above the Boulder Field at RM 5.6) of Icicle Creek and its tributaries.

Specific changes in habitat resulting from this project would vary depending on the species, the month of the year, general flow conditions, and the affected stream reach; however, in general, increased flow in the later summer would correspond to increased aquatic habitat.

Elevated flows in Icicle Creek are also expected to improve fish passage through obstructions in Icicle Creek during late summer and fall, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout by allowing access to high-quality habitat in the upper reaches of Icicle Creek. Potential impacts associated with improved fish passage can result in increased genetic mixing and increased competition between different species or distinct populations of the same species. These impacts are described in greater detail under Section 4.7.2.2, Long-term Impacts, Fish Passage Improvements; however, improving fish passage is generally considered to be beneficial overall.

There remains uncertainty around how the proposed patterns of release would affect resident fish in receiving tributaries immediately downstream of the lakes but upstream of Icicle Creek. Compared to existing conditions, all of these streams would receive water released from the lakes each year instead of every few years; however, the releases would likely be more intermittent compared to a steady release.

Increasing instream flows in downstream tributaries, including Icicle Creek, over the summer and fall could also alter the hydrology in areas in which upstream-migrating salmon currently tend to gather, which could alter the distribution pattern of fish and affect fishing opportunities on a localized basis. There is uncertainty at this time whether increasing instream flow would cause fish to distribute themselves more broadly or in different areas than they currently do. Potential impacts would be addressed in part by efforts to be completed under the Tribal Fishery Preservation and Enhancement Project as described in greater detail in Chapter 2.

As part of the overall Icicle Strategy, the Guiding Principles require flows to be managed to benefit aquatic species and minimize adverse impacts. An example of a strategy under consideration is prioritizing the timing of releases relative to potential impacts on downstream aquatic habitat. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.7.7, Mitigation Measures.

Upper Klonaqua Lake Storage Enhancement

The Upper Klonaqua Lake Storage Enhancement Project would result in similar long-term impacts on fish and aquatic invertebrate as the Eightmile Lake Storage Enhancement Project (4.7.5.2, Long-term Impacts). This would provide the ability to store and release additional flows from Upper Klonaqua Lake, which would represent a change compared to existing conditions and the No-action Alternative as discussed further below. Over the long term, the greatest potential for impacts affecting fish and

aquatic invertebrates would be related to the relative changes in lake levels and the resulting changes in flows in lower Icicle Creek.

The new high lake level in Upper Klonaqua Lake would not change. The lake would still refill and outlet naturally through an existing channel to Lower Klonaqua Lake during most of the year. However, the new facilities would allow for the lake to be drawn down an additional 20 feet to allow for access to an additional 1,146 acre-feet of storage. The draw down would likely occur over a couple of months in the late summer.

Compared with existing conditions, this project would result in an increase in habitat for any resident fish in the Upper Lake in the early summer and a decrease in late summer. The extent of the decrease in aquatic habitat would depend on how far the lake is drawn down each year.

During draw down, shallow water areas would become disconnected from shorelines that have more vegetation and wood accumulation. This would reduce the area available for cover and foraging, although deeper water refugia towards the center of the lake would remain. As noted previously, productivity of the Alpine Lakes is low and the ability to support existing fish populations is also likely to be low. Over time, reductions in habitat area could further reduce the capacity of the lakes to support existing trout populations.

Modifications at Upper Klonaqua Lake would also result in the ability to release up to an additional 5 to 20 cfs from the lake. Increased flows would be released from the dam into downstream tributaries, which flow into Icicle Creek. Increased flows would occur from the point of release at Klonaqua Dam down to the IPID diversion at RM 5.7.

The potential impacts associated with increased flows would generally be beneficial with respect to fish and aquatic invertebrates. The benefits are mainly associated with increasing aquatic habitat in lower Icicle Creek in the later summer months and improving fish passage to the upper reaches (above the Boulder Field at RM 5.6) of Icicle Creek and its tributaries.

Specific changes in habitat resulting from this project would vary depending on the species, the month of the year, general flow conditions, and the affected stream reach; however, in general, increased flow in the later summer would correspond to increased aquatic habitat.

Elevated flows in Icicle Creek are also expected to improve fish passage through obstructions in Icicle Creek during late summer and fall, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout by allowing access to high-quality habitat in the upper reaches of Icicle Creek. Potential impacts associated with improved fish passage can result in increased genetic mixing and increased competition between different species or distinct populations of the same species. These impacts are described in greater detail under Section 4.7.2.2, Long-term Impacts, Fish Passage Improvements; however, improving fish passage is generally considered to be beneficial overall.

There remains uncertainty around how the proposed patterns of release would affect resident fish in receiving tributaries immediately downstream of the lakes but upstream of Icicle Creek. Compared to existing conditions, all of these streams would receive water released from the lakes each year instead of every few years; however, the releases would likely be more intermittent compared to a steady release.

Increasing instream flows in downstream tributaries, including Icicle Creek, over the summer and fall could also alter the hydrology in areas in which upstream-migrating salmon currently tend to gather, which could alter the distribution pattern of fish and affect fishing opportunities on a localized basis. There is uncertainty at this time whether increasing instream flow would cause fish to distribute themselves more broadly or in different areas than they currently do. Potential impacts would be addressed in part by efforts to be completed under the Tribal Fishery Preservation and Enhancement Project as described in greater detail in Chapter 2.

As part of the overall Icicle Strategy, the Guiding Principles require flows to be managed to benefit aquatic species and minimize adverse impacts. An example of a strategy under consideration is prioritizing the timing of releases relative to potential impacts on downstream aquatic habitat. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.7.7, Mitigation Measures.

Upper and Lower Snow Lakes Storage Enhancement

The Upper and Lower Snow Lakes Storage Enhancement Project would result in similar long-term impacts on fish and aquatic invertebrates as the Eightmile Lake Storage Enhancement Project (4.7.5.2, Long-term Impacts). This project would provide the ability to store and release additional flows at the lake, which would represent a change compared to existing conditions and the No-action Alternative as discussed further below. Over the long term, the greatest potential for impacts affecting fish and aquatic invertebrates would be related to the relative changes in lake levels and the resulting changes in flows in lower Icicle Creek.

The proposed enhancement project would increase the high-water storage levels in both Upper and Lower Snow Lakes by 5 feet compared with existing high levels. This change would result in the inundation of some upland vegetation that has grown along the shoreline areas between the current and proposed high lake levels, and would most likely occur in the fall through the early summer when releases would be likely to begin. The project would also allow for the Lower Snow Lake to be drawn down 3 feet below the current lake level, which would result in the exposure of slightly more lake bed.

Compared with existing conditions, this project would result in an increase in habitat for resident fish in the early summer and a decrease in late summer. The extent of the decrease in aquatic habitat would depend on how far the lake is drawn down each year.

During draw down, shallow water areas would become disconnected from shorelines that have more vegetation and wood accumulation. This would reduce the area available for cover and foraging, although deeper water refugia towards the center of the lake would remain. As noted previously, productivity of the Alpine Lakes is low and the ability to support existing fish populations is also likely to be low. Over time, reductions in habitat area could further reduce the capacity of lakes to support existing trout populations.

Restoration of the dams at Upper and Lower Snow Lakes would result in the ability to release up to an additional 9 to 18 cfs from the lake. Increased flows would be released from the Lower Snow Lake Dam or from the Upper Snow Lake release valve through Nada Lake to Snow Creek, which flows into Icicle Creek. Increased flows would occur from the point of release down to the IPID diversion at RM 5.7.

The potential impacts associated with increased flows would generally be beneficial with respect to fish and aquatic invertebrates. The benefits are mainly associated with increasing aquatic habitat in lower Icicle Creek in the later summer months and improving fish passage to the upper reaches (above the Boulder Field at RM 5.6) of Icicle Creek and its tributaries.

Specific changes in habitat resulting from this project would vary depending on the species, the month of the year, general flow conditions, and the affected stream reach; however, in general, increased flow in the late summer would correspond to increased aquatic habitat.

Elevated flows in Icicle Creek are also expected to improve fish passage through obstructions in Icicle Creek during late summer and fall, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout by allowing access to high-quality habitat in the upper reaches of Icicle Creek. Potential impacts associated with improved fish passage can result in increased genetic mixing and increased competition between different species or distinct populations of the same species. These impacts are described in greater detail under Section 4.7.2.2, Long-term Impacts, Fish Passage Improvements; however, improving fish passage is generally considered to be beneficial overall.

There remains uncertainty around how the proposed patterns of release would affect resident fish in receiving tributaries immediately downstream of the lakes but upstream of Icicle Creek. Compared to existing conditions, all of these streams would receive water released from the lakes each year instead of every few years; however, the releases would likely be more intermittent compared to a steady release.

Increasing instream flows in downstream tributaries, including Icicle Creek, over the summer and fall could also alter the hydrology in areas in which upstream-migrating salmon currently tend to gather, which may alter the distribution pattern of fish and affect fishing opportunities on a localized basis. There is uncertainty at this time whether increasing instream flow would cause fish to distribute themselves more broadly or in different areas than they currently do. Potential impacts would be addressed in part by

efforts to be completed under the Tribal Fishery Preservation and Enhancement Project as described in greater detail in Chapter 2.

As part of the overall Icicle Strategy, the Guiding Principles require flows to be managed to benefit aquatic species and minimize adverse impacts. An example of a strategy under consideration is prioritizing the timing of releases relative to potential impacts on downstream aquatic habitat. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.7.7, Mitigation Measures.

4.7.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Station Project would be included.

4.7.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange Project

This IPID Full Piping and Pump Exchange project would involve fully converting the IPID delivery systems to pressurized pipelines, removing or abandoning the existing intakes on Icicle and Peshastin Creeks, and constructing three new pump stations and screened intakes on the Wenatchee River. Short-term impacts that could adversely affect fish and aquatic invertebrates include direct disturbance associated with work near or in water and any associated temporary impacts on aquatic habitat.

Work affecting the delivery system is unlikely to adversely affect fish because it would be done in the dry during the off-season when the irrigation canals are dry, and away from where these species may be found. As noted in Section 4.5, Water Quality, there would also be relatively limited potential for water quality impacts that could adversely affect aquatic habitat related to these activities.

Removal of the existing intake structures and construction of the pump stations and new intakes would require in-water work along lower Icicle and Peshastin Creeks and the Wenatchee River. These activities have a higher potential to adversely affect fish and aquatic invertebrates. Potential impacts associated with intake removal could include increased risk of disturbance, depending on the type of equipment and extent of the work along the shoreline or within the creeks. Construction of the new pump stations and associated facilities could also result in increased risk of disturbance or harm from construction activities such as from installation of a cofferdam, increased potential for harm from noise and vibration, increased risks of water quality impacts adversely affecting aquatic habitat, and temporary loss of aquatic habitat during dewatering for in water construction. Depending on the location and extent of these activities and the

number and type of fish or aquatic invertebrates likely to be affected, short-term impacts could be significant.

Work within waters of the United States or State of Washington or within irrigation canals or spillways that reconnect to these waters would require a CWA Section 404 Permit and associated Section 401 Water Quality Certification; work in other portions of the irrigation system could require local review and authorization.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include limiting in-water work, excluding aquatic species from in-water work areas, and implementing construction timing restrictions (Section 4.7.7, Mitigation Measures).

4.7.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange Project

Under this project, installing pipelines would occur in areas that have already been developed with irrigation infrastructure and would not result in long-term adverse impacts on fish from operation and maintenance activities. However, the new pump stations and associated facilities would create a permanent change in the near-field hydraulics and levels of vibration on the Wenatchee River at the three proposed locations. In addition, the new facilities would result in limited loss of riparian vegetation.

Generally speaking, the overall impacts associated with this project are expected to be beneficial because instream flows would increase between the current IPID diversion (RM 5.7) and the new pump station locations on the Wenatchee River. The benefit could be as much as 117 cfs in the late summer compared to the existing condition.

This project is intended to benefit all fish in Icicle Creek, including ESA-listed spring-run Chinook salmon, steelhead, and bull trout, by replacing diversions from Icicle Creek with water pumped to irrigation canals from the Wenatchee River. Increased flows in Icicle Creek would likely improve fish passage through obstructions in Icicle Creek during summer, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout by allowing access to high-quality habitat in the upper reaches of Icicle Creek.

Rearing juvenile steelhead have been chosen to generally represent how flow changes are expected to affect aquatic habitat mainly because this species is present year-round when others are not. Assuming that a full 117 cfs is achieved in late summer, the WUA per 1,000 linear feet of stream could increase by approximately 32-percentpercentfor juvenile steelhead rearing in the historical channel. Specific changes in habitat resulting from this project would vary depending on the species, the month of the year, general flow conditions, and the affected stream reach; however, in general, increased flow in the later summer would correspond to increased habitat.

The IPID Full Piping and Pump Exchange Project would also allow more water to remain in Peshastin Creek, which is a smaller tributary to the Wenatchee River where late summer low flows impact fish passage and habitat below the PID Diversion below RM 2.4. The project would benefit native fish in Peshastin Creek with relatively small additional adverse impact to fish in the Wenatchee River.

As noted in Section 4.8, Vegetation, compliance with applicable regulations would minimize the potential impacts on habitat and ecosystem functions and values associated with siting and operating the proposed facilities and would help reduce potential adverse impacts on fish and aquatic invertebrates. Overall, the new facilities are anticipated to represent a net benefit over the current facilities because they would be designed according to the current NMFS guidelines to ensure fish-friendly irrigation diversion operations, for example by providing intake screens that would be designed to prevent entrainment of juvenile fish.

As part of the overall Icicle Strategy, efforts to characterize the impacts of the managed flows on fish species are ongoing. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.7.7, Mitigation Measures.

4.7.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.7.7.1 Short-term Impacts

Short-term impacts on fish and aquatic invertebrates would be mitigated by complying with the terms and conditions of local, state, and federal regulations and obtaining required project-specific permits and approvals, such as any Shoreline Management Act shoreline permits, Critical Areas Review, HPAs, CWA compliance, and Endangered Species Act compliance.

Common mitigation measures are likely to include pre-construction surveys, when deemed appropriate; conducting construction work in a manner to minimize disturbance of wildlife, including excluding sensitive species from work areas; ensuring no net loss of any important habitat or ecosystem functions or values; and possibly restricting the timing of some construction activities to avoid affecting particular species.

Specific mitigation measures would be developed as part of future project-level review and permitting. In addition to the measures identified in Section 4.8, Vegetation, implementation of the following measures would ensure short-term impacts would be less than significant.

- Contracts for construction projects would include language directing workers to protect fish during construction such as excluding sensitive species from work areas, rescuing entrained fish in areas that are dewatered, and working within seasonal fish windows to avoid impacts on special-status species during periods of migration, spawning, and incubation.

4.7.7.2 Long-term Impacts

As part of the overall Icicle Strategy, the Guiding Principles must be met. This requires ensuring that proposed projects benefit fish and fisheries, provide adequate stream flow for fish, enhance aquatic habitat, support a sustainable LNFH, protect treaty and non-treaty harvest rights, and comply with state and federal laws, such as the ESA. Efforts are ongoing to ensure that projects implemented as part of the Icicle Strategy meet these objectives. More specifically, the following measures would help to reduce potential adverse impacts that could occur over the long term.

- Develop a long-term management plan for releases from IPID at the Alpine Lakes. To support project-level permitting and optimization planning, continue to evaluate how flow changes might affect downstream habitat of Icicle Creek and its tributaries.

  Examples of measures under consideration to help minimize impacts include the following.

  - Ramp down lake releases gradually toward the end of the augmentation period to avoid stranding fish.
  - Limit releases from these lakes in September to avoid negatively affecting spawning bull trout.

- Minimize ice and debris build-up on fish screens at existing diversion points by sustaining or increasing the frequency of maintenance compared to current activities. Sequence projects implemented as part of the Icicle Strategy to ensure irrigation diversion screens are updated prior to improving passage for anadromous fish above hatchery barriers and the Boulder Field barrier.
- Continue monitoring and adaptive management of tribal and non-tribal fisheries to prevent overfishing and unintended adverse impacts to non-target fish species, including endangered and threatened salmon and bull trout.
- Ensure compliance with permits issued by NMFS and USFWS for the protection of endangered and threatened native salmon, steelhead, and bull trout.
- Continue monitoring and adaptive management of fish passage efficiency through Structures 2 and 5 in association with different hydraulic conditions and structure configurations.

4.8 Vegetation

This section describes the potential short- and long-term impacts that could affect the resources identified in Section 3.8, Vegetation, from construction and operation related to the No-action Alternative and Program Alternatives.

4.8.1 No-action Alternative

4.8.1.1 Short-term Impacts

Under the No-action Alternative, various entities and agencies would undertake individual actions that could result in short-term impacts on vegetation and wetlands in the Icicle Creek Watershed project area. This is anticipated to entail construction of water diversion modifications, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure at the Alpine Lakes including the restoration of the Eightmile Lake Dam, and improvements to existing irrigation systems to support agricultural reliability. Potential impacts would primarily be associated with projects that require construction and improvements to the seven Alpine Lakes. Impacts that could adversely affect vegetation and wetlands include direct disturbance from construction activity and increased potential for exposure to contaminated stormwater runoff. These impacts would be localized to specific areas of disturbance along the Wenatchee River, Icicle and Peshastin Creeks, and the seven Alpine Lakes.

The agencies or entities implementing projects under the No-action Alternative would be required to comply with applicable local, state, and federal environmental review requirements and permits as described in Section 5.2, Table 5-2. Applicable permits would require appropriate mitigation measures to reduce impacts on vegetation, such as revegetation of adversely affected areas and BMPs designed to reduce the potential for erosion and accidental spills of construction chemicals (Section 4.8.7, Mitigation Measures). For instance, Chelan County Code requires riparian buffer protection and mitigation with buffer widths determined based on Environment Designation and intensity of use as shown in Table 4-2.

Table 4-2
Chelan County Riparian Buffer Protection and Mitigation Requirements

Environment Classification	Buffer Width	
	High Intensity (feet)	Low Intensity (feet)
Natural	250	200
Conservancy	250	200
Rural	150	100
Urban	100	75

A habitat management and mitigation plan could be required to avoid degradation of the riparian habitat function, structure, and value. Therefore, short-term impacts under the No-action Alternative are not expected to be significant.

4.8.1.2 Long-term Impacts

Long-term impacts associated with the diversion and water efficiency projects are anticipated to be largely beneficial for vegetation around Icicle and Peshastin Creeks because project elements that would be implemented would seek to improve instream flows during the late summer, which would provide a benefit to riparian vegetation. However, implementation of the Eightmile Restoration Project means that some area of vegetation around that lake would be periodically inundated more frequently. In addition, because projects would not generally be coordinated with other activities in the Icicle project area, instream flow benefits are not anticipated to be as great as they would under the other Program Alternatives. Potential long-term benefits from such projects are also expected to be more localized, providing only minor overall benefits within the larger Icicle Creek Subbasin.

4.8.2 Alternative 1

Implementation of Alternative 1 has the potential to result in greater impacts on vegetation compared with the No-action Alternative because there would be higher likelihood that certain projects would be implemented and the scale of certain efforts would likely be greater. Compliance with the Guiding Principles addresses vegetation in general by enhancing Icicle Creek aquatic and riparian habitat. The following sections describe the short- and long-term impacts that would occur under Alternative 1.

4.8.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Construction activities associated with this project would involve replacing existing gates and installing solar panels, flow monitors, and other new equipment. Most of the work would occur in upland areas. Some limited work would occur within the lake shorelines but within the dry when the lakes are drawn down at the end of the summer. Activities would have limited potential to affect surrounding vegetated or potential wetland areas.

Accessing the project sites, staging equipment, and providing for worker accommodations could temporarily disturb vegetation or wetlands mainly as the result of inadvertent trampling. Construction equipment and supplies would most likely be flown in by helicopter with the exception of possibly carrying some equipment up by hand to Eightmile Lake. Hiking would occur within existing trails and roadways and would therefore have limited potential to adversely affect adjacent vegetation or wetlands along the route. Although some small vegetated areas may be disturbed during staging of

equipment and supplies, vegetation and wetland impacts would largely be avoided by limiting vegetation removal and limiting work within sensitive areas.

As noted in Section 4.5, Water Quality, construction activities would also slightly increase the potential for contaminated stormwater runoff or spills of construction chemicals that could adversely affect vegetation and wetlands. However, as discussed in Section 4.5, Water Quality, this risk would be very low because there would be limited use of powered equipment near water.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include limiting the extent of work within sensitive areas, requiring revegetation of disturbed sites, and compensating for any loss of important ecosystem functions and values (Section 4.8.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on vegetation and wetlands would be less than significant.

IPID Irrigation Efficiencies

Construction activities associated with the IPID Irrigation Efficiencies Project include the conversion of irrigation canals to pipelines, replacing or abandoning pipelines, and the lining of irrigation canals with concrete. Impacts that could adversely affect vegetation and wetlands include inadvertent trampling or disturbance during construction. Short-term impacts on vegetation would be limited because most of the work would occur within areas that are already disturbed, such as within rights-of-way and existing irrigation canal easements, and would occur during the off-season when the irrigation canals are dry. As noted in Section 4.5, Water Quality, there would also be limited potential for water quality impacts that could adversely affect vegetation or wetlands.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include limiting the extent of work within sensitive areas, requiring revegetation of disturbed sites, and compensating for any loss of important ecosystem functions and values (Section 4.8.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on vegetation and wetlands would be less than significant.

COIC Irrigation Efficiencies and Pump Exchange

Potential impacts on vegetation and wetlands associated with work affecting COIC irrigation system would be similar to those described above. Construction of the COIC pump station would also require work along the streambank of lower Icicle Creek or the Wenatchee River, and depending on the location would likely result in the loss of riparian vegetation. Depending on the location and extent of these activities, there would also be a

potential for wetlands to be adversely affected. Impacts that could adversely affect vegetation and wetlands include inadvertent trampling or disturbance during construction.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include limiting the extent of work within sensitive areas, requiring revegetation of disturbed sites, and compensating for any loss of important ecosystem functions and values (Section 4.8.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on vegetation and wetlands would be less than significant.

Domestic Conservation Efficiencies

Construction activities proposed under the Domestic Conservation Efficiencies Project include pipeline replacement and meter installation. These activities are unlikely to adversely affect vegetation because the work would be done in areas that are already developed.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project involves demolishing the existing dam, installing new piping, and constructing new impoundment and water control structures. Construction activity would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down, and in Eightmile Creek immediately downstream of the dam. While most construction equipment (potentially including a small tracked excavator) and materials would likely be flown into the project site via helicopter, IPID is considering the option of walking in a larger tracked excavator or a spider excavator. The trail to access the project site requires several stream crossings and parallels several potential wetlands (Figure 3-10).

Disturbance within these areas has the potential to adversely affect vegetation and wetlands through direct impact or through increased exposure to contaminated stormwater runoff. Direct impacts could occur as the result of general construction activity resulting in clearing or trampling of vegetation during earth movement and staging of equipment and materials. There would also be minor potential for contaminated runoff to adversely affect vegetation and wetlands by increased erosion or accidental spills of chemicals, such as fuels, cement, and solvents, used during construction.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include limiting the extent of work within sensitive areas, requiring revegetation of disturbed sites, and compensating for any loss of important ecosystem functions and values (Section 4.8.7, Mitigation Measures). With implementation of BMPs and any

required mitigation measures, the short-term impacts on vegetation and wetlands would be less than significant.

Tribal Fishery Preservation and Enhancement

The focus of this project is to ensure that there would be no adverse effects on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. The specifics of this project are not yet determined, but would involve elements of restoration along the Lower Icicle Creek that could result in localized construction disturbance and removal of vegetation. At this stage, the primary options under consideration include the construction of facilities such as a bubble curtain, sprayer, or other minor modifications to the Hatchery Channel spillway at LNFH to promote favorable fishing conditions in the pool at the bottom of the spillway.

Depending on the specific location of the activities, construction would affect vegetation and any wetlands as a result of direct disturbance or through exposure to contaminated stormwater as described previously. However, project activities with the potential to affect these resources would likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include limiting the extent of work within sensitive areas, requiring revegetation of disturbed sites, and compensating for any loss of important ecosystem functions and values (Section 4.8.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on vegetation and wetlands would be less than significant.

Habitat Protection and Enhancement

Habitat protection and enhancement proposed under this project could involve grading; planting and thinning vegetation; hauling and placing logs, rock, soil, and other materials; and some in-water work on lower Icicle Creek. These activities could affect vegetation and wetlands. Depending on the specific location of the activities, construction would affect vegetation and any wetlands as the result of direct disturbance or through exposure to contaminated stormwater as described previously. However, project activities with the potential to affect these resources would likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures may include limiting the extent of work within sensitive areas, requiring revegetation of disturbed sites, and compensating for any loss of important ecosystem functions and

values (Section 4.8.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on vegetation and wetlands would be less than significant.

Instream Flow Rule Amendment

There are no construction activities proposed under this project and, therefore, no potential short-term impacts on vegetation or wetlands.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project includes various elements geared toward improving water quality and hatchery rearing conditions at the LNFH. In general, construction of these elements has the potential to affect vegetation and wetlands, depending on the specific location and type of disturbance. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential short-term impacts under NEPA would be completed once the full scope of the project is determined.

Similar to the construction activities described above, various authorizations are likely to be required that would ensure that potential impacts would be avoided, minimized, or compensated as noted in Section 4.8.7, Mitigation Measures. Therefore, short-term impacts on vegetation and wetlands from construction work are expected to be less than significant.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek as well as instream modifications to the Boulder Field near RM 5.6. This work would result in disturbances along the streambank and within Icicle Creek that would be addressed in subsequent environmental review and permitting once project specifics are determined. This work would also likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would help to further address potential impacts on vegetation and wetlands. Therefore, short-term impacts on vegetation and wetlands from construction work are expected to be less than significant.

Fish Screen Compliance

The Fish Screen Compliance Project involves replacing fish screens at three different diversions on lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Under this project, screens and associated infrastructure would be improved to bring all three intakes up to compliance with state and federal laws. This work would result in disturbances along the streambank and within Icicle Creek that would be addressed once project specifics are determined. This work would also likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would help to further address potential impacts on vegetation and

wetlands. Therefore, short-term impacts on vegetation and wetlands from construction work are expected to be less than significant.

Water Markets

There are no construction activities proposed under the Water Markets Project and therefore no potential short-term impacts on vegetation or wetlands.

4.8.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Under this project, the greatest potential for impacts on vegetation and wetlands over the long term could occur as the result of any disturbance during maintenance activities and any changes in operations with respect to how lake levels are managed.

Because the facilities would be newer and largely operated remotely by IPID, any trips to and from the lakes, or activities needed to maintain the facilities, are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative. However, this project would result in increased frequency in fluctuations in lake levels compared to existing conditions and the No-action Alternative. This is because lake levels would be drawn down every year instead of rotating one or two lakes per year.

Although the lakes would be drawn down more frequently, the high and low lake levels would not change. The variation in lake levels would be consistent with the general pattern that currently occurs. Therefore, there would be no impacts on shoreline vegetation or wetlands.

Likewise, as discussed in Section 3.5, Water Quality, changes in flows in Icicle Creek would be within the natural variation already occurring within the system. The main changes would be beneficial increases in flows during times when water levels would otherwise be low. As noted in Section 3.18, Shorelines, flow changes on Icicle Creek would not occur at a level that would negatively affect the shoreline. For these reasons, this project is not anticipated to result in significant long-term impacts on vegetation or wetlands.

IPID Irrigation Efficiencies

The majority of the IPID Irrigation Efficiencies Project elements include pipelines or canal improvements that would occur in areas that have already been disturbed and would not result in long-term impacts on vegetation or wetlands. Over the long term, efficiencies gained would result in an increase in instream flows that would also be beneficial to riparian vegetation and wetlands.

COIC Irrigation Efficiencies and Pump Exchange

In general, the potential impacts associated with the COIC Irrigation Efficiencies and Pump Exchange Project would be similar to those described for the IPID Irrigation Efficiencies Project with the exception of the COIC pump station and intake facilities.

These facilities would result in the loss of a small area of riparian vegetation and, depending on the specific location, could potentially affect wetlands. Any adverse impacts would likely be minor because the amount of area converted from vegetation to the new facilities would be small and would be addressed as required by applicable local, state, and federal permits or approvals, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts, such as compensating for the permanent loss of any sensitive areas (Section 4.8.6, Mitigation Measures). Over the long term, this project would also contribute to beneficial increases in instream flows that would be beneficial to riparian vegetation and wetlands.

Domestic Conservation Efficiencies

Increased conservation and re-use associated with this project is expected to lead to decreased return flows, which could decrease flows in the Wenatchee River downstream of the Leavenworth Wastewater Treatment Plant; however, the long-term effects on streamflow and any associated changes to riparian vegetation are expected to be negligible.

Eightmile Lake Storage Restoration

Operation of the proposed facilities for the Eightmile Lake Storage Restoration Project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. The greatest potential for impacts on vegetation and wetlands over the long term would occur as the result of permanent conversion of any sensitive areas, disturbance during maintenance, and any changes in operations with respect to how lake levels are managed.

Because the facilities would be newer and largely operated remotely by IPID, any trips to and from the lakes, or activities needed to maintain the facilities, are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative. However, restoration of the facilities and re-operation of the lake would result in the ability to maintain the lake at higher, historical levels compared to existing conditions and the No-action Alternative.

Under existing conditions, the maximum fill height of the lake is approximately 4,667 feet because the embankment portion of the dam has deteriorated. After the dam is restored, the lake would be able to fill to the historical high level of 4,671 feet. Under this project, lake levels would be managed to rise beginning in the late fall and would continue to approximately 4,666 feet, which would be the crest elevation of a notch in the proposed dam. The lake would remain at this height until stop logs are placed in the notch early in the summer. Placement of the stop logs would allow the lake level to continue to rise to the spillway elevation of 4,671 feet, equal to the historical full water surface elevation. The lake would stay at this level for less than a month in the early summer, after which time IPID would begin drawing down the lake by releasing water.

Compared with existing conditions and the No-action Alternative, this means that an additional area of shoreline would be under water. These areas have been historically inundated, but have not been under water since deterioration of the embankment. This change in lake levels could result in some changes to the vegetative community along the fringes of the shoreline; however, this area is expected to be relatively small, on the order of 3.6 acres of shoreline area inundated.

The project would also allow for the lake to be drawn down below the existing low lake levels to an elevation of 4,621 feet, which is approximately 22.4 feet below the existing low. This change would result in the exposure of slightly more lake bed, mainly in the later summer months and early fall up to the point when the water would no longer be drawn down, generally around the end of September. The additional draw down is not expected to adversely affect vegetation or wetlands by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

Likewise, as discussed in Section 3.5, Water Quality, changes in flows in Icicle Creek would be within the natural variation already occurring within the system. The main changes would be beneficial increases in flows during times when water levels would otherwise be low. As noted in Section 3.18, Shorelines, flow changes on Icicle Creek would not occur at a level that would negatively affect the shoreline. For these reasons, this project is not anticipated to result in significant long-term impacts on vegetation or wetlands.

Tribal Fishery Preservation and Enhancement

The purpose of this project is to protect and enhance the tribal fishery, which, depending on the specific actions, could result in the loss of some small areas of vegetation and wetlands; however, these project elements are meant to preserve and enhance stream and riparian habitat, leading to improved vegetation and wetland quality and habitat functions. Additionally, work within sensitive areas would require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts affecting sensitive areas (Section 4.8.7, Mitigation Measures). These requirements would be developed once project-specific details were available.

Habitat Protection and Enhancement

The purpose of this project is to protect and enhance habitat within the lower Icicle Creek corridor, which could require work within riparian areas and wetlands. Although these activities could result in the loss of some small areas of these resources, overall, the purpose of this project is to preserve and enhance stream and riparian habitat, which would improve vegetation and wetland quality and habitat functions. Additionally, work within sensitive areas would require multiple authorizations from local, state, and federal

regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts, such as compensating for the permanent loss of any sensitive areas (Section 4.8.7, Mitigation Measures). These requirements would be developed once project-specific details were available.

Instream Flow Rule Amendment

Under the Instream Flow Rule Amendment Project, the Icicle Creek Reserve established under Chapter 173-545 WAC would be increased by 0.4 cfs. Over the long term, this amendment would ultimately result in the removal of 0.4 cfs from Icicle Creek annually, which could adversely affect riparian vegetation and any associated wetland areas because there could be less water to support these areas. However, potential impacts on vegetation and wetlands would be offset by the implementation of required instream flow and habitat restoration actions under this Program Alternative, as well as several other projects associated with Alternative 1.

No instream flow reduction would occur in the Wenatchee River because this project would move 0.4 cfs out of the Wenatchee River Reserve.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

The potential long-term adverse impacts on vegetation and wetlands under the LNFH Conservation and Water Quality Improvements Project would occur in areas where new facilities resulted in the conversion or loss of vegetation and possibly wetland areas. Potential adverse impacts would likely be minor because the potential permanent loss of vegetation is expected to affect a relatively small area. Additionally, work within sensitive areas would require compliance with various local, state, and federal regulations, including NEPA, which would address the need for mitigation to reduce potential long-term impacts affecting sensitive areas (Section 4.8.7, Mitigation Measures).

Fish Passage Improvements

Proposed Fish Passage Improvements Project elements occur entirely within Icicle Creek, therefore no long-term negative impacts to vegetation and wetlands would be expected.

Fish Screen Compliance

Long-term impacts associated with the Fish Screen Compliance Project would largely be beneficial; however, it is possible that some small areas of vegetation could be removed, depending on final design of the proposed project elements.

Any adverse impacts on vegetation would be likely minor because these impacts would be addressed as required by applicable local, state, and federal permits or approvals, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require

appropriate mitigation measures to reduce potential long-term impacts, such as revegetating any disturbed areas and compensating for the permanent loss of any sensitive areas that could not otherwise be restored (Section 4.8.7, Mitigation Measures). These requirements would be developed once project-specific details were available.

Water Markets

Proposed Water Markets Project elements would result in changes in the water market with the intention of increasing flows in lower Icicle Creek. There would be no long-term negative impacts on vegetation and wetlands. Potential long-term impacts would be beneficial.

4.8.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would also be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. Compliance with the Guiding Principles addresses vegetation in general by enhancing Icicle Creek aquatic and riparian habitat. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Impacts of other project elements are described under Alternative 1

4.8.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction of a new pump station under this project would require both in-water and riverbank work on the Wenatchee River. Such activities could result in many of the same construction-related short-term impacts on vegetation and wetlands described for the COIC Irrigation Efficiencies and Pump Exchange Project, including clearing of vegetation along the bank of the Wenatchee River and along the delivery pipeline route. As long as construction activities comply with permit terms and conditions that would be required as discussed in Section 4.8.7, Mitigation Measures, potential short-term impacts would not be significant. Specific mitigation measures would be developed as part of future project-level review and permitting.

4.8.3.2 Long-term Impacts

IPID Dryden Pump Exchange

IPID Dryden Pump Exchange Project facilities would likely result in the loss of a small area of riparian vegetation for the pump station and intake facilities constructed along the right bank of the Wenatchee River and, depending on the specific location, could potentially affect wetlands. The project could also require clearing of vegetation along the delivery pipeline alignment, which would likely pass through existing agricultural properties and could impact orchard trees.

Any adverse impacts would likely be minor because the amount of area converted from vegetation to the new facilities would be small and would be addressed as required by

applicable local, state, and federal permits or approvals, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts, such as compensating for the permanent loss of any sensitive areas (Section 4.8.6, Mitigation Measures).

Operational changes associated with relocating the pump exchange would result in increased flows within Icicle Creek from the point of the existing diversion (RM 5.7) to the new location. Increased flows within the creek would be beneficial.

4.8.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 would be included while the Eightmile Lake Storage Restoration Project would not. Compliance with the Guiding Principles addresses vegetation in general by enhancing Icicle Creek aquatic and riparian habitat. This section describes the specific short- and long-term impacts associated with the legislative change. The impacts of all other project elements are described under Alternative 1 and Alternative 2.

4.8.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

There are no construction activities proposed under this project and therefore no potential short-term impacts to vegetation or wetlands.

4.8.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

If the proposed Legislative Change Creating OCPI Authority Project were enacted, there could be potential conflicts with instream flow allocations. Under the proposed changes, junior domestic water rights could be exercised even when the Instream Flow Rule is not met, resulting in potential adverse impacts on riparian vegetation and any associated wetlands as a result of low-flow conditions. Under Alternative 3, there would be flow improvement projects. However, the timing of flow improvement might not always provide for in-time mitigation for junior users.

4.8.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1. The Eightmile Lake Storage Restoration Project would be replaced with the Eightmile Lake Storage Enhancement Project. The Upper Klonaqua and Upper and Lower Snow Lakes Storage Enhancement Projects would also be included. Compliance with the Guiding Principles addresses vegetation in general by enhancing Icicle Creek aquatic and riparian habitat. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.8.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would involve demolishing the existing dam, installing new piping, and constructing new impoundment and water control structures that would allow for an increase in the accessible storage at Eightmile Lake to 3,500 acre-feet. The spillway elevation would be raised to allow for storage at a higher level than current or historical water storage levels and the project would allow for additional draw down of the lake.

Construction activity would occur along the banks and within the dry areas of the lake margins once the lake was drawn down. While most construction equipment (potentially including a small tracked excavator) and materials would likely be flown into the project site via helicopter; however, IPID is considering the option of walking in a larger tracked excavator or a spider excavator. The trail to access the project site requires several stream crossings and parallels several potential wetlands (Figure 3-10).

Disturbance within these areas has the potential to adversely affect vegetation and wetlands through direct impact or through increased exposure to contaminated stormwater runoff. Direct impacts could occur as the result of general construction activity resulting in clearing or trampling of vegetation during earth movement and staging of equipment and materials. There would also be minor potential for contaminated runoff to adversely affect vegetation and wetlands by increased erosion or accidental spills of chemicals used during construction.

This project would require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential impacts on vegetation and wetlands, such as requiring all in-water work to be performed in the dry with the lake level drawn down and implementing construction BMPs designed to reduce the potential for erosion and inadvertent contamination from vehicle fluids, uncured concrete, human waste, and other sources (Section 4.8.7, Mitigation Measures). As such, potential impacts on vegetation and wetlands would not be significant.

Upper Klonaqua Lake Storage Enhancement

Short-term impacts on vegetation and wetlands from the Upper Klonaqua Lake Storage Enhancement Project would primarily be associated with construction activities required to provide a low-level outlet from Upper Klonaqua Lake to Lower Klonaqua Lake using one of the three conceptual connection options discussed in Section 2.8. Construction activity would occur between the lakes and along the banks within the dry areas of the lake margins once the lakes were drawn down.

Disturbance within these areas has the potential to adversely affect vegetation and wetlands through direct impact or through increased exposure to contaminated

stormwater runoff. Direct impacts could occur as the result of general construction activity resulting in clearing or trampling of vegetation during earth movement and storage of equipment. There would also be minor potential for contaminated runoff to adversely affect vegetation and wetlands by increased erosion or accidental spills of chemicals used during construction.

This project would require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential impacts on vegetation and wetlands, such as requiring all in-water work to be performed in the dry and implementing construction BMPs designed to reduce the potential for erosion and inadvertent contamination from vehicle fluids, uncured concrete, human waste, and other sources (Section 4.8.6, Mitigation Measures). As such, potential impacts on vegetation and wetlands would not be significant.

Upper and Lower Snow Lakes Storage Enhancement

Short-term impacts on vegetation and wetlands from this project would be primarily related to construction activities, and the impacts are similar in type and mechanism to those discussed in Sections 4.8.5.1, Short-term Impacts, Eightmile Lake Storage Enhancement and Upper Klonaqua Lake Storage Enhancement. Specific construction activities that could result in impacts include the transportation of construction equipment and materials to the project site; draw down of the lakes to isolate in-water work areas; demolition of the existing dams and water control structures; removal of vegetation, excavation, and fill placement to install new low-level outlet piping; and the placement of concrete and other materials to construct new dams. Impacts that could result from these activities include direct disturbance of vegetation or wetlands or increased potential for exposure of these resources to contaminated stormwater runoff.

The Upper and Lower Snow Lakes Storage Enhancement Project would require multiple local, state, and federal environmental reviews and permits as described in Section 4.8.7, Mitigation Measures. Permits issued by regulatory agencies would include requirements for the implementation of appropriate mitigation measures and construction BMPs to reduce impacts on water quality. As a result of these requirements, potential impacts on vegetation and wetlands would not be significant.

4.8.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Operation of the proposed facilities for the Eightmile Lake Storage Enhancement Project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. The greatest potential for impacts on vegetation and wetlands over the long term would occur as the result of permanent conversion of any sensitive areas, disturbance during maintenance, and any changes in operations with respect to how lake levels are managed.

As noted previously, compliance with applicable regulations, as discussed in Section 4.8.7, Mitigation Measures, would ensure there would be no net loss of important ecological functions that may be associated with impacts on any sensitive vegetative communities.

Because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative. However, this project would result in the ability to maintain the lake at higher than historical levels compared to existing conditions and the No-action Alternative.

Under existing conditions, the maximum fill height of the lake is approximately 4,667 feet because the embankment portion of the dam has deteriorated. After the dam is restored, the lake would be able to fill to a new high water surface of 4,682 feet. Under this project, lake levels would be managed to rise beginning in the late fall and would continue to approximately 4,677 feet to the height of a notch in the proposed dam. The lake would remain at this height until stop logs are placed in the notch in the early summer. Placement of the stop logs would allow the lake level to continue to rise to the spillway elevation of 4,682 feet. The lake would stay at this level for less than a month in the early summer, after which time IPID would begin drawing down the lake by releasing water.

Compared with existing conditions and the No-action Alternative, this means that an additional area of shoreline would be under water. Shoreline areas up to 4,671 feet have been historically inundated, but areas above 4,671 feet to 4,682 feet have not been inundated. The additional area would be under water for a little less than a month each summer. This change in lake levels could result in some changes to the vegetative community along the shoreline. The proposed project would inundate approximately 13.6 acres that are not currently inundated, which would not represent a substantial loss but rather a change in the mix of vegetation.

The project would also allow for the lake to be drawn down below existing lake levels to an elevation of 4,619 feet, which is approximately 24.4 feet lower than the existing low. This change would result in the exposure of slightly more lake bed, mainly in the later summer months and early fall up to the point when the water would no longer be drawn down, generally around the end of September. The additional draw down is not expected to adversely affect vegetation or wetlands by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity

Likewise, as discussed in Section 3.5, Water Quality, changes in flows in Icicle Creek would be within the natural variation already occurring within the system. The main changes would be beneficial increases in flows during times when water levels would otherwise be low. As noted in Section 3.18, Shorelines, flow changes on Icicle Creek

would not occur at a level that would negatively affect the shoreline. Additionally, work within sensitive areas would likely require compliance with various local, state, and federal regulations, which would require appropriate mitigation measures to reduce potential long-term impacts affecting sensitive areas (Section 4.8.7, Mitigation Measures). For these reasons, this project is not anticipated to result in significant long-term impacts on vegetation or wetlands.

Upper Klonaqua Lake Storage Enhancement

Potential long-term impacts to vegetation and wetlands would be similar to those described under the Eightmile Lake Storage Enhancement Project (Section 4.8.5.2, Long-term Impacts). Potential benefits would mainly occur in Icicle Creek and would include an increased ability to augment stream flow in the late summer or during drought years, with flow augmentation primarily benefitting the section of Icicle Creek between Upper Klonaqua Lake and the IPID diversion.

As noted previously, compliance with applicable regulations, as discussed in Section 4.8.7, Mitigation Measures, would ensure there would be no net loss of important ecological functions that may be associated with impacts on any sensitive vegetative communities.

The frequency in fluctuations in lake levels in Upper Klonaqua Lake would increase compared to existing conditions and the No-action Alternative. Lake levels would also be drawn down further compared to existing conditions.

The high lake level in Upper Klonaqua Lake would not change. The lake would still refill and outlet naturally through an existing channel to Lower Klonaqua Lake during most of the year. However, the new facilities would allow for the lake to be drawn down an additional 20 feet to allow for access to an additional 1,146 acre-feet of storage. The draw down would likely occur over a couple of months in the late summer. The additional draw down is not expected to adversely affect vegetation or wetlands by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

Likewise, as discussed in Section 3.5, Water Quality, changes in flows in Icicle Creek resulting from this action would be within the natural variation already occurring within the system. The main changes would be beneficial increases in flows during times when water levels would otherwise be low. As noted in Section 3.18, Shorelines, flow changes on Icicle Creek would not occur at a level that would negatively affect the shoreline. Additionally, work within sensitive areas would likely require compliance with various local, state, and federal regulations, which would require appropriate mitigation measures to reduce potential long-term impacts affecting sensitive areas (Section 4.8.7, Mitigation Measures). For these reasons, this project is not anticipated to result in significant long-term impacts on vegetation or wetlands.

Upper and Lower Snow Lakes Storage Enhancement

Potential long-term impacts to vegetation and wetlands would be similar to those described under the Eightmile Lake Storage Enhancement Project (Section 4.8.5.2, Long-term Impacts). Potential benefits would mainly occur in Icicle Creek and would include an increased ability to augment stream flow in the late summer or during drought years, with flow augmentation primarily benefitting the section of Icicle Creek between Lower Snow Lake and the IPID diversion.

The proposed enhancement project would increase the high-water storage levels in both Upper and Lower Snow Lakes by 5 feet compared with existing high levels. This change would result in the inundation of some upland vegetation that has grown along the shoreline areas between the current and proposed high lake levels, most likely occurring in the fall through the early summer when releases would be likely to begin. This could result in some changes to the vegetative community along the shoreline.

The project would also allow for the Lower Snow Lake to be drawn down 3 feet below the current lake level, which would result in the exposure of slightly more lake bed. The additional draw down is not expected to adversely affect vegetation or wetlands by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

Overall, potential adverse impacts would likely be minor because the potential loss or conversion of vegetation is expected to affect a relatively small area. Additionally, work within sensitive areas would require compliance with various local, state, and federal regulations, including NEPA, which would address the need for mitigation to reduce potential long-term impacts affecting sensitive areas (Section 4.8.7, Mitigation Measures).

4.8.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange Project would be included.

4.8.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange Project

This project would involve converting the IPID delivery systems to pressurized pipelines throughout the entire system, removing or abandoning the existing intakes on Icicle and Peshastin Creeks, and constructing three new pump stations and intakes on the Wenatchee River. Construction of the new pump stations and removal of existing diversion facilities under this project would require both in-water and riverbank work on the Wenatchee River, Icicle Creek, and Peshastin Creek. Such activities could result in construction-related short-term impacts on vegetation and wetlands, including clearing of vegetation along the bank of the Wenatchee River and along the extensive delivery

pipeline route. As long as construction activities comply with permit terms and conditions that would be required as discussed in Section 4.8.7, Mitigation Measures, potential short-term impacts would not be significant. Specific mitigation measures would be developed as part of future project-level review and permitting.

4.8.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange Project

IPID Full Piping and Pump Exchange Project facilities would likely result in the loss of a small area of riparian vegetation where the pump stations are located along the Wenatchee River and, depending on the specific location, there could be could potentially a loss of wetlands. The project could also require clearing of vegetation along the entire delivery pipeline alignment, which would likely pass through existing agricultural properties and could impact orchard trees.

Permanent loss of vegetation is expected to be relatively small and would be compensated for as required by applicable local, state, and federal permits or approvals, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts, such as compensating for the permanent loss of any sensitive areas (Section 4.8.6, Mitigation Measures).

Operational changes associated with relocating the intakes from Icicle and Peshastin Creeks to the Wenatchee River would result in increased flows within Icicle and Peshastin Creeks. Increased flows would be beneficial to riparian vegetation and wetlands.

4.8.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.8.7.1 Short-term Impacts

Short-term impacts on vegetation and wetlands would be mitigated by complying with the terms and conditions of local, state, and federal regulations and project-specific permits and approvals, including local building, grading, and stormwater construction permits; state stormwater permits; Shoreline Management Act shoreline permits; HPAs; and CWA Section 404 permits and their associated Section 401 Water Quality Certifications, among others. Common permit conditions are likely to include conducting work in a manner to minimize potential disturbance of sensitive vegetation communities and possibly compensating for loss of any important habitat or ecosystem functions. For permits or approvals affecting any work near or within wetlands, refer to Section 4.5.7, [Water Quality] Mitigation Measures.

Specific mitigation measures would be developed as part of future project-level review and permitting. Implementation of the following additional measures would ensure impacts would be less than significant.

- Mark clearing or disturbance limits and protect vegetation outside those limits.
- Design and locate any permanent facilities to avoid, to the extent possible, potential impacts on sensitive vegetative communities, including the removal of trees or wetlands.
- Locate construction staging areas and any new access roads to avoid disturbing sensitive areas to the extent possible.
- Revegetate disturbed areas with native plant species as agreed upon by the appropriate regulatory agencies.

4.8.7.2 Long-term Impacts

Long-term impacts on vegetation and wetlands would be mitigated by complying with the terms and conditions of local, state, and federal regulations and project-specific permits and approvals, as described above.

Specific mitigation measures would be developed as part of future project-level review and permitting. Implementation of the following additional measures would ensure impacts would be less than significant.

- Monitor and continue to remove invasive species from any revegetated areas to ensure re-establishment of the desired vegetation communities and ecological function as agreed upon by the appropriate regulatory agency.

4.9 Wildlife

This section describes the potential short- and long-term impacts that could affect the resources identified in Section 3.9, Wildlife, from construction and operation related to the No-action Alternative and Program Alternatives. Potential impacts on special-status species are addressed in Section 4.10, Threatened and Endangered Species.

4.9.1 No-action Alternative

4.9.1.1 Short-term Impacts

Under the No-action Alternative, various entities and agencies would undertake individual actions that could result in short-term impacts on wildlife in the ALWA and in riparian areas along Icicle Creek and the Wenatchee River. This is anticipated to entail construction of water diversion modifications, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure

at the Alpine Lakes including the restoration of the Eightmile Lake Dam, and improvements to existing irrigation systems to support agricultural reliability. Potential impacts would be associated with projects that require construction. In the short term, construction activity could adversely affect wildlife by causing noise disturbance and adversely affecting habitat as described in Section 4.8, Vegetation.

The agencies or entities implementing projects under the No-action Alternative would be required to comply with applicable local, state, and federal environmental review requirements and permits as described in Section 5.2, Table 5-2. Applicable permits would require appropriate mitigation measures to reduce impacts on wildlife, such as including any necessary timing restrictions for construction work and ensuring no net loss of important habitat and ecological values and functions (Section 4.9.7, Mitigation Measures). Therefore, short-term impacts to wildlife under the No-action Alternative are not expected to be significant.

4.9.1.2 Long-term Impacts

Long-term impacts under the No-action Alternative are anticipated to be largely beneficial for wildlife, especially wildlife dependent on Icicle Creek, because many projects would seek to improve instream flows during the late summer and improve habitat overall although the benefit is not excepted to be as great without implementation of a coordinated strategy.

4.9.2 Alternative 1

Implementation of Alternative 1 has the potential to result in greater impacts on wildlife compared with the No-action Alternative because there would be higher likelihood that certain projects would be implemented and the scale of certain efforts would likely be greater. Compliance with the Guiding Principles addresses wildlife in general by enhancing Icicle Creek aquatic and riparian habitat. The following sections describe the short- and long-term impacts that would occur under Alternative 1.

4.9.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Most of the work would occur in upland areas. Some limited work would occur within the lake shorelines but within the dry when the lakes are drawn down at the end of the summer. Construction would last for a period of a few days to a couple of weeks at each lake. Some equipment may be walked in via the Eightmile Lake Trail but most equipment and workers would be transported to the project site by helicopter.

Construction activity could disrupt the use of riparian and forested habitat by native wildlife species to breed, forage, rest, and overwinter. As discussed in Section 3.9, Wildlife, the lakes are used by many species, including large and small mammals, reptiles, amphibians, cavity nesting birds, raptors, waterfowl, and a variety of songbirds.

Waterfowl species such as common loons nest along the lake shoreline. Aquatic species such as amphibians could also be present during construction.

Although some vegetated areas would be used to stage construction equipment and temporarily provide housing for workers, there would be no permanent loss of habitat and the activities would not block access to habitat areas. As discussed in Section 4.5, Surface Water Quality, risks of spills (e.g., fuel, chemicals, etc.) would be very low because there would be limited use of powered equipment near water.

Wildlife would be exposed to some increased noise during construction. Short-term increases in noise lasting a couple days to a couple of weeks are described in Section 4.14, Noise, and would include some helicopter trips. As noted, the majority of construction noise would be relatively minor. In general, in response to periodic increases in noise and activity, most wildlife species are expected to disperse to adjacent habitat areas to avoid impacts. However, particularly vulnerable species include special-status species, especially those that may be breeding during this time. These species are discussed in Section 4.10, Threatened and Endangered Species.

Compliance with applicable local, state, and federal regulations would further ensure that there were no significant impacts on wildlife. If needed, mitigation would be developed during project-level review, which may include measures such as implementing construction timing restrictions and no net loss of ecological functions and values (Section 4.9.7, Mitigation Measures).

IPID Irrigation Efficiencies

Construction activities associated with this project include the conversion of IPID canals to pipelines and lining of irrigation canals with concrete. Short-term impacts that could adversely affect wildlife include disturbance from increased construction activity and noise, and temporary disturbance of habitat. These impacts would be relatively limited because most of the work would occur within areas that are already disturbed, such as within rights-of-way and existing canal easements. As noted in Section 4.14, Noise, construction-related noise is anticipated to be relatively minimal. Species in the work area may temporarily relocate to other areas during periods of increased activity.

Compliance with applicable local, state, and federal regulations would further ensure that there were no significant impacts on wildlife. If needed, mitigation would be developed during project-level review, such as implementing construction timing restrictions and ensuring no net loss of ecological functions and values for wildlife habitat (Section 4.9.6, Mitigation Measures).

COIC Irrigation Efficiencies and Pump Exchange

Potential impacts on wildlife associated with work affecting COIC canals and laterals would be similar to those described for the IPID Irrigation Efficiencies Project (4.9.2.1, Short-term Impacts). Construction of the COIC pump station would also require work along the streambank of lower Icicle Creek or the Wenatchee River. Depending on the

specific location, there could be a slightly greater potential for adverse construction-related impacts compared with canal-related work, particularly if construction disturbance occurred in an otherwise relatively undisturbed area.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include limiting the extent of work within sensitive areas, requiring revegetation of disturbed sites, and compensating for any loss of important ecosystem functions and values (Section 4.9.6, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on wildlife would be less than significant.

Domestic Conservation Efficiencies

Construction activities proposed under the Domestic Conservation Efficiencies Project include pipeline replacement and meter installation. These activities are unlikely to adversely affect wildlife because the work would be done in areas that are already developed.

Eightmile Lake Storage Restoration

This project involves demolishing the existing dam, installing new piping, and constructing new impoundment and water control structures. Construction activity would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down and in Eightmile Creek immediately downstream of the dam. While most construction equipment (potentially including a small tracked excavator) and materials would likely be flown into the project site via helicopter, IPID is considering the option of walking in a larger tracked excavator or a spider excavator. The trail to access the project site requires several stream crossings and parallels several potential wetlands (Figure 3-10.

Construction activity could disrupt the use of riparian and forested habitat by native wildlife species to breed, forage, rest, and overwinter. As discussed in Section 3.9, Wildlife, the lakes are used by many species, including large and small mammals, reptiles, amphibians, cavity nesting birds, raptors, waterfowl, and a variety of songbirds. Waterfowl species such as common loons nest along the lake shoreline. Aquatic species such as amphibians could also be present during construction.

Construction activity would be limited to the dry lake margins and the existing structure for a period of 2 to 3 months. Although some vegetated areas would be used to stage construction equipment and temporarily provide housing for workers, there would be no permanent loss of habitat and the activities would not block access to adjacent habitat. As discussed in Section 4.5, Water Quality, risks of spills (e.g., fuel, chemicals, etc.) would be very low because there would be limited use of powered equipment near water and work would occur in the dry after the lake was drawn down.

The greatest potential for short-term impacts on wildlife would occur as the result of increased noise during construction. Short-term increases in noise lasting 2 to 3 months are described in Section 4.14, Noise, and would include some helicopter trips and possibly blasting. As noted, the majority of construction noise would be relatively minor. In general, in response to periodic increases in noise and activity, most wildlife species are expected to disperse to adjacent habitat areas to avoid impacts. Potential noise disturbance would be most disruptive if it occurred during the spring months when many species are breeding However, the potential for overlap with construction is more limited because construction activities would occur in late summer or early fall when lake water levels can be drawn down to allow for construction. Particularly vulnerable species include special-status species discussed in Section 4.10, Threatened and Endangered Species.

Compliance with applicable local, state, and federal regulations would further ensure that there were no significant impacts on wildlife. If needed, mitigation would be developed during project-level review, which may include measures such as implementing construction timing restrictions and no net loss of ecological functions and values (Section 4.9.6, Mitigation Measures).

Tribal Fishery Preservation and Enhancement

The focus of this project is to ensure that there would be no adverse effects on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. The specifics of this project are not yet determined, but would involve elements of restoration along the lower Icicle Creek that could result in localized construction-related noise and short-term disturbance to habitat. At this stage, the primary options under consideration include the construction of facilities such as a bubble curtain, sprayer, or other minor modifications to the LNFH to promote favorable fishing conditions in the pool at the bottom of the spillway.

Depending on the specific location of the activities, construction could result in short-term impacts on wildlife, primarily related to construction disturbance. Project activities with the potential to affect sensitive wildlife species would require authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to address these impacts (Section 4.9.7, Mitigation Measures).

Habitat Protection and Enhancement

Habitat protection and enhancement proposed under this project could involve grading; planting and thinning vegetation; hauling and placing logs, rock, soil, and other materials; and some in-water work on lower Icicle Creek. Depending on the specific location of the activities, construction could result in short-term impacts on wildlife, primarily associated with construction disturbance similar to those described above.

Project activities with the potential to affect sensitive wildlife species would require authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential impacts (Section 4.9.7, Mitigation Measures).

Instream Flow Rule Amendment

There are no construction activities proposed under this project and therefore no potential short-term impacts to wildlife or wildlife habitat.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project includes various elements geared towards improving water quality and hatchery rearing conditions at the LNFH. In general, construction of these elements has the potential to affect wildlife, depending on the specific location and type of disturbance. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential short-term impacts under NEPA would be completed once the full scope of the project is determined.

Similar to the construction activities described above, various authorizations are likely to be required that would ensure that potential impacts would be avoided, minimized, or compensated as noted in Section 4.9.7, Mitigation Measures.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek, as well as instream modifications to the Boulder Field near RM 5.6. This work would result in disturbances along the streambank and within Icicle Creek that would be addressed in subsequent environmental review and permitting once project specifics are determined. This work would also likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would further help to address potential impacts on wildlife.

Fish Screen Compliance

The Fish Screen Compliance Project involves replacing fish screens at three different diversions on Lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Under this project, screens and associated infrastructure would be improved to bring all three intakes up to compliance with state and federal laws. This work would result in disturbances along the streambank and within Icicle Creek that would be addressed once project specifics are determined. This work would also likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would help to further address potential impacts on wildlife.

Water Markets

There are no construction activities proposed under the Water Markets Project and therefore no potential short-term impacts to wildlife or wildlife habitat.

4.9.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from the affected lakes. Long-term impacts on wildlife could occur if there was a substantial loss of habitat or from long-term disturbance of species from maintenance activities or changes in how lake levels are managed.

As discussed above, there would be no permanent loss of habitat. Because the facilities would be newer and operated remotely by IPID and USFWS personnel, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less than would occur compared to existing conditions.

The frequency in fluctuations in lake levels would increase compared to existing conditions because lake levels would be drawn down every year instead of rotating one or two lakes per year; however, the high and low lake water levels would not change. This variation would be consistent with natural fluctuations in lake level changes and no impacts on shorelines or vegetation and wetlands are anticipated (Section 4.8, Vegetation, and Section 4.18, Shorelines). Similarly, no significant impacts on wildlife are expected.

As discussed in Section 4.5, Water Quality, changes in flows in Icicle Creek would be within the natural variation already occurring within the system. The main changes would be beneficial increases in flows during times when water levels would otherwise be low. As noted in Section 3.18, Shorelines, flow changes on Icicle Creek would not occur at a level that would negatively affect the shoreline. For these reasons, this project is not anticipated to result in significant long-term impacts on wildlife.

IPID Irrigation Efficiencies

The majority of the IPID Irrigation Efficiencies Project elements include pipelines or canal improvements that would occur in areas that have already been disturbed and would not result in long-term impacts on wildlife. Over the long-term, efficiencies gained would result in an increase in instream flows that would be beneficial to riparian habitat and associated wildlife species.

COIC Irrigation Efficiencies and Pump Exchange

In general, the potential impacts associated with the COIC Irrigation Efficiencies and Pump Exchange Project would be similar to those described for the IPID Irrigation Efficiencies Project (4.9.2.2, Long-term Impacts) with the exception of the COIC pump station and intake facilities. These facilities would result in the loss of a small area of riparian habitat. Any adverse impacts on wildlife would be likely minor because the

amount of habitat lost would be small and would be addressed as required by applicable local, state, and federal permits or approvals, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts, such as compensating for the permanent loss of any sensitive areas (Section 4.9.7, Mitigation Measures). Over the long-term, this project would also contribute to beneficial increases in instream flows that would be beneficial to riparian habitat and associated wildlife species.

Domestic Conservation Efficiencies

Increased conservation and re-use associated with this project is expected to lead to decreased return flows, which could decrease flows in the Wenatchee River downstream of the Leavenworth Wastewater Treatment Plant; however, the long-term effects on streamflow and any associated changes to riparian vegetation and associated wildlife habitat are expected to be negligible.

Eightmile Lake Storage Restoration

Operation of the proposed facilities for the Eightmile Lake Storage Restoration Project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. Wildlife impacts could occur over the long term from any permanent conversion of wildlife habitat, disturbance during maintenance, or any changes in operations with respect to how lake levels are managed.

As discussed above, there would be no permanent loss of habitat. Because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions. However, restoration of the facilities and re-operation of the lake would result in the ability to maintain the lake at higher, historical levels compared to existing conditions.

Under existing conditions, the maximum fill height of the lake is approximately 4,667 feet because the embankment portion of the dam has deteriorated. After the dam is restored, the lake would be able to fill to the historical high level of 4,671 feet. Under this project, lake levels would be managed to rise beginning in the late fall and would continue to approximately 4,666 feet, which would be the crest elevation of a notch in the proposed dam. The lake would remain at this height until stop logs are placed in the notch early in the summer. Placement of the stop logs would allow the lake level to continue to rise to the spillway elevation of 4,671 feet, equal to the historical full water surface elevation. The lake would stay at this level for less than a month in the early summer, after which time IPID would begin drawing down the lake by releasing water.

Compared with existing conditions and the No-action Alternative, this means that an additional area of shoreline would be under water. These areas have been historically inundated, but have not been under water since deterioration of the embankment. This change in lake levels could result in some changes to the vegetative community along the

fringes of the shoreline; however, this area is expected to be relatively small, on the order 3.6 acres of shoreline area inundated, and would not represent a substantial loss of habitat that is anticipated to adversely affect wildlife.

The project would also allow for the lake to be drawn down below the existing low lake levels to an elevation of 4,621 feet, which is approximately 22.4 feet below the existing low. This change would result in the exposure of slightly more lake bed, mainly in the later summer months and early fall up to the point when the water would no longer be drawn down, generally around the end of September. The additional draw down is not expected to adversely affect wildlife habitat by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity or any other changes that would adversely affect wildlife.

As discussed in Section 3.5, Water Quality, changes in flows in Icicle Creek would be within the natural variation already occurring within the system. The main changes would be beneficial increases in flows during times when water levels would otherwise be low. As noted in Section 3.18, Shorelines, flow changes on Icicle Creek would not occur at a level that would negatively affect the shoreline. For these reasons, this project is not anticipated to result in significant long-term impacts on wildlife.

Tribal Fishery Preservation and Enhancement

The intent of the Tribal Fishery Preservation and Enhancement Project is to ensure that other projects implemented as part of the Icicle Strategy do not have negative effects on tribal fisheries, and tribal treaty and federally protected harvest rights. Depending on the specific actions, this could result in the loss of some small areas of vegetation and wetlands that provide wildlife habitat; however, these project elements are meant to preserve and enhance stream and riparian habitat in the system overall, leading to improved vegetation and wetland quality, improved habitat functions, and long-term benefits for wildlife.

Additionally, work within sensitive areas would require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts affecting sensitive areas (Section 4.9.7, Mitigation Measures). These requirements would be developed once project-specific details were available.

Habitat Protection and Enhancement

No long-term adverse impacts on wildlife and wildlife habitat are expected under the Habitat Protection and Enhancement Project. The purpose of this project is to improve the quality and functions of riparian and wetland habitats for wildlife. Improved water quality conditions would benefit wildlife species, including amphibians and stream invertebrates. In addition, work within sensitive areas would require multiple

authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts, such as compensating for the permanent loss of any sensitive areas (Section 4.9.7, Mitigation Measures). These requirements would be developed once project-specific details are available.

Instream Flow Rule Amendment

Under the Instream Flow Rule Amendment Project, the Icicle Creek Reserve established under Chapter 173-545 WAC would be increased by 0.4 cfs. Over the long-term, this amendment would ultimately result in the removal of an additional 0.4 cfs from Icicle Creek only after habitat and flow restoration elements are implemented. This project could adversely affect water quantity and quality in portions of Icicle Creek and thus could adversely affect dependent wildlife.

Potential impacts associated with the Instream Flow Rule Amendment are anticipated to be offset by the implementation of required instream flow and habitat restoration actions under this Program Alternative as well as several other projects associated with Alternative 1. Depending on the instream conditions at the time this reserve is accessed, there could be potential conflicts with the beneficial uses, most likely those associated with fish and wildlife habitat uses, designated for Icicle Creek.

No instream flow reduction would occur in the Wenatchee River because this project would move 0.4 cfs out of the Wenatchee River Reserve.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

Over the long term, the water conservation and water quality improvement elements proposed at LNFH for this project are expected to benefit water quality and associated wildlife in Icicle Creek and the Wenatchee River. As part of this project, LNFH would be required to secure an updated National Pollutant Discharge Elimination System permit and state Water Quality Certification for the LNFH through the implementation of facility upgrades and operational improvements. These actions would require compliance with relevant total maximum daily loads for the Wenatchee River Watershed and would ultimately be designed to avoid additional water quality impacts in the basin.

In addition, most of the work included under this project is designed to improve water use efficiency at LNFH and to develop additional groundwater supplies such that less water would need to be diverted from Icicle Creek for hatchery operations. Such actions would potentially support higher flows in the system, especially during late summer, which would benefit wildlife present within and along the creek.

Fish Passage Improvements

Long-term impacts associated with the Fish Passage Improvements Project would largely be beneficial; however, it is possible that some small areas of vegetation may be removed

that could affect wildlife. The extent of the impacts would depend on final design of the proposed project elements and whether the affected area is used by wildlife.

Any adverse impacts on vegetation would be likely less than significant because these impacts would be addressed as required by applicable local, state, and federal permits or approvals, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts, such as revegetating any disturbed areas and compensating for the permanent loss of any sensitive areas that could not otherwise be restored (Section 4.9.7, Mitigation Measures). These requirements would be developed once project-specific details were available.

Fish Screen Compliance

The Fish Screen Compliance Project involves replacing fish screens along Icicle Creek. The potential for any impacts related to loss of riparian habitat that could adversely affect wildlife would be addressed in project-level review. Long-term operations would be beneficial to fish and aquatic species and by extension to the larger ecosystem in general. Therefore, no adverse long-term wildlife impacts are expected.

Water Markets

As noted in Section 4.5, Water Quality, the long-term impacts of the Water Markets Project on water quality would be beneficial. Therefore, there are no adverse long-term wildlife impacts that are expected.

4.9.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would also be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. Compliance with the Guiding Principles addresses wildlife in general by enhancing Icicle Creek aquatic and riparian habitat. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Impacts of other projects considered under Alternative 2 are described under Alternative 1.

4.9.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction of a new IPID pump exchange would require both in-water and riverbank work on the Wenatchee River, including the placement and removal of instream cofferdams, removal of streamside vegetation, and excavation of the streambed and bank. Depending on the specific location of the activities, construction could result in short-term impacts on wildlife, primarily related to construction disturbance. Project activities with the potential to affect sensitive wildlife species would require authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable

permits issued by these agencies would require appropriate mitigation measures to address these impacts (Section 4.9.7, Mitigation Measures). Specific mitigation measures would be developed as part of future project-level review and permitting.

4.9.3.2 Long-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange facilities would likely result in the loss of a small area of riparian vegetation for the pump exchange station and intake facilities constructed along the right bank of the Wenatchee River, which could potentially affect wildlife, depending on the specific location. The project could also require clearing of vegetation along the delivery pipeline alignment, which would likely pass through existing agricultural properties and could impact orchard trees.

Any adverse impacts would be likely less than significant because the amount of area converted from vegetation to the new facilities would be small and would be addressed as required by applicable local, state, and federal permits or approvals, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts such as compensating for the permanent loss of any sensitive areas (Section 4.9.7, Mitigation Measures).

Operational changes associated with relocating the pump exchange would result in increased flows within Icicle Creek from the point of the existing diversion (RM 5.7) to the new location. Increased flows within the creek would be beneficial.

4.9.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3would be included while the Eightmile Lake Storage Restoration project would not. Compliance with the Guiding Principles addresses wildlife in general by enhancing Icicle Creek aquatic and riparian habitat. This section describes the specific short- and long-term impacts associated with the legislative change. Impacts of other projects proposed under Alternative 3 are described in Alternative 1 and Alternative 2.

4.9.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

There are no construction activities proposed under this project and therefore no potential short-term impacts on wildlife or wildlife habitat are expected.

4.9.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

If the proposed Legislative Change Creating OCPI Authority Project were enacted, there could be potential conflicts with instream flow allocations that could result in adverse impacts on wildlife and wildlife habitat. Under the proposed changes, junior domestic water rights could be exercised even when the Instream Flow Rule is not met, resulting in potential adverse impacts on water quality as a result of low-flow conditions. Under Alternative 3, flow improvement projects would be implemented. However, the timing of flow improvement might not always provide in-time mitigation for junior users.

4.9.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1 with the exception that the Eightmile Lake Storage Restoration project would be replaced with the Eightmile Lake Storage Enhancement project, and the Upper Klonaqua and Upper and Lower Snow Lakes Storage Enhancement Projects would also be included. Compliance with the Guiding Principles addresses wildlife in general by enhancing Icicle Creek aquatic and riparian habitat. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.9.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would involve demolishing the existing dam, installing new piping, and constructing new impoundment and water control structures that would allow for an increase in the accessible storage at Eightmile Lake to 3,500 acre-feet. The spillway elevation would be raised to allow for storage at a higher level than current or historical water storage levels and the project would allow for additional draw down of the lake.

Construction activity could disrupt the use of riparian and forested habitat by native wildlife species to breed, forage, rest, and overwinter. As discussed in Section 3.9, Wildlife, the lakes are used by many species, including large and small mammals, reptiles, amphibians, cavity nesting birds, raptors, waterfowl, and a variety of songbirds. Waterfowl species such as common loons nest along the lake shoreline. Aquatic species such as amphibians could also be present during construction.

Construction activity would be limited to the dry lake margins and the existing structure for a period of 4 to 6 months. Although some vegetated areas would be used to stage construction equipment and temporarily provide housing for workers, there would be no permanent loss of habitat and the activities would not block access to adjacent habitat. As discussed in Section 4.5, Water Quality, risks of spills (e.g., fuel, chemicals, etc.) would

be very low because there would be limited use of powered equipment near water and work would occur in the dry after the lake was drawn down.

The greatest potential for short-term impacts on wildlife would occur as the result of increased noise during construction. Short-term increases in noise lasting approximately 4 to 6 months are described in Section 4.14, Noise, and would include some helicopter trips and possibly blasting. As noted, the majority of construction noise would be relatively minor and similar to noise levels that already occur under existing conditions related to ongoing operations and maintenance and recreational use. In general, in response to periodic increases in noise and activity, most wildlife species are expected to disperse to adjacent habitat areas to avoid impacts. However, particularly vulnerable species include special-status species, especially those that may be breeding during this time. These species are discussed in Section 4.10, Threatened and Endangered Species.

Compliance with applicable local, state, and federal regulations would further ensure that there were no significant impacts on wildlife. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and no net loss of ecological functions and values (Section 4.9.7, Mitigation Measures).

Upper Klonaqua Lake Storage Enhancement

Under the Upper Klonaqua Lake Storage Enhancement Project, wildlife could be adversely affected in the short-term from construction activity in a manner similar to what would occur as described above for the Eightmile Lake Storage Enhancement Project (4.9.5.1, Short-term Impacts).

Construction activity could disturb the use of riparian and forested habitat used by native wildlife species to breed, forage, rest, and overwinter. As discussed in Section 3.9, Wildlife, riparian areas are used by many species, including large and small mammals, reptiles, amphibians, cavity nesting birds, raptors, waterfowl, and a variety of songbirds. Waterfowl species such as common loons could be nesting along the lake shoreline. Aquatic species such as amphibians could be present where in-water work is proposed.

Construction activity would be limited to the dry lake margins and the existing structure. Although some vegetated areas would be used to stage construction equipment and provide temporary housing for workers, there would be no permanent loss of habitat and the activities would not block access to adjacent habitat. As discussed in Section 4.5, Water Quality, risks of spills (e.g., fuel, chemicals, etc.) would be very low because there would be limited use of powered equipment near water and work would occur in the dry after the lake was drawn down.

The greatest potential for short-term impacts on wildlife would occur as the result of increased noise during construction. Short-term increases are described in Section 4.14, Noise, and would include some helicopter trips and possibly blasting. As noted, the majority of construction noise would be relatively minor. In general, in response to

periodic increases in noise and activity, most wildlife species are expected to disperse to adjacent habitat areas to avoid impacts. However, particularly vulnerable species include special-status species, especially those that may be breeding during this time. These species are discussed in Section 4.10, Threatened and Endangered Species.

Compliance with applicable local, state, and federal regulations would further ensure that there were no significant impacts on wildlife. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and no net loss of ecological functions and values (Section 4.9.6, Mitigation Measures).

Upper and Lower Snow Lakes Storage Enhancement

Wildlife could be adversely affected in the short-term from construction activity in a manner similar to what would occur as described above for the Eightmile Lake Storage Enhancement Project (4.9.5.1, Short-term Impacts).

Construction activity could disturb the use of riparian and forested habitat used by native wildlife species to breed, forage, rest, and overwinter. As discussed in Section 3.9, Wildlife, riparian areas are used by many species, including large and small mammals, reptiles, amphibians, cavity nesting birds, raptors, waterfowl, and a variety of songbirds. Waterfowl species such as common loons could be nesting along the lake shoreline. Aquatic species such as amphibians could be present where in-water work is proposed.

Construction activity would be limited to the dry lake margins and the existing structure. Although some vegetated areas would be used to stage construction equipment and provide temporary housing for workers, there would be no permanent loss of habitat and the activities would not block access to adjacent habitat. As discussed in Section 4.5, Water Quality, risks of spills (e.g., fuel, chemicals, etc.) would be very low because there would be limited use of powered equipment near water and work would occur in the dry after the lake was drawn down.

The greatest potential for short-term impacts on wildlife would occur as the result of increased noise during construction. Short-term increases are described in Section 4.14, Noise, and would include some helicopter trips and possibly blasting. As noted, the majority of construction noise would be relatively minor. In general, in response to periodic increases in noise and activity, most wildlife species are expected to disperse to adjacent habitat areas to avoid impacts. However, particularly vulnerable species include special-status species, especially those that may be breeding during this time. These species are discussed in Section 4.10, Threatened and Endangered Species.

Compliance with applicable local, state, and federal regulations would further ensure that there were no significant impacts on wildlife. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and no net loss of ecological functions and values (Section 4.9.7, Mitigation Measures).

4.9.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Operation of the proposed facilities for the Eightmile Lake Storage Enhancement Project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. Because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative. However, this project would result in the ability to maintain the lake at higher than historical levels compared to existing conditions and the No-action Alternative.

Under existing conditions, the maximum fill height of the lake is approximately 4,667 feet because the embankment portion of the dam has deteriorated. After the dam is restored and raised, the lake would be able to fill to a new high water surface of 4,682 feet. Under this project, lake levels would be managed to rise beginning in the late fall and would continue to approximately 4,677 feet to the height of a notch in the proposed dam. The lake would remain at this height until stop logs are placed in the notch early in the summer. Placement of the stop logs would allow the lake level to continue to rise to the spillway elevation of 4,682 feet. The lake would stay at this level for less than a month in the early summer, after which time IPID would begin drawing down the lake by releasing water.

Compared with existing conditions and the No-action Alternative, this means that an additional area of shoreline, approximately 13.6 acres, would be under water for a part of each year. Shoreline areas up to 4,671 feet have been historically inundated, but areas above 4,671 feet to 4,682 feet have not. This additional area would be under water for a little less than a month each summer. This change in lake levels could result in some changes to the vegetative community along the shoreline. However, because of the availability of habitat in the surrounding area and the fact that increased water levels would not represent a permanent increase in the lake height, it would not represent a substantial loss of habitat and is not anticipated to adversely affect wildlife.

The project would also allow for the lake to be drawn down below existing lake levels to an elevation of 4,619 feet, which is approximately 24.4 feet lower than the existing low. This change would result in the exposure of slightly more lake bed, mainly in the later summer months and early fall up to the point when the water would no longer be drawn down, generally around the end of September. The additional draw down is not expected to adversely affect wildlife by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity or any other changes that would adversely affect wildlife.

As discussed in Section 3.5, Water Quality, changes in flows in Icicle Creek would be within the natural variation already occurring within the system. The main changes would be beneficial increases in flows during times when water levels would otherwise be low.

As noted in Section 3.18, Shorelines, flow changes on Icicle Creek would not occur at a level that would negatively affect the shoreline. For these reasons, this project is not anticipated to result in significant long-term impacts on wildlife.

Upper Klonaqua Lake Storage Enhancement

Potential long-term impacts on wildlife would be similar to those described under the Eightmile Lake Storage Enhancement Project (see Section 4.9.5.2, Long-term Impacts). Potential benefits would mainly occur in Icicle Creek and would include an increased ability to augment stream flow in the late summer or during drought years, with flow augmentation primarily benefitting the section of Icicle Creek between Upper Klonaqua Lake and the IPID diversion.

As noted previously, compliance with applicable regulations, as discussed in Section 4.9.6, Mitigation Measures, would ensure there would be no net loss of important ecological functions that may be associated with impacts on any wildlife communities.

The frequency in fluctuations in lake levels in Upper Klonaqua Lake would increase compared to existing conditions and the No-action Alternative. Lake levels would also be drawn down further compared to existing conditions.

The high lake level in Upper Klonaqua Lake would not change. The lake would still refill and outlet naturally through an existing channel to Lower Klonaqua Lake during most of the year. However, the new facilities would allow for the lake to be drawn down an additional 20 feet to allow for access to an additional 1,146 acre-feet of storage. The draw down would likely occur over a couple of months in the late summer. The additional draw down is not expected to adversely affect wildlife habitat by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

As discussed in Section 3.5, Water Quality, changes in flows in Icicle Creek would be within the natural variation already occurring within the system. The main changes would be beneficial increases in flows during times when water levels would otherwise be low. As noted in Section 3.18, Shorelines, flow changes on Icicle Creek would not occur at a level that would negatively affect the shoreline. For these reasons, this project is not anticipated to result in significant long-term impacts on wildlife.

Upper and Lower Snow Lakes Storage Enhancement

Potential long-term impacts on wildlife would be similar to those described under the Eightmile Lake Storage Enhancement Project (Section 4.9.5.2, Long-term Impacts). Potential benefits would mainly occur in Icicle Creek and would include an increased ability to augment stream flow in the late summer or during drought years with flow augmentation primarily benefitting the section of Icicle Creek between Upper Klonaqua Lake and the IPID diversion.

As noted previously, compliance with applicable regulations, as discussed in Section 4.9.6, Mitigation Measures, would ensure there would be no net loss of important ecological functions that may be associated with impacts on any sensitive wildlife communities.

Because the facilities would be newer and operated remotely by USFWS, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less than would occur compared to existing conditions and the No-action Alternative. However, lake levels would also be able to reach higher or lower levels compared to both existing conditions and historical levels.

The proposed enhancement project would increase the high-water storage levels in both Upper and Lower Snow Lakes by 5 feet compared with existing high levels. This change would result in the inundation of some upland vegetation that has grown along the shoreline areas between the current and proposed high lake levels, most likely occurring in the fall through the early summer when releases would be likely to begin. This could result in some changes to the vegetative community along the shoreline, similar to those described for the other lakes under this Program Alternative. However, these changes would not likely result in significant impacts on wildlife for the reasons described previously.

The project would also allow for the Lower Snow Lake to be drawn down 3 feet below the current lake level, which would result in the exposure of slightly more lake bed. The additional draw down is not expected to adversely affect wildlife habitat by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

As discussed in Section 3.5, Water Quality, changes in flows in Icicle Creek would be within the natural variation already occurring within the system. The main changes would be beneficial increases in flows during times when water levels would otherwise be low. As noted in Section 3.18, Shorelines, flow changes on Icicle Creek would not occur at a level that would negatively affect the shoreline. For these reasons, this project is not anticipated to result in significant long-term impacts on wildlife.

Overall, potential adverse impacts would likely be less than significant because the potential loss or conversion of vegetation is expected to affect a relatively small area. Additionally, work within sensitive areas would require compliance with various local, state, and federal regulations, including NEPA, which would address the need for mitigation to reduce potential long-term impacts affecting wildlife (Section 4.9.7, Mitigation Measures).

4.9.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange Project would be included.

4.9.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange Project

This project would involve fully converting the IPID delivery systems to pressurized pipelines, removing the existing intakes on Icicle and Peshastin Creeks, and constructing three new pump stations and intakes on the Wenatchee River. Construction disturbance required throughout the entire delivery system for conversion to pressurized pipelines could result in short-term impacts on wildlife related to increase noise and temporary disturbance to surrounding vegetation.

Construction of the pump stations would require both in-water and riverbank work on the Wenatchee River, and Icicle and Peshastin Creeks, which could include the placement and removal of instream cofferdams, removal of streamside vegetation, and excavation of the streambed and bank. Project activities with the potential to affect sensitive wildlife species would require authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to address these impacts (Section 4.9.7, Mitigation Measures). Specific mitigation measures would be developed as part of future project-level review and permitting IPID Full Piping and Pump Exchange Project

4.9.6.2 Long-term Impacts

The IPID Full Piping and Pump Exchange Project would likely result in the loss of a small area of riparian vegetation for the pump stations, which could potentially affect wildlife, depending on the specific location. The project could also require clearing of vegetation along the entire delivery pipeline alignment, which would likely pass through existing agricultural properties and could impact orchard trees or other wildlife habitat.

Any adverse impacts would be likely less than significant because the area converted from vegetation to the new facilities or cleared would be compensated and mitigated as required by applicable local, state, and federal permits or approvals, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts such as compensating for the permanent loss of any sensitive areas (Section 4.9.7, Mitigation Measures).

Operational changes associated with relocating the pump stations and removing the existing diversion facilities would result in increased flows within Icicle and Peshastin Creeks. Increased flows within the creek would be beneficial to wildlife to the extent that higher flows would support riparian vegetation and any associated wildlife habitat.

4.9.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.9.7.1 Short-term Impacts

Short-term impacts on wildlife would be mitigated by complying with the terms and conditions of local, state, and federal regulations and obtaining required project-specific permits and approvals, such as any Shoreline Management Act shoreline permits; Critical Areas Review; HPAs; and CWA and Endangered Species Act compliance.

Common mitigation measures are likely to include pre-construction surveys, when deemed appropriate, conducting construction work in a manner to minimize disturbance of wildlife, ensuring no net loss of any important habitat or ecosystem functions or values, and possibly restricting the timing of some construction activities to avoid affecting particular species.

Specific mitigation measures would be developed as part of future project-level review and permitting. Mitigation measures to address potential short-term impacts on wildlife and habitat are expected to be the same as those described for vegetation and wetlands in Section 4.8.7, Mitigation Measures.

4.9.7.2 Long-term Impacts

Long-term impacts on wildlife would be mitigated by complying with the terms and conditions of local, state, and federal regulations and project-specific permits and approvals, as described under Short-term Impacts.

Specific mitigation measures would be developed as part of future project-level review and permitting. Mitigation measures to address potential long-term impacts on wildlife and habitat are expected to be the same as those described for vegetation and wetlands in Section 4.8.7, Mitigation Measures.

4.10 Threatened and Endangered Species

This section describes the potential short- and long-term impacts that could affect the special-status plant, wildlife, and fish species identified in Section 3.10, Threatened and Endangered Species, from construction and operation related to the No-action Alternative and Program Alternatives. Impacts on fish, vegetation, and wildlife in general are addressed in Section 4.7, Fish; Section 4.8, Vegetation; and Section 4.9, Wildlife.

4.10.1 No-action Alternative

4.10.1.1 Short-term Impacts

Under the No-action Alternative, various entities and agencies would undertake individual actions in the ALWA and in riparian areas along Icicle Creek and the Wenatchee River. This is anticipated to entail construction of water diversion modifications, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure at the Alpine Lakes including the restoration of the Eightmile Lake Dam, and improvements to existing irrigation systems to support agricultural reliability. Potential impacts would primarily be associated with projects that require construction. In the short term, construction activity could affect special-status species by causing noise disturbance and temporarily disturbing areas where habitat occurs as described in Section 4.8, Vegetation.

The agencies or entities implementing projects under the No-action Alternative would be required to comply with applicable local, state, and federal environmental review requirements, which would include compliance with the federal and state ESA, as described in Section 5.2, Table 5-2. In the event of any potential adverse impacts, project applicants would be required to implement appropriate mitigation measures to reduce impacts on special-status species, such as including any necessary timing restrictions for construction work and ensuring no net loss of important habitat and ecological values and functions (Section 4.10.7, Mitigation Measures). Additionally, federal agencies are required to ensure that their actions do not adversely affect listed critical habitat. Therefore, short-term impacts on special-status species under the No-action Alternative are not expected to be significant.

4.10.1.2 Long-term Impacts

Long-term impacts under the No-action Alternative are anticipated to be largely beneficial for fish and wildlife species, especially those dependent on Icicle Creek (including special-status species), because many projects would seek to improve instream flows during the late summer and improve habitat conditions overall. The restoration of the dam at Eightmile Lake and re-operation of the lake would result in the ability to maintain the lake at higher, historical levels compared to existing conditions. This change in lake levels could result in some changes to the vegetative community along the fringes of the shoreline; however, this area is expected to be relatively small, on the order 3.6 acres of shoreline area inundated, and would not represent a substantial loss of habitat that is anticipated to adversely affect special-status species. Because both instream flow and fish habitat enhancement projects would not generally be coordinated with other activities in the Icicle project area, benefits are not anticipated to be as great as they would under the other Program Alternatives. Potential long-term benefits from such projects are also expected to be more localized, providing only minor overall benefits within the larger Icicle Creek Subbasin.

4.10.2 Alternative 1

Implementation of Alternative 1 has the potential to result in greater impacts on special-status species compared with the No-action Alternative because there would be a higher likelihood that certain projects would be implemented and the scale of certain efforts would likely be greater. Compliance with the Guiding Principles addressed special-status species in general by ensuring compliance with applicable regulations, including the ESA. The following sections describe the short- and long-term impacts that would occur under Alternative 1.

4.10.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Most of the work under the Alpine Lakes Optimization, Modernization, and Automation Project would occur in upland areas. Some limited work would occur within the lake shorelines but within the dry when the lakes are drawn down at the end of the summer. Construction activity would last for a period of 2 to 4 weeks at each lake. Some small equipment may be packed in via various trails, but it is likely that most equipment and construction personnel would be transported to the project site by helicopter. Construction activity could disturb any special-status species that may be present during construction.

Listed plant species with the greatest potential to occur within the project site include showy stickseed (*Hackelia venusta*) and Wenatchee Mountains checkermallow (*Sidalcea oregana var. calva*); however, these species would not likely be affected by construction because the proposed activities would occur within areas where these species are very unlikely to be found. If activities were to occur outside of these areas, compliance with existing regulations would require the implementation of mitigation measures to minimize potential impacts as noted in Section 4.10.7, Mitigation Measures.

Listed animal species that could occur at or near the project sites include northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratus*), yellow-billed cuckoo (*Coccyzus americanus*), Canada lynx (*Lynx canadensis*), gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos horribilis*), and wolverine (*Gulo gulo*). As noted in Section 3.10, Threatened and Endangered Species, there are no special-status fish species located within these lakes.

Although some vegetated areas would be used to stage construction equipment and provide temporary housing for workers, there would be no permanent loss of habitat and the activities would not block access to adjacent habitat areas. As discussed in Section 4.5, Water Quality, construction is not anticipated to result in significant water quality impacts.

Construction activities would also result in an increase in noise above background conditions that could disturb any species that may be present. However, the levels would

be similar to the noise that already occurs as the result of maintenance-related activities, including the use of helicopters, which have occurred and would continue regardless of this project. As noted in Section 3.15, Recreation, background noise includes regular recreational activity around each of the lakes, including hikers and overnight campers. If bothered by increased sound, generally speaking, special-status species would be able to temporarily relocate to other areas of similarly suitable habitat without significant impacts. This would be similar to what currently occurs related to operation and maintenance at the lakes.

There is a potential for more significant disturbance to occur if loud construction noise occurs during the breeding season. Special-status bird species are particularly vulnerable because nesting birds have been known to abandon their nests in response to sudden loud increases in noise; however, construction activity would occur in late summer, which is outside the breeding period for both marbled murrelet and northern spotted owl. Compliance with applicable local, state, and federal regulations would ensure that there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and ensuring no net loss of ecological functions and values for important habitat (Section 4.10.7, Mitigation Measures).

IPID Irrigation Efficiencies

Construction activities associated with this project include the conversion of IPID canals to pipelines and lining of irrigation canals with concrete. Short-term impacts that could adversely affect special-status species include disturbance from increased construction activity and noise and temporary disturbance of habitat. As noted in Section 4.14, Noise, construction-related noise is anticipated to be relatively minimal. Species in the area may temporarily relocate to other areas during periods of increased activity. Short-term impacts would be relatively limited because most of the work would occur within areas that are already disturbed, such as within rights-of-way and existing canal easements, during the off-season when the irrigation canals are dry, and away from where special-status fish species may be found.

Compliance with applicable local, state, and federal regulations would further ensure that there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and ensuring no net loss of ecological functions and values for important habitat (Section 4.10.7, Mitigation Measures).

COIC Irrigation Efficiencies and Pump Exchange

Potential impacts on special-status species associated with work affecting COIC canals and laterals would be similar to those described for the IPID Irrigation Efficiencies Project. This project would also involve construction of the COIC pump station, requiring in-water work along lower Icicle Creek or the Wenatchee River, which would result in a slightly higher potential to adversely affect special-status species, particularly any fish

that might be present during construction. Potential impacts include increased risk of disturbance or harm from construction activities, such as from installation of a cofferdam, increased potential for harm from noise and vibration, increased risks of water quality impacts adversely affecting aquatic habitat, and temporary loss of aquatic habitat during dewatering for in-water construction.

Work within waters of the United States or State or within irrigation canals or spillways that reconnect to these waters would require a CWA Section 404 Permit and associated Section 401 Water Quality Certification; work in other portions of the irrigation system could require local review and authorization. Compliance with these and other applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include limiting in-water work, excluding aquatic species from in-water work areas, and implementing construction timing restrictions (Section 4.10.7, Mitigation Measures).

Domestic Conservation Efficiencies

Construction activities proposed under the Domestic Conservation Efficiencies Project include pipeline replacement and meter installation. These activities are unlikely to adversely affect special-status species because the work would be done in areas that are already developed that provide minimal to no habitat.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project involves demolishing an existing dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures to restore the maximum water storage level in the lake to an elevation of 4,671 feet and restore the accessible storage in the lake to the volume permitted by IPID's water right (2,500 acre-feet). Construction activity would occur along the shorelines and within the dry areas of the lake margins once the lake has been drawn down and in Eightmile Creek immediately downstream of the dam. While most construction equipment (potentially including a small tracked excavator) and materials would likely be flown into the project site via helicopter, IPID is considering the option of walking in a larger tracked excavator or a spider excavator. The trail to access the project site requires several stream crossings and parallels several potential wetlands (Figure 3-10).

Listed plant species with the greatest potential to occur within the project site include showy stickseed and Wenatchee Mountains checkermallow; however, these species would not likely be affected by construction because the proposed activities would occur within dry lake margins or the existing structures where these species are very unlikely to be found. If activities were to occur outside of these areas, compliance with existing regulations would require the implementation of mitigation measures to minimize potential impacts as noted in Section 4.10.7, Mitigation Measures.

Listed animal species that could occur near the project site include northern spotted owl, marbled murrelet, yellow-billed cuckoo, Canada lynx, gray wolf, grizzly bear, and wolverine. There are no special-status fish species located at this lake.

Although some vegetated areas would be used to stage construction equipment and provide temporary housing for workers, there would be no permanent loss of habitat and the activities would not block access to adjacent habitat areas. As discussed in Section 4.5, Water Quality, potential impacts affecting water quality would be low.

Construction activities would also result in an increase in noise above background conditions that could disturb any species that may be present. However, most construction activities would result in noise levels similar to those that already occur and would continue for maintenance unrelated to this project. As noted in Section 3.15, Recreation, background noise includes regular recreational activity around the lake, including hikers and overnight campers. If bothered by increased sound, generally speaking, special-status species would be able to temporarily relocate to other areas of similarly suitable habitat without significant impacts. This would be similar to what currently occurs related to operation and maintenance at the lakes.

There is a potential for more significant disturbance to occur if loud construction noise occurs during the breeding season. Construction for this project could involve blasting. Special-status bird species are particularly vulnerable because nesting birds have been known to abandon their nests in response to sudden loud increases in noise; however, construction activity would occur in late summer, which is outside the breeding period for both marbled murrelet and northern spotted owl. Compliance with applicable local, state, and federal regulations would ensure there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and ensuring no net loss of ecological functions and values for important habitat (Section 4.10.7, Mitigation Measures).

Tribal Fishery Preservation and Enhancement

The details of the Tribal Fishery Preservation and Enhancement Project and the specific impacts on fish and wildlife species are not known at this time but are expected to require ground disturbance and likely in-water work on lower Icicle Creek. Depending on the specific location of the activities, construction could result in short-term impacts on special-status species, similar to those described above. Compliance with applicable local, state, and federal regulations would ensure that there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and ensuring no net loss of ecological functions and values for important habitat (Section 4.10.6, Mitigation Measures).

Habitat Protection and Enhancement

The details of the Habitat Protection and Enhancement Project and the specific impacts on fish and wildlife species are not known at this time, although construction is expected to involve grading; planting and thinning vegetation; hauling and placing logs, rock, soil, and other materials; and some in-water work on lower Icicle Creek. Depending on the specific location of the activities, construction could result in short-term impacts on special-status species, similar to those described above. Compliance with applicable local, state, and federal regulations would ensure there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and ensuring no net loss of ecological functions and values for important habitat (Section 4.10.7, Mitigation Measures).

Instream Flow Rule Amendment

There are no construction activities proposed under the Instream Flow Rule Amendment Project and therefore no potential short-term impacts to special-status species.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project includes various elements geared towards improving water quality and hatchery rearing conditions at the LNFH. In general, construction of these elements has the potential to affect special-status species, depending on the specific location and type of disturbance. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential short-term impacts under NEPA would be completed once the full scope of the project is determined.

Similar to the construction activities described above, various authorizations are likely to be required that would ensure potential impacts would be avoided, minimized, or compensated as noted in Section 4.10.7, Mitigation Measures.

Fish Passage Improvements

The details of the Fish Passage Improvements Project and the specific impacts on fish and wildlife species are not known at this time, although construction is expected to involve in-water work and some streambank alterations along lower Icicle Creek. Depending on the specific location of the activities, construction could result in short-term impacts on special-status species, similar to those described above. Compliance with applicable local, state, and federal regulations would ensure there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and ensuring no net loss of ecological functions and values for important habitat (Section 4.10.7, Mitigation Measures).

Fish Screen Compliance

The details of the Fish Screen Compliance Project and the specific impacts on fish and wildlife species are not known at this time, although construction is expected to involve in-water work and some streambank alterations along lower Icicle Creek. Depending on the specific location of the activities, construction could result in short-term impacts on special-status species, similar to those described above. Project activities are expected to require authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits and approvals issued by these agencies would require appropriate mitigation measures to address any significant impacts on special-status species (Section 4.10.7, Mitigation Measures). These measures would be developed to address any such impacts once project-level information is available.

Water Markets

There are no construction activities proposed under the Water Markets Project and therefore no potential short-term impacts to non-fish listed species and associated habitats.

4.10.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from the affected lakes. Over the long term, the greatest potential for affecting special-status species would be related to changes in how the lakes are managed and the resulting changes in flows in Lower Icicle Creek.

Under this project, the frequency in fluctuations in lake levels would increase compared to existing conditions because some portion of each lake would be drawn down every year instead of relying on only one or two lakes per year; however, the high and low lake water levels at the lakes would not change. Although total water withdrawn would increase, operation of the proposed project would also potentially result in less draw down at any one lake because releases would be spread across all lakes and releases would be optimized to meet instream and water supply needs in Icicle Creek. Lake level variation would largely remain within the same parameters as existing conditions.

As noted in Sections 4.5, Surface Water Quality; 4.7, Fish; 4.8, Vegetation; and 4.9, Wildlife, re-operation of the lakes is not anticipated to result in significant changes affecting aquatic or terrestrial species. This is because although lakes could be affected each year compared to every few years, the changes in lake levels (e.g., highs and lows) would be consistent with existing operations and the current seasonal pattern of change, and is not expected to result in significant changes in ecosystem processes.

Additional flows released from these lakes would also be more evenly spread out across receiving streams that flow into Icicle Creek and eventually the Wenatchee River. This is expected to result in conditions more similar to the natural flow regime of these lakes

than otherwise would occur under existing conditions, benefiting special-status species in Icicle Creek, including ESA-listed spring-run Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), and bull trout. These benefits are generally anticipated to extend to any listed critical habitat and essential fish habitat within Icicle Creek and its tributaries and the Wenatchee River.

With more efficient operation of the lakes, flow releases to lower Icicle Creek could be better targeted to the periods when they are needed. In general, this would mean that there would be lower contributions to peak flows early in the season and there would be higher contributions, estimated at up to 30 cubic cfs, when flows are low later in the summer.

As part of the Guiding Principles, flows would also be managed to benefit these species and minimize adverse impacts. For example, lake releases would ramp down gradually toward the end of the augmentation period to avoid stranding fish, and releases from these lakes would be limited in September to avoid negative affects to spawning bull trout (*Salvelinus confluentus*).

As part of the overall Icicle Strategy, efforts to characterize the impacts of the managed flows on special-status species are ongoing and future monitoring is also planned to determine whether additional mitigation measures could be needed to address potential impacts. For example, studies have looked at how instream flow releases affect important characteristics of bull trout Critical Habitat in French and Leland Creeks, including potential impacts on the food base and groundwater connectivity. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.10.7, Mitigation Measures.

IPID Irrigation Efficiencies

The majority of the project elements include pipelines or canal improvements that would occur in areas that have already been developed and would not result in long-term adverse impacts on special-status species.

As noted in Section 4.7, Fish, in the long term, this project would also contribute to beneficial increases in instream flows downstream of the current IPID diversion in the lower 5.7 RMs of Icicle Creek and in the Wenatchee River downstream of Icicle Creek. Improving irrigation system efficiency is intended to benefit special-status species in Icicle Creek, including ESA-listed spring-run Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), and bull trout, by allowing more water to remain in the creek downstream of the IPID irrigation diversions from April through September.

COIC Irrigation Efficiencies and Pump Exchange

Replacing canals and laterals with piping would occur in areas that have already been developed and would not result in long-term adverse impacts on special-status species. A pump station near the confluence of Icicle Creek and the Wenatchee River would

potentially result in long-term changes affecting habitat. As part of this project, a new pump station would be constructed on the Wenatchee River or Lower Icicle Creek. These facilities would result in the loss of a small area of riparian vegetation and, depending on the specific location, could affect special-status fish species.

Compliance with applicable regulations would be required to ensure there is no net loss of ecological functions or values associated with siting the pump station and that there would be no significant impacts affecting special-status species. Therefore, there would be no significant long-term adverse impacts on special-status species expected. The long-term impacts associated with this project would be beneficial with respect to fish and wildlife in general, including special-status species.

As noted in Section 4.7, Fish, in the long term, this project would also contribute to beneficial increases in instream flows downstream of the current COIC diversion in the lower 4.5 RMRMs of Icicle Creek and in the Wenatchee River downstream of Icicle Creek. Improving irrigation system efficiency is intended to benefit special-status species in Icicle Creek, including ESA-listed spring-run Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), and bull trout, by allowing more water to remain in the creek downstream of COIC irrigation diversions during the irrigation season.

Domestic Conservation Efficiencies

As discussed in Section 4.7, Fish; Section 4.8, Vegetation; and Section 4.9, Wildlife, this project is not expected to result in adverse long-term impacts on threatened and endangered species. Over the long term, the impacts are expected to be beneficial as the result of improved instream flows, which would also provide benefits for special-status fish species.

Eightmile Lake Storage Restoration

Operation of the proposed facilities for the Eightmile Lake Storage Restoration Project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. Over the long term, the greatest potential for affecting special-status species would be related to changes in how the lakes are managed and the resulting changes in flows in lower Icicle Creek.

Because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions. However, this project would result in the ability to maintain the lake at historical levels compared to existing conditions.

Under existing conditions, the maximum fill height of the lake is approximately 4,667 feet because the embankment portion of the dam has deteriorated. After the dam is restored, the lake would be able to fill to the historical high level of 4,671 feet. Under this project, lake levels would be managed to rise beginning in the late fall and would continue to approximately 4,666 feet, which would be the crest elevation of a notch in the

proposed dam. The lake would remain at this height until stop logs are placed in the notch early in the summer. Placement of the stop logs would allow the lake level to continue to rise to the spillway elevation of 4,671 feet, equal to the historical full water surface elevation. The lake would stay at this level for less than a month in the early summer, after which time IPID would begin drawing down the lake by releasing water.

Compared with existing conditions and the No-action Alternative, this means that an additional area of shoreline would be under water. These areas have been historically inundated, but have not been under water since deterioration of the embankment. This change in lake levels could result in some changes to the vegetative community along the fringes of the shoreline; however, this area is expected to be relatively small, on the order of 3.6 acres of shoreline area inundated, and would not represent a substantial loss of habitat that is anticipated to adversely affect special-status species.

The project would also allow for the lake to be drawn down below the existing low lake levels to an elevation of 4,621 feet, which is approximately 22.4 feet below the existing low. This change would result in the exposure of slightly more lake bed, mainly late in the summer and early fall up to the point when the water would no longer be drawn down, generally around the end of September. The additional draw down is not expected to adversely affect vegetation or wetlands by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity or any other changes that would adversely affect special-status species.

Restoration of the dam would result in the ability to release up to 9.5 additional cfs from the lake relative to existing conditions. Increased flows would be released from the dam into Eightmile Creek, which flows into Icicle Creek. Increased flows would occur from the point of release at Eightmile Lake Dam down to the IPID diversion at RM 5.7.

As discussed in Section 4.7, Fish, the potential impacts associated with increased flows would generally be beneficial with respect to fish and aquatic invertebrates. The benefits are mainly associated with increasing aquatic habitat in lower Icicle Creek in the later summer months and improving fish passage to the upper reaches (above the Boulder Field at RM 5.6) of Icicle Creek and its tributaries, benefiting special-status species in Icicle Creek, including ESA-listed spring-run Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), and bull trout. However, there remains uncertainty around how increased flows might affect fish habitat within the study area or interaction within and between fish species, including any special-status fish that may be present. For additional information, see Section 4.7, Fish.

As part of the overall Icicle Strategy, the Guiding Principles require flows to be managed to benefit aquatic species and minimize adverse impacts. An example of a strategy under consideration is prioritizing the timing of releases relative to potential impacts on downstream aquatic habitat. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to

address potential impacts on special-status species as noted in Section 4.10.7, Mitigation Measures.

Tribal Fishery Preservation and Enhancement

The purpose of the Tribal Fishery Preservation and Enhancement Project is to protect and enhance the tribal fishery, which, depending on the specific actions, could result in the loss of some small areas of terrestrial or aquatic habitat used by special-status species; however, these project elements are meant to preserve and enhance stream and riparian habitat in the system overall, leading to improved habitat functions and long-term benefits for fish and wildlife in general, including special-status species.

Compliance with applicable local, state, and federal regulations would ensure that there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review (Section 4.10.7, Mitigation Measures).

Habitat Protection and Enhancement

As discussed in Sections 4.7, Fish; 4.8, Vegetation; and 4.9, Wildlife, the Habitat Protection and Enhancement Project is not expected to result in adverse long-term impacts on fish and wildlife, including special-status species. Over the long term, the impacts are expected to be beneficial by providing improved instream and riparian habitat conditions.

Compliance with applicable local, state, and federal regulations would ensure that there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review (Section 4.10.7, Mitigation Measures).

Instream Flow Rule Amendment

As provided for in the Wenatchee Instream Flow Rule (Chapter 173-545 WAC), this project would increase the Icicle Reserve after implementation of instream flow and habitat restoration actions. The Icicle Reserve increase would be 0.4 cfs and offset by an equal reserve reduction for the mainstem Wenatchee River. This would create a 0.4 cfs impact on Icicle Creek, which does not exist under current conditions. This impact is anticipated to be offset by the implementation of other projects that benefit streamflow under Alternative 1.

Depending on the instream conditions at the timing and location of this 0.4 cfs impact, there could be potential conflicts with the other uses, most likely those associated with fish and wildlife habitat uses designated for Icicle Creek, which could adversely affect special-status species on a localized basis.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

As discussed in Sections 4.7, Fish; 4.8, Vegetation; and 4.9, Wildlife, this project is not expected to result in adverse long-term impacts on fish and wildlife but rather, would improve water quantity and water quality, which would benefit fish and wildlife in general, including any special-status species. Most the work included under this project is designed to improve water use efficiency at LNFH and to develop additional groundwater supplies

such that less water would need to be diverted from Icicle Creek for hatchery operations. Such actions would potentially support higher flows in the system, especially during late summer, which would benefit special-status species present within and along the creek.

Fish Passage

As discussed in Sections 4.7, Fish; 4.8, Vegetation; and 4.9, Wildlife, the long-term impacts on fish and wildlife under the Fish Passage Project are generally anticipated to be beneficial because of increased access to additional habitat for listed fish species and the associated general improvement in ecosystem function. As discussed in Section 4.7, Fish, the potential impacts associated with increased flows would generally be beneficial with respect to fish and aquatic invertebrates and listed critical habitat. The benefits are mainly associated with increasing aquatic habitat in lower Icicle Creek in the later summer months and improving fish passage to the upper reaches (above the Boulder Field at RM 5.6) of Icicle Creek and its tributaries. However, there remains uncertainty around how increased flows might affect fish habitat or interaction within and between fish species, including any special-status fish that may be present within the study area. For additional information, see Section 4.7, Fish.

Potential long-term impacts on special-status species, particularly listed fish, would be addressed during project design. Compliance with applicable local, state, and federal regulations would ensure there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review (Section 4.10.7, Mitigation Measures).

Fish Screen Compliance

As discussed in Section 4.7, Fish, and Section 4.9, Wildlife, the long-term impacts on fish and wildlife, including special-status species, under the Fish Screen Compliance Project are generally anticipated to be beneficial because of increased protection and improved passage conditions for listed fish species and the associated general improvement in ecosystem function. Under this project, screens and associated infrastructure would be improved to bring all three intakes up to compliance with state and federal laws. Improvements to fish screens are intended to provide a long-term benefit to fish.

Any adverse impacts associated with screen improvements would be likely less than significant because these impacts would be addressed as required by applicable local, state, and federal permits or approvals, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts such as revegetating any disturbed areas and compensating for the permanent loss of any sensitive areas that could not otherwise be restored (Section 4.10.7, Mitigation Measures). These requirements would be developed once project-specific details were available.

Water Markets

As discussed in Section 4.7, Fish, and Section 4.9, Wildlife, the long-term impacts on fish and wildlife, including special-status species, under the Water Markets Project are generally anticipated to be beneficial because of the potential to increase instream flows that would provide for improved ecological function and habitat values.

4.10.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. Compliance with the Guiding Principles addressed special-status species in general by ensuring compliance with applicable regulations, including the ESA. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Impacts of other projects proposed under Alternative 2 are described under Alternative 1.

4.10.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction of a new IPID pump exchange would require both in-water and riverbank work on the Wenatchee River, including the placement and removal of instream cofferdams, removal of streamside vegetation, and excavation of the streambed and bank. Depending on the specific location of the activities, construction could result in short-term impacts on special-status species, primarily related to construction disturbance. Project activities with the potential to affect these species would require authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to address these impacts (Section 4.10.7, Mitigation Measures). Specific mitigation measures would be developed as part of future project-level review and permitting.

4.10.3.2 Long-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project facilities would likely result in the loss of a small area of riparian vegetation for the pump exchange station and intake facilities constructed along the right bank of the Wenatchee River and, depending on the specific location, could potentially affect special-status species. The project could also require clearing of vegetation along the delivery pipeline alignment, which would likely pass through existing agricultural properties and could impact orchard trees. Depending on the specific location, long-term operation could affect special-status fish species.

Generally speaking, the overall impacts associated with this project are expected to be beneficial because instream flows would increase by approximately 25 cfs between the

current IPID diversion (RM 5.7) and the new pump station location, yet to be determined, during late summer pump station operation. This project is intended to benefit special-status species in Icicle Creek, including ESA-listed spring-run Chinook salmon, steelhead, and bull trout, by replacing diversions from Icicle Creek with water pumped to irrigation canals from the Wenatchee River. Increased flows in Icicle Creek are likely to improve fish passage through obstructions in Icicle Creek during summer, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout by allowing access to high-quality habitat in the upper reaches of Icicle Creek.

Any adverse impacts on special-status species would be likely less than significant because the amount of area converted from vegetation to the new facilities would be small. Potential operational impacts affecting fish species would be addressed as required by applicable local, state, and federal permits or approvals.

4.10.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 1 and Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 project would be included while the Eightmile Lake Storage Restoration Project would not. Compliance with the Guiding Principles addressed special-status species in general by ensuring compliance with applicable regulations, including the ESA. This section describes the specific short- and long-term impacts associated with the Legislative Change Creating OCPI Authority for Alternative 3 Project. Impacts associated with other projects proposed under Alternative 3 are described in Alternative 1 and Alternative 2.

4.10.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

There are no construction activities proposed under this project and therefore no potential short-term impacts on special-status species.

4.10.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

If the proposed Legislative Change Creating OCPI Authority for Alternative 3 Project were enacted, there could be potential conflicts with instream flow allocations that could result in adverse impacts on special-status species, primarily fish. Under the proposed changes, junior domestic water rights could be exercised even when the Instream Flow Rule is not met. This could result in potential adverse impacts on water quality as a result of low-flow conditions that could adversely affect special-status species, mainly fish. Under Alternative 3, there would be flow improvement projects implemented. However, the timing of flow improvements might not always provide in-time mitigation for junior users.

4.10.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1. The Eightmile Lake Storage Restoration Project would be replaced with the Eightmile Lake Storage Enhancement Project, and the Upper Klonaqua Lake and Upper and Lower Snow Lakes Storage Enhancement Projects would be included. Compliance with the Guiding Principles addressed special-status species in general by ensuring compliance with applicable regulations, including the ESA. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.10.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

This project would involve demolishing the existing dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures that would allow for an increase in the accessible storage at Eightmile Lake to 3,500 acre-feet. The spillway elevation would be raised to allow for storage at a higher level than current or historical water storage levels and the project would allow for additional draw down of the lake.

Listed plant species with the greatest potential to occur within the project site include showy stickseed and Wenatchee Mountains checkermallow; however, these species would not likely be affected by construction because the proposed activities would occur within dry lake margins or the existing structures where these species are very unlikely to be found. If activities were to occur outside of the work areas, compliance with existing regulations would require the implementation of mitigation measures to minimize potential impacts as noted in Section 4.10.7, Mitigation Measures.

Listed animal species with the greatest potential to occur near the project site include northern spotted owl, marbled murrelet, yellow-billed cuckoo, Canada lynx, gray wolf, grizzly bear, and wolverine. There are no special-status fish species located at this lake.

Although some vegetated areas would be used to stage construction equipment and provide temporary housing for workers, there would be no permanent loss of habitat and the activities would not block access to adjacent habitat areas. As discussed in Section 4.5, Water Quality, potential impacts affecting water quality would be low.

Construction activities would also result in an increase in noise above background conditions that could disturb any species that may be present. However, most construction activities would result in noise levels similar to those that already occur and would continue for maintenance unrelated to this project. As noted in Section 3.15, Recreation, background noise includes regular recreational activity around the lake, including hikers and overnight campers. If bothered by increased sound, generally speaking, special-status species would be able to temporarily relocate to other areas of

similarly suitable habitat without significant impacts. This would be similar to what currently occurs related to operation and maintenance at the lake.

There is a potential for more significant disturbance to occur if loud construction noise occurs during the breeding season. Construction for this project could involve blasting. Special-status bird species are particularly vulnerable because nesting birds have been known to abandon their nests in response to sudden loud increases in noise; however, construction activity would occur in late summer, which is outside the breeding period for both marbled murrelet and northern spotted owl. Compliance with applicable local, state, and federal regulations would ensure there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and ensuring no net loss of ecological functions and values for important habitat (Section 4.10.6, Mitigation Measures).

Upper Klonaqua Lake Storage Enhancement

Special-status species could be adversely affected in the short-term from construction activity in a manner similar to what would occur as described above for the Eightmile Lake Storage Enhancement Project (Section 4.10.5.1, Short-term Impacts). The same special-status species have the potential to occur at this project site.

Construction activity would mainly occur in the dry lake margins in the late summer when the lake is drawn down. Although some vegetated areas would be used to stage construction equipment and provide temporary housing for workers, there would be no permanent loss of habitat and the activities would not block access to adjacent habitat. As discussed in Section 4.5, Water Quality, risks of spills (e.g., fuel, chemicals, etc.) would be very low because there would be limited use of powered equipment near water and work would occur in the dry after the lake was drawn down.

Construction activities would also result in an increase in noise above background conditions that could disturb any species that may be present. However, most construction activities would result in noise levels similar to those that already occur and would continue for maintenance unrelated to this project. As noted in Section 3.15, Recreation, background noise includes regular recreational activity around the lakes, including hikers and overnight campers. If bothered by increased sound, generally speaking, special-status species would be able to temporarily relocate to other areas of similarly suitable habitat without significant impacts. This would be similar to what currently occurs related to operation and maintenance at the lakes.

There is a potential for more significant disturbance to occur if loud construction noise occurs during the breeding season. Construction for this project could involve blasting. Special-status bird species are particularly vulnerable because nesting birds have been known to abandon their nests in response to sudden loud increases in noise; however, construction activity would occur in late summer, which is outside the breeding period for both marbled murrelet and northern spotted owl. Compliance with applicable local,

state, and federal regulations would ensure there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and ensuring no net loss of ecological functions and values for important habitat (Section 4.10.7, Mitigation Measures).

Upper and Lower Snow Lakes Storage Enhancement

Special-status species could be adversely affected in the short-term from construction activity in a manner similar to what would occur as described above for the Eightmile Lake Storage Enhancement Project (4.10.5.1, Short-term Impacts). The same special-status species have the potential to occur at this project site.

Construction activity would occur primarily in the dry lake margins in the late summer when the lake is drawn down. Although some vegetated areas would be used to stage construction equipment and temporarily provide housing for workers, there would be no permanent loss of habitat and the activities would not block access to adjacent habitat. As discussed in Section 4.5, Water Quality, risks of spills (e.g., fuel, chemicals, etc.) would be very low because there would be limited use of powered equipment near water and work would occur in the dry after the lake was drawn down.

Construction activities would also result in an increase in noise above background conditions that could disturb any species that may be present. However, most construction activities would result in noise levels similar to those that already occur and would continue for maintenance unrelated to this project. As noted in Section 3.15, Recreation, background noise includes regular recreational activity around each of the lakes, including hikers and overnight campers. If bothered by increased sound, generally speaking, special-status species would be able to temporarily relocate to other areas of similarly suitable habitat without significant impacts. This would be similar to what currently occurs related to operation and maintenance at the lakes.

There is a potential for more significant disturbance to occur if loud construction noise occurs during the breeding season. Construction for this project could involve blasting. Special-status bird species are particularly vulnerable because nesting birds have been known to abandon their nests in response to sudden loud increases in noise; however, construction activity would occur in late summer, which is outside the breeding period for both marbled murrelet and northern spotted owl. Compliance with applicable local, state, and federal regulations would ensure there were no significant impacts on special-status species. If needed, mitigation would be developed during project-level review, which could include measures such as implementing construction timing restrictions and ensuring no net loss of ecological functions and values for important habitat (Section 4.10.7, Mitigation Measures).

4.10.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. Over the long term, the greatest potential for affecting special-status species would be related to changes in how the lakes are managed and the resulting changes in flows in lower Icicle Creek.

Because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative. However, this project would result in the ability to maintain the lake at higher than historical levels compared to existing conditions and the No-action Alternative.

Under existing conditions, the maximum fill height of the lake is approximately 4,667 feet because the embankment portion of the dam has deteriorated. After the dam is restored, the lake would be able to fill to a new high water surface of 4,682 feet. Under this project, lake levels would be managed to rise beginning in the late fall and would continue to approximately 4,677 feet to the height of a notch in the proposed dam. The lake would remain at this height until stop logs are placed in the notch early in the summer. Placement of the stop logs would allow the lake level to continue to rise to the spillway elevation of 4,682 feet. The lake would stay at this level for less than a month in the early summer, after which time IPID would begin drawing down the lake by releasing water. These changes would increase the accessible storage to 3,500 acre-feet, which is 1,000 acre-feet more than currently permitted by IPID's water right.

Compared with existing conditions and the No-action Alternative, this means that an additional area of shoreline, approximately 13.6 acres, would be under water for a part of each year. Shoreline areas up to 4,671 feet have been historically inundated, but areas above 4,671 feet to 4,682 feet have not. This additional area would be under water for a little less than a month each summer. This change in lake levels could result in some changes to the vegetative community along the shoreline. However, because of the availability of habitat in the surrounding area and the fact that increased water levels would not represent a permanent increase in the lake height, it would not represent a substantial loss of habitat that is anticipated to adversely affect special-status species.

The project would also allow for the lake to be drawn down below existing lake levels to an elevation of 4,619 feet, which is approximately 24.4 feet lower than the existing low. This change would result in the exposure of slightly more lake bed, mainly in the later summer months and early fall up to the point when the water would no longer be drawn down, generally around the end of September. The additional draw down is not expected to adversely affect vegetation or wetlands by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity or any other changes that would adversely affect special-status species.

As discussed in Section 4.7, Fish, the potential impacts associated with increased flows would generally be beneficial with respect to fish and aquatic invertebrates. The benefits are mainly associated with increasing aquatic habitat in lower Icicle Creek in the later summer months and improving fish passage to the upper reaches (above the Boulder Field at RM 5.6) of Icicle Creek and its tributaries. However, there remains uncertainty around how increased flows might affect fish habitat within Eightmile Creek or interaction within and between fish species, including special-status fish. For additional information, see Section 4.7, Fish.

As part of the overall Icicle Strategy, the Guiding Principles require flows to be managed to benefit aquatic species and minimize adverse impacts. An example of a strategy under consideration is prioritizing the timing of releases relative to potential impacts on downstream aquatic habitat. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.10.7, Mitigation Measures.

Upper Klonaqua Lake Storage Enhancement

The Upper Klonaqua Lake Storage Enhancement Project would provide the ability to store and release additional flows from Upper Klonaqua Lake, which would represent a change compared to existing conditions and the No-action Alternative as discussed further below. Over the long term, the greatest potential for impacts affecting fish and aquatic invertebrates would be related to the relative changes in lake levels and the resulting changes in flows in lower Icicle Creek.

The frequency in fluctuations in lake levels in Upper Klonaqua Lake would increase compared to existing conditions and the No-action Alternative. Lake levels would also be drawn down further compared to existing conditions.

The high lake level in Upper Klonaqua Lake would not change. The lake would still refill and outlet naturally through an existing channel to Lower Klonaqua Lake during most of the year. However, the new facilities would allow for the lake to be drawn down an additional 20 feet to allow for access to an additional 1,146 acre-feet of storage. The draw down would likely occur over a couple of months in the late summer. The additional draw down is not expected to adversely affect special-status species, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

Modifications at Upper Klonaqua Lake would also result in the ability to release up to an additional 5 to 20 cfs from the lake. Increased flows would be released from the dam into a downstream tributary, which flows into Icicle Creek. Increased flows would occur from the point of release at Klonaqua Dam down to the IPID diversion at RM 5.7.

As discussed in Section 4.7, Fish, the potential impacts associated with increased flows would generally be beneficial with respect to fish and aquatic invertebrates. The benefits

are mainly associated with increasing aquatic habitat in lower Icicle Creek in the later summer months and improving fish passage to the upper reaches (above the Boulder Field at RM 5.6) of Icicle Creek and its tributaries. However, there remains uncertainty around how increased flows might affect fish habitat immediately downstream of the lake or interaction within and between fish species, including special-status fish. For additional information, see Section 4.7, Fish.

As part of the overall Icicle Strategy, the Guiding Principles require flows to be managed to benefit aquatic species and minimize adverse impacts. An Example of a strategy under consideration is prioritizing the timing of releases relative to potential impacts on downstream aquatic habitat. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.10.7, Mitigation Measures.

Upper and Lower Snow Lakes Storage Enhancement

The Upper and Lower Snow Lakes Storage Enhancement Project would provide the ability to store and release additional flows at the lake, which would represent a change compared to existing conditions and the No-action Alternative as discussed further below. Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from the lakes. Long-term impacts on special-status species could occur if there were any lasting impacts on critical habitat or long-term disturbance to these species from maintenance activities or changes in how lake levels are managed.

As discussed above, there would be no permanent loss of habitat, which would include designated critical habitat. Because the facilities would be newer and remotely operated by USFWS, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less than would occur compared to existing conditions and the No-action Alternative. However, lake levels would also be able to reach higher or lower levels compared to both existing conditions and historical levels.

The proposed enhancement project would increase the high-water storage levels in both Upper and Lower Snow Lakes by 5 feet compared with existing high levels. This change would result in the inundation of some upland vegetation that has grown along the shoreline areas between the current and proposed high lake levels, most likely occurring in the fall through the early summer when releases would be likely to begin. This could result in some changes to the vegetative community along the shoreline, similar to those described for the other lakes under this Program Alternative. However, these changes would not likely result in significant impacts on special-status species for the reasons described previously.

The project would also allow for Lower Snow Lake to be drawn down 3 feet below the current lake level, which would result in the exposure of slightly more lake bed. The additional draw down is not expected to adversely affect vegetation or wetlands by

comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

As discussed in Section 4.7, Fish, the potential impacts associated with increased flows would generally be beneficial with respect to fish and aquatic invertebrates. The benefits are mainly associated with increasing aquatic habitat in lower Icicle Creek in the later summer months and improving fish passage to the upper reaches (above the Boulder Field at RM 5.6) of Icicle Creek and its tributaries. However, there remains uncertainty around how increased flows might affect fish habitat immediately downstream of the lakes or interaction within and between fish species, including special-status fish. For additional information, see Section 4.7, Fish.

As part of the overall Icicle Strategy, the Guiding Principles require flows to be managed to benefit aquatic species and minimize adverse impacts. An example of a strategy under consideration is prioritizing the timing of releases relative to potential impacts on downstream aquatic habitat. Continued coordination on the development of the Icicle Strategy along with compliance with applicable regulatory requirements would help to address potential impacts on special-status species as noted in Section 4.10.7, Mitigation Measures.

4.10.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange would be included.

4.10.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange Project

This project would involve fully converting the IPID delivery systems to pressurized pipelines, removing the existing intakes on Icicle and Peshastin Creeks, and constructing three new pump stations and intakes on the Wenatchee River. Construction disturbance required throughout the entire delivery system for conversion to pressurized pipelines could result in short-term disturbance of special-status from increased noise and short-term impacts on vegetation.

Construction of the IPID Full Piping and Pump Exchange Project would require both in-water and riverbank work on the Wenatchee River and Icicle and Peshastin Creeks, including the placement and removal of instream cofferdams, removal of streamside vegetation, and excavation of the streambed and bank. Construction disturbance required throughout the entire delivery system for conversion to pressurized pipelines could result in short-term impacts on any special-status species that may be found within these areas as discussed further in Section 4.7.

Project activities with the potential to affect these species would require authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and

a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to address these impacts (Section 4.10.7, Mitigation Measures). Specific mitigation measures would be developed as part of future project-level review and permitting. Such measures could include limiting in-water work, excluding aquatic species from in-water work areas, and implementing construction timing restrictions.

4.10.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange Project

The project would likely result in the loss of a small area of riparian vegetation for the new pump stations and intake facilities constructed along the Wenatchee River and, depending on the specific location, could potentially affect special-status species. The project could also require clearing of vegetation along the delivery pipeline alignment, which would likely pass through existing agricultural properties and could impact orchard trees. Depending on the specific location, long-term operation could affect special-status fish species.

Generally speaking, the overall impacts associated with this project are expected to be beneficial because instream flows would in Icicle and Peshastin Creeks during late summer pump station operation. This project is intended to benefit special-status species in Icicle Creek, including ESA-listed spring-run Chinook salmon, steelhead, and bull trout, by replacing diversions from Icicle Creek and Peshastin Creek with water pumped to irrigation canals from the Wenatchee River. Increased flows in Icicle Creek are likely to improve fish passage through obstructions in Icicle Creek during summer, particularly benefiting anadromous and migratory salmon, steelhead, and bull trout by allowing access to high-quality habitat in the upper reaches of Icicle Creek.

Any adverse impacts would be likely less than significant because the area converted from vegetation to the new facilities or cleared would be compensated and mitigated. Potential operational impacts affecting fish species would be addressed as required by applicable local, state, and federal permits or approvals.

4.10.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.10.7.1 Short-term Impacts

Short-term impacts on special-status species would be mitigated by complying with the terms and conditions of local, state, and federal regulations and obtaining required project-specific permits and approvals, such as any Shoreline Management Act shoreline permits, Critical Areas Review, HPAs, CWA compliance, and ESA compliance.

Common mitigation measures are likely to include pre-construction surveys, when deemed appropriate, conducting construction work in a manner to minimize disturbance of special-status species, ensuring no net loss of any important habitat or ecosystem functions or values, and possibly restricting the timing of some construction activities to avoid affecting particular special-status fish and wildlife species, in particular during critical life stages (i.e., breeding or mating).

Specific mitigation measures would be developed as part of future project-level review and permitting. As long as any blasting occurs outside sensitive breeding periods for special-status species with a high potential to be in the project vicinity, mitigation measures to address potential short-term impacts on special-status species are expected to be the same as those described for vegetation and wetlands in Section 4.8.7, Mitigation Measures.

4.10.7.2 Long-term Impacts

Long-term impacts on special-status species would be mitigated by complying with the terms and conditions of local, state, and federal regulations and project-specific permits and approvals, as described above under Short-term Impacts.

Specific mitigation measures to address any potential long-term impacts would be developed as part of any future project-level review and permitting. Mitigation measures to address potential long-term impacts on special-status species and their habitat are expected to be similar to those described for vegetation and wetlands in Section 4.8.7, Mitigation Measures, but may also include subsequent monitoring activities.

4.11 Aesthetics

This section describes the potential short- and long-term environmental impacts that could affect the resources identified in Section 3.11, Aesthetics, from construction and operation related to the No-action Alternative and Program Alternatives.

To assess the potential impacts, key viewpoints within the Icicle Creek Watershed project area were selected based in part on a GIS viewshed analysis, refined through field observations. Key viewpoints are specific locations where sensitive viewer groups would be able to see aesthetic changes. Sensitive viewer groups represent multiple user groups who are more sensitive to aesthetic changes because their underlying activity relies in part on the aesthetic setting. The magnitude of an impact depends on, among other factors, the number of individuals exposed to a change and their collective sensitivity to the change.

Once the Icicle project area was defined, the GIS viewshed analysis involved identifying specific locations from which important aesthetic resources (e.g., scenic views, landscape features) can be seen. When available, information about how people use the Icicle project area (e.g., recreational use data) was overlaid to show where there is a concentrated area of potentially sensitive viewers. For a general example, a trailhead that

opens onto a panoramic overlook could represent a key viewpoint within a study area. Places where project changes are planned, such as a newly proposed facility, are also identified. A GIS analysis is then conducted to determine the visibility of project changes for sensitive viewers at each key viewpoint. The location of key viewpoints and representative views at these locations are presented in the discussion of Program Alternatives below.

4.11.1 No-action Alternative

4.11.1.1 Short-term Impacts

Under the No-action Alternative, various agencies and other entities would continue to undertake individual actions to restore and enhance fish and aquatic resources in the Icicle project area and maintain existing infrastructure, but those actions would not be part of a coordinated program implemented with the support of the Icicle Work Group. Actions implemented by individual agencies and entities to restore and enhance fish and aquatic resources could include upgrading irrigation infrastructure at the Alpine Lakes and constructing diversion improvements, irrigation system upgrades, LNFH improvements, and fish passage work.

Under the No-action Alternative, short-term impacts on aesthetics would primarily occur as the result of construction-related activities. Visual changes resulting from these activities could include short-term dewatering of stream segments and increased activity, including the transport of construction materials, and the operation of construction equipment. In some cases, construction may require vegetation removal, grading, and stockpiling soil. Depending on the specific location of these activities, there is a potential for aesthetic changes to be disruptive in the short-term; however, most of these changes would be temporary (i.e., lasting only for the duration of the construction activity) and would, therefore, not be likely to be significant.

In addition, as noted in Section 4.8, Vegetation, any potentially significant impacts related to removal of riparian vegetation or other vegetation types that constitute important habitat would be addressed prior to construction by compliance with applicable local, state, and federal permits and approvals. For instance, Chelan County Code requires riparian buffer protection and mitigation, with buffer widths determined based on Environment Designation and intensity of use as shown in Table 4-2 in Section 4.8, Vegetation.

A habitat management and mitigation plan may be required to avoid degradation of the riparian habitat function, structure, and value. Mitigation requirements would also provide aesthetic benefits.

4.11.1.2 Long-term Impacts

Long-term impacts under the No-action Alternative are anticipated to be largely beneficial for aesthetics because the projects likely to be implemented are expected to improve habitat and upgrade aging and degraded infrastructure. However, there would be no coordinated and integrated effort to ensure that the projects move forward in a well-planned manner, and thus these benefits are not anticipated to be as great as they would under the other Program Alternatives. In addition, project proponents may have less input or coordination with other stakeholders on the visual impact of a specific project that moves forward under the No-action Alternative. For example, if the Alpine Lakes Optimization, Modernization, and Automation project or the Eightmile Lake Storage Restoration project were to move forward as individual projects without input from a coordinated IWG, there might be less emphasis placed on making sure the infrastructure blends in aesthetically with the environment. Potential long-term benefits from such projects are also expected to be more localized, providing only minor overall benefits within the larger Icicle Creek Subbasin.

4.11.2 Alternative 1

Implementation of Alternative 1 has the potential to result in greater impacts on aesthetics compared with the No-action Alternative because there would be higher likelihood that certain projects would be implemented and the scale of certain efforts would likely be greater. The following sections describe existing viewpoints and the short- and long-term impacts that would occur under Alternative 1.

4.11.2.1 Short-term Impacts

This section addresses the potential for short-term impacts on aesthetics anticipated with implementation of individual projects under Alternative 1.

Alpine Lakes Optimization, Modernization, and Automation

The Alpine Lakes Optimization, Modernization, and Automation Project would improve management and releases of stored water at five lakes in the upper Icicle Creek Subbasin to meet agricultural needs. It would also increase instream flows for fish and improve reliability for agricultural use.

The sensitive viewers for this project are predominately recreation users (e.g., hikers and campers) who visit the Alpine Lakes as discussed in greater detail in Section 3.15, Recreation. Impacts on recreational use are described in greater detail in Section 4.15, Recreation.

The areas from which it would be possible to see proposed project changes are presented in orange in Figures 4-1 through 4-5 at each lake. This viewshed analysis is based on topographic relief and does not take into account obstructions that may limit views, such as vegetation, and is therefore a conservative representation. Viewpoints within these areas were selected as representative because these are locations from which the most recreational users are likely to be able to see project changes.

Figure 4-1. Colchuck Lake Viewshed

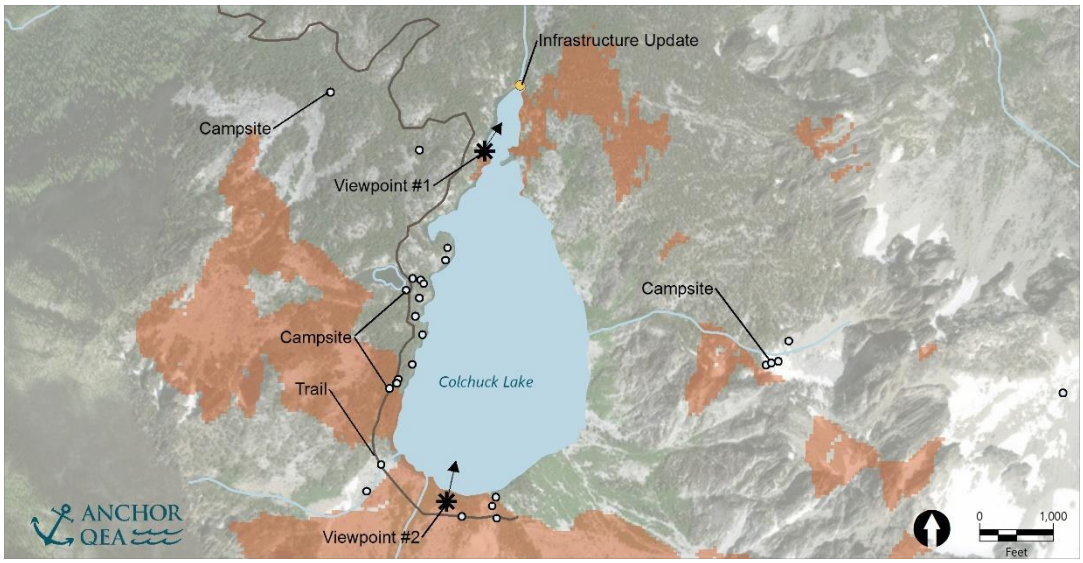


Figure 4-2. Eightmile Lake Viewshed

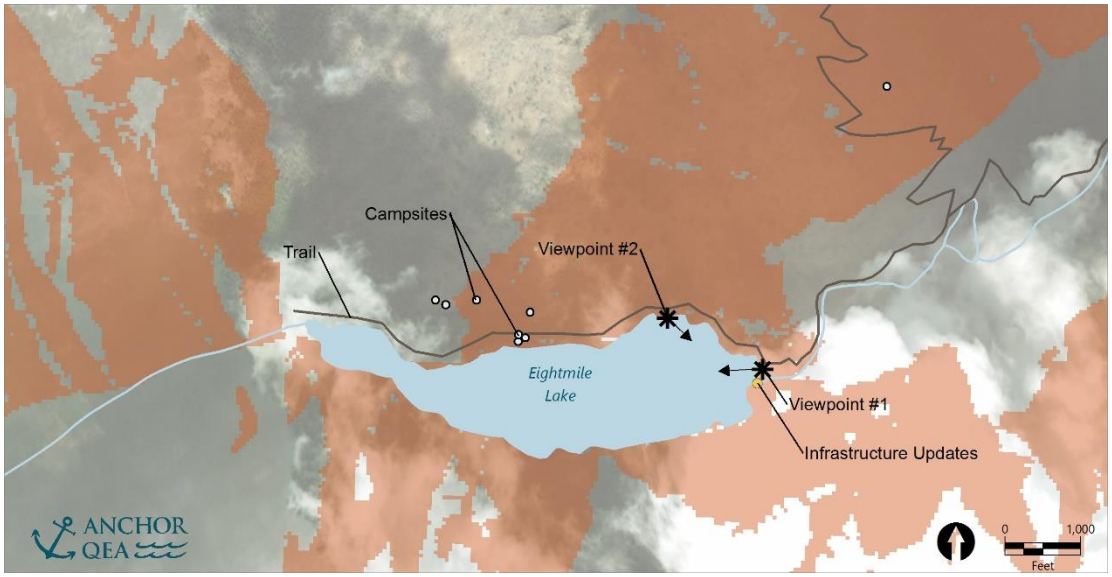


Figure 4-3. Upper and Lower Klonaqua Lakes Viewshed

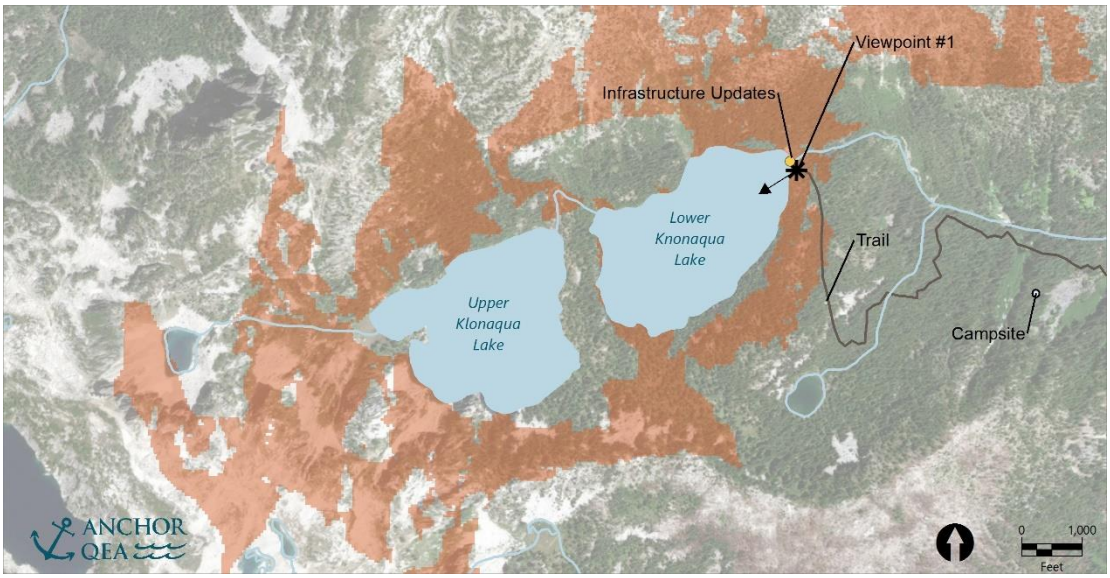


Figure 4.4 Snow Lake Viewshed

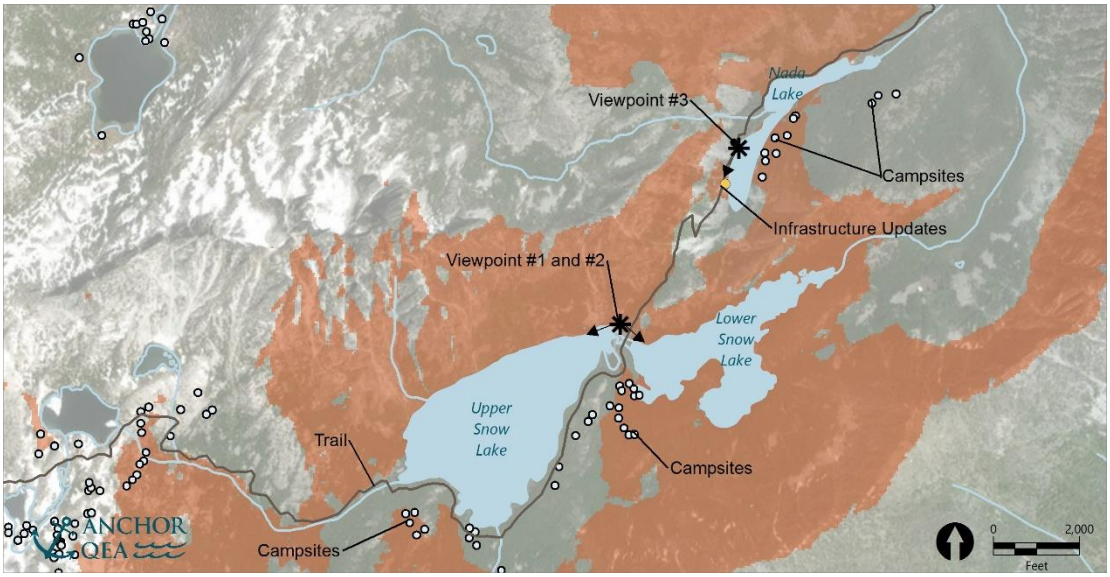
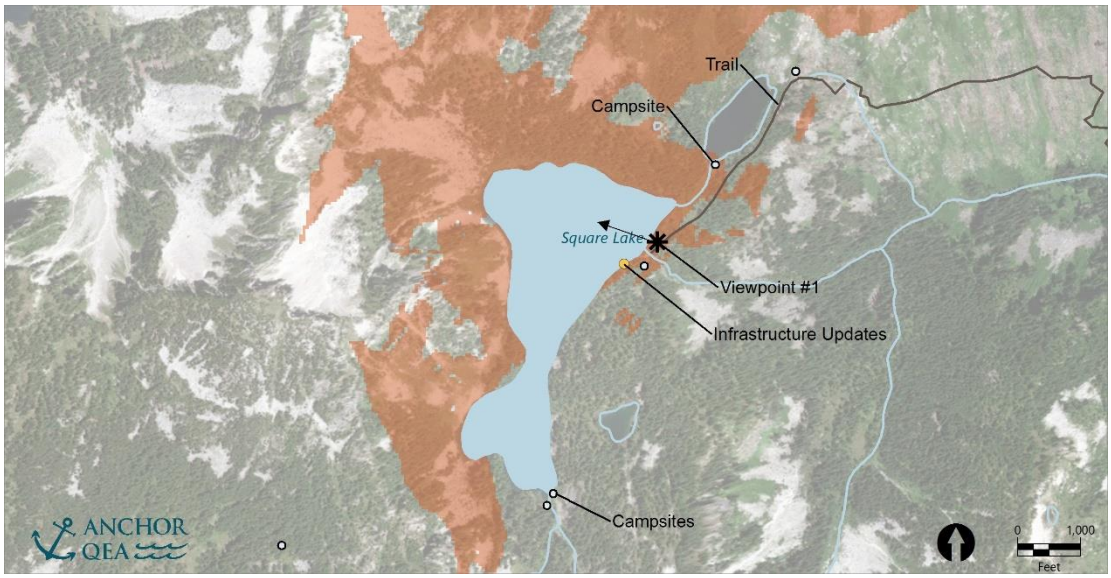


Figure 4-5. Square Lake Viewshed



Representative views from the selected viewpoints at each lake are presented in Figures 4-6 through 4-14. In general, the aesthetic setting around the lakes where proposed changes would take place consist of views of the lakes and surrounding forested areas and in some cases contain mountain views. For the most part, the views are relatively open and consist of largely intact views of undeveloped wilderness.

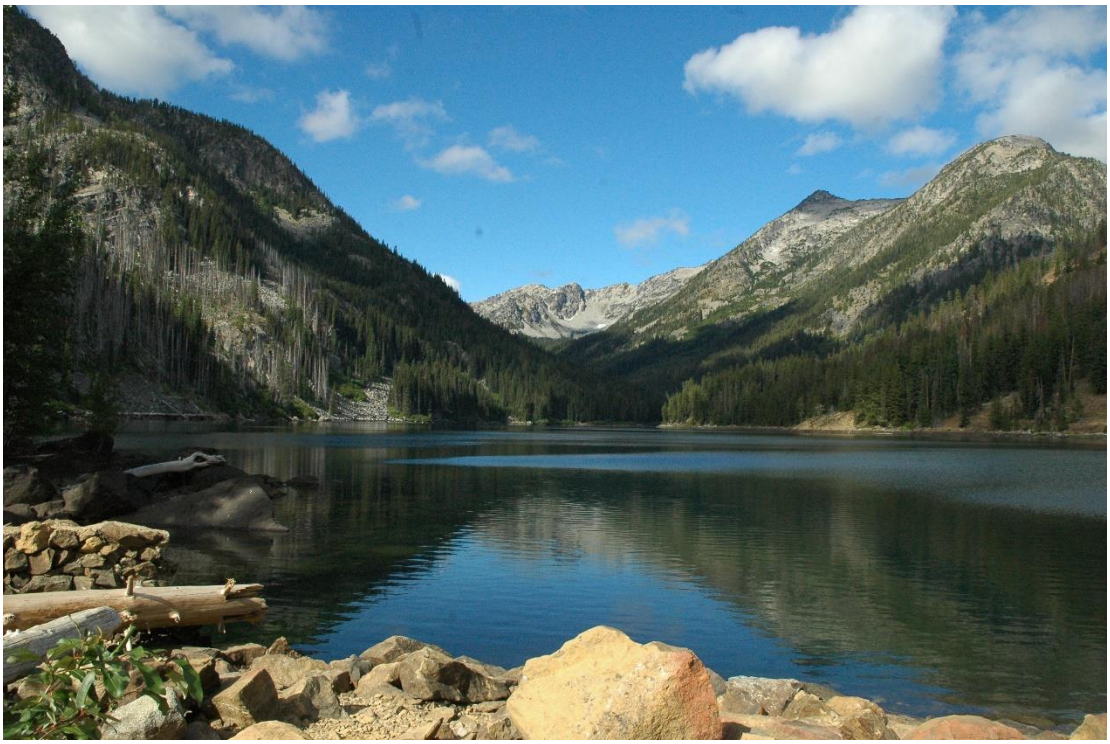
Figure 4-6. Colchuck Lake Viewpoint 1: Looking Northeast (August)

Viewpoint 1 at Colchuck Lake is along the trail north of the Lake. This location has views of conifers, snags, a large boulder, and the lake shoreline in the foreground; the lake, dam, large wood material in the lake, and forested shoreline in the midground; and further forested slopes and the sky in the background.

Figure 4-7. Colchuck Lake Viewpoint 2: Looking North (August)

Viewpoint 2 at Colchuck Lake occurs along the southern shoreline near camping sites. This location includes views of boulders and the lake shoreline in the foreground, forested slopes on either side of the lake in the midground, and further peaks and the sky in the background.

Figure 4-8. Eightmile Lake Viewpoint 1: Looking West (August)



Viewpoint 1 at Eightmile Lake is located along the berm of the existing dam east of the lake. This location includes views of boulders, large wood material, dam infrastructure and the lake edge in the foreground; the lake and forested slopes in the midground; and further forested and alpine peaks as well as sky in the background.

Figure 4-9. Eightmile Lake Viewpoint 2: Looking Southeast (July)

Viewpoint 2 at Eightmile Lake is located near the trail running along the north side of the lake. This location includes views of the lake in the foreground; the lake, lake edge, and dam infrastructure in the midground; and forested and rock slopes in the background.

Figure 4-10. Klonaqua Lake Viewpoint 1: Looking Southwest (July)

Viewpoint 1 at Klonaqua Lake is located at the terminus of the trail to the lake. The location includes views of conifers and snags in the foreground, the lake and forested slope in the midground, and alpine peaks and the sky in the background.

Figure 4-11. Snow Lake Viewpoint 1: Looking East (August)

Viewpoint 1 at Snow Lake is located along the trail in between Upper and Lower Snow Lakes. This location includes views of groundcover and small conifers, cobbles, boulders, shallow water, and large wood material in the foreground; the lake, aquatic vegetation, and a conifer forest in the midground; and a sloped conifer forest in the background.

Figure 4-12. Upper Snow Lake Viewpoint 2: Looking West (August)

Viewpoint 2 at Snow Lake is located at the northeast corner of Upper Snow Lake. This location features views of driftwood and the bare shoreline bank in the foreground; the lake, snags, and conifers in the midground; and forested edge of the lake, further peaks, and sky in the background.

Figure 4-13. Snow Lake Viewpoint 3 (Nada Lake): Looking Southwest

Viewpoint 3 at Snow Lake/Nada Lake is found along the trail west of Nada Lake. This location features views of boulders, the existing gatehouse, and outlet.

Figure 4-14. Square Lake Viewpoint 1: Looking West (September)

Viewpoint 1 at Square Lake is located at the terminus of the trail to the lake. The location includes views of the tops of conifer trees in the foreground, the lake and forested edge of the lake in the midground, and alpine slopes in the background.

In the short term, construction activities would result in some aesthetic changes visible to recreationalists who may be present at the time of construction. Construction activities associated with this project would involve replacing existing gates and installing solar panels, flow monitors, and motorized actuators at each of the lakes. Visual changes would include increased activity and the presence of hand-held construction tools, materials, and temporary worker housing near each dam. Most of the work would occur in upland areas with limited work occurring within the dry shorelines when the lakes are drawn down at the end of the summer.

- Depending on the specific location of these activities, there is a potential for aesthetic changes to be disruptive in the short term; however, construction activity would not be easily seen from many representative viewpoint locations as discussed further below. This is because in these locations, project changes are either obstructed by topography or vegetation or are too far away to be very noticeable.
- Colchuck Lake: construction activities would be visible from Viewpoint 1, but not from Viewpoint 2.
- Eightmile Lake: construction activities would be visible from Viewpoint 1, but not from Viewpoint 2.
- Lower Klonaqua Lake: construction activities would not be visible from the viewpoint.
- Snow Lake: construction activities would be visible from Viewpoint 3 only.
- Square Lake: construction activities would not be visible from the viewpoint.

Even when project activity may occur in areas where recreationalists would be located in close proximity, such as would be the case at Eightmile Lake, disturbance and associated aesthetic changes would be temporary (i.e., lasting only for the duration of the construction activity or about 2 to 4 weeks at each lake) and would not differ in duration or magnitude of change from the existing maintenance activities currently taking place or that would continue under the No-action Alternative. For these reasons, short-term aesthetic impacts are not likely to be significant.

IPID Irrigation Efficiencies

The IPID Irrigation Efficiencies Project involves improving irrigation delivery and on-farm efficiencies. Construction activities associated with this project could include lining and piping irrigation canals throughout the IPID service area. These activities would require the use of excavators, compactors, and other heavy equipment, such as dump trucks that would represent short-term changes to the aesthetic surroundings. However, construction activities would be occurring in areas that are already developed and in agricultural use. As a result, it is expected that there would be limited sensitivity of viewers to short-term changes and the potential impacts would not be significant. As noted previously, any vegetation removal would be mitigated through compliance with local, state, and federal requirements. If additional mitigation is required, it would be developed through project-level review as discussed in greater detail in Section 4.11.7, Mitigation Measures.

COIC Irrigation Efficiencies and Pump Exchange

The potential aesthetic impacts associated with the COIC Irrigation Efficiencies and Pump Exchange Project would largely be similar to those described above except that this project would also include construction of a new COIC pump station along the right bank of the Wenatchee River somewhere near its confluence with Icicle Creek or along the left bank of Icicle Creek near its confluence with the Wenatchee River. Depending on the site that is selected, construction could result in short-term aesthetic impacts associated with vegetation clearing, grading, soil stockpiling, and general construction activity.

Representative viewpoints where sensitive viewers would be able to see aesthetic changes are presented for the Wenatchee River (Figure 4-15). The areas from which it would be possible to see proposed project changes are presented in orange. These viewpoints were selected because of their proximity to potential pump station locations and their accessibility for recreationalists using hand-boat launch facilities (Icicle Creek Viewpoint 1) and the creek or river for boating (all viewpoints). Views from each of these viewpoints are presented in Figures 4-16 through 4-18.

Figure 4-15. Wenatchee River Viewshed: Viewpoints 1 through 3

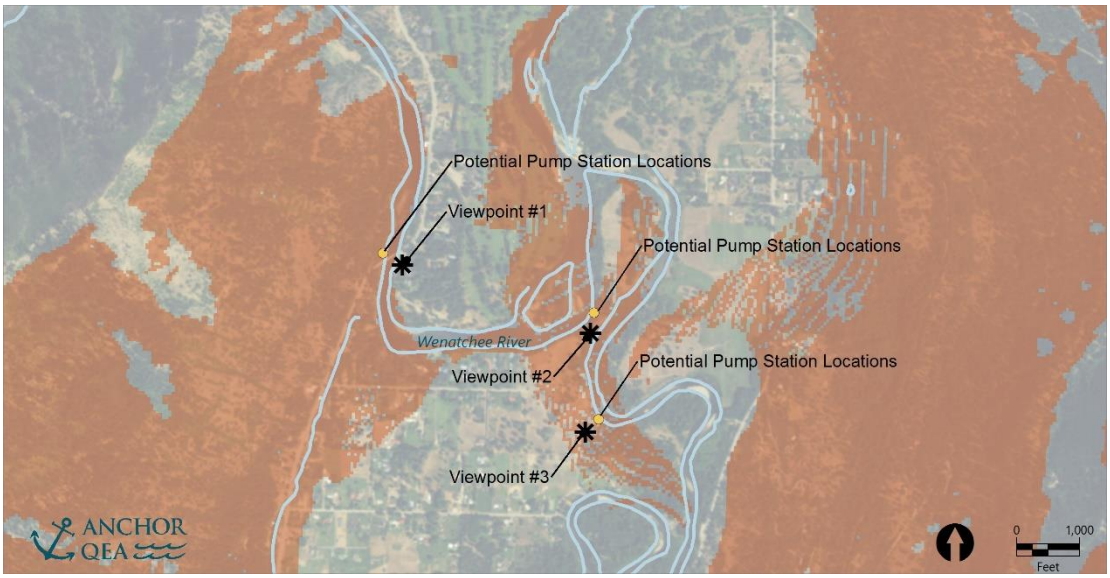


Figure 4-16. Wenatchee River Viewpoint 1: Looking Northwest (September)

This viewpoint is found near a public water access point along the river. The location includes views of the creek; the gravel, cobble, and boulder bank in the foreground; and the creek, bridge, armored bank, and upland and riparian vegetation in the midground.

Figure 4-17. Wenatchee Viewpoint 2: Looking Northeast (September)

This viewpoint is found at the water's edge accessible from upland private properties. The location features views of the river and gravel/cobble bank in the foreground, the creek and deciduous riparian vegetation in the midground, and conifer slopes and sky in the background.

Figure 4-18. Wenatchee Viewpoint 3: Looking Northeast (September)

This viewpoint is found along the shoreline slope accessible from upland private properties. The location features views of the gravel bank and herbaceous vegetation in the foreground; the creek, vegetated gravel bar, and riparian vegetation in the midground; and further riparian vegetation and upland forest slope and sky in the background.

Visual changes resulting from project activities could include short-term dewatering of stream segments through cofferdam construction and increased construction activity overall, including the transport of construction materials and the operation of construction equipment. In some cases, construction may require vegetation removal, grading, and stockpiling soil. Depending on the specific location of these activities, there is a potential for aesthetic changes to be disruptive in the short term; however, most of these changes would be temporary (i.e., lasting only for the duration of the construction activity) and would therefore not be likely to be significant.

In addition, any potentially significant impacts related to removal of riparian vegetation or other vegetation types that constitute important habitat would be addressed prior to construction by compliance with applicable local, state, and federal permits and approvals. This would include riparian vegetation, with potential mitigation requirements providing aesthetic benefits. If additional mitigation is required, it would be developed through project-level review as discussed in greater detail in Section 4.11.7, Mitigation Measures.

Domestic Conservation Efficiencies

The Domestic Conservation Efficiencies Project focuses on conservation projects in the City of Leavenworth and Chelan County and implements municipal and rural water efficiency projects such as leak detection and repair, meter installation, and implementation of water conservation measures to improve domestic supply. Any construction activities proposed under this project would occur in areas that are already developed and would be minimal. Therefore, potential short-term impacts on aesthetics would be less than significant.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project would involve rebuilding the dam and outlet facilities to allow for restoration of water storage levels and useable storage volumes to their historical levels. The existing dam and embankment structure has eroded, which has limited the volume of water that can be stored in Eightmile Lake. This would help to increase the amount of water available in lower Icicle Creek, primarily in the late summer and fall.

The sensitive viewers for this project are predominately recreation users (e.g., hikers and campers) who would be visiting Eightmile Lake during construction activities. However, recreational access is currently limited due to damage caused by the Jack Creek fire that burned to lakeshore at Eightmile Lake during the summer of 2017. The subsequent emergency declarations made by IPID and local emergency response officials have resulted in USFS limiting access to Eightmile Lake. Impacts on recreational use are described in greater detail in Section 4.15, Recreation.

The locations where it would be possible to see proposed project changes, including construction-related disturbance in the short term, are presented in orange in Figure 4-2. This viewshed analysis is based on topographic relief and does not take into account obstructions that may limit views such as vegetation. Viewpoints 1 and 2 were selected as

representative for this project because these are locations from which the most recreational users are likely to be able to see the areas where project changes are proposed.

This project involves demolishing the existing dam, installing new piping, and constructing new impoundment and water control structures. Construction activity would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down. Short-term impacts on aesthetics would be moderate because while most of the work and staging would occur within areas that are already disturbed and developed, the construction work would require flying in or "walking in" an excavator and other equipment, clearing vegetation, and blasting or rock-hammering the existing structure and bedrock. Specifically, replacement of the low-level outlet pipe below the dam would require excavation and movement of rock to a depth of as much as 10 to 15 feet below the existing ground surface. Construction of a 99-foot-long spillway northeast of the dam face, and a 75-foot-long spillway south of the existing dam would require the removal of some natural vegetation, placement of concrete, and moving and placing earth and rock.

These changes would be highly visible from Viewpoint 1, which is adjacent to the main construction activity. The work would also be visible from Viewpoint 2, although it would occur about 0.25 mile away from this location. Overall, short-term aesthetic impacts would be moderate.

Any potentially significant impacts related to removal of riparian vegetation or other vegetation types that constitute important habitat would be addressed prior to construction by compliance with applicable local, state, and federal permits and approvals. This would include riparian vegetation, with potential mitigation requirements providing aesthetic benefits.

Tribal Fishery Preservation and Enhancement

The focus of this project is to ensure that there would be no adverse effects on tribal fishing as a result of implementing other projects as part of the overall Icicle Creek Strategy. Although the specific activities are not yet defined, there are some elements under consideration, including the construction of facilities such as new plumbing to create a bubble curtain, sprayer, or other minor modifications near the spillway in front of the LNFH to promote favorable fishing conditions.

Project activities are anticipated to largely occur along lower Icicle Creek. Depending on the specific location of the activities, construction activities could be visible to recreational users. For any project elements occurring near LNFH, some aesthetic changes could be visible to trail users near LNFH or kayakers in Icicle Creek.

A representative viewpoint where potentially sensitive viewers would be able to see aesthetic changes is shown in Figure 4-19 and a representative view in Figure 4-20. This viewpoint was selected because of its proximity to potential project changes and its accessibility for recreationalists visiting the LNFH.

Figure 4-19. Icicle Creek Viewpoint 1

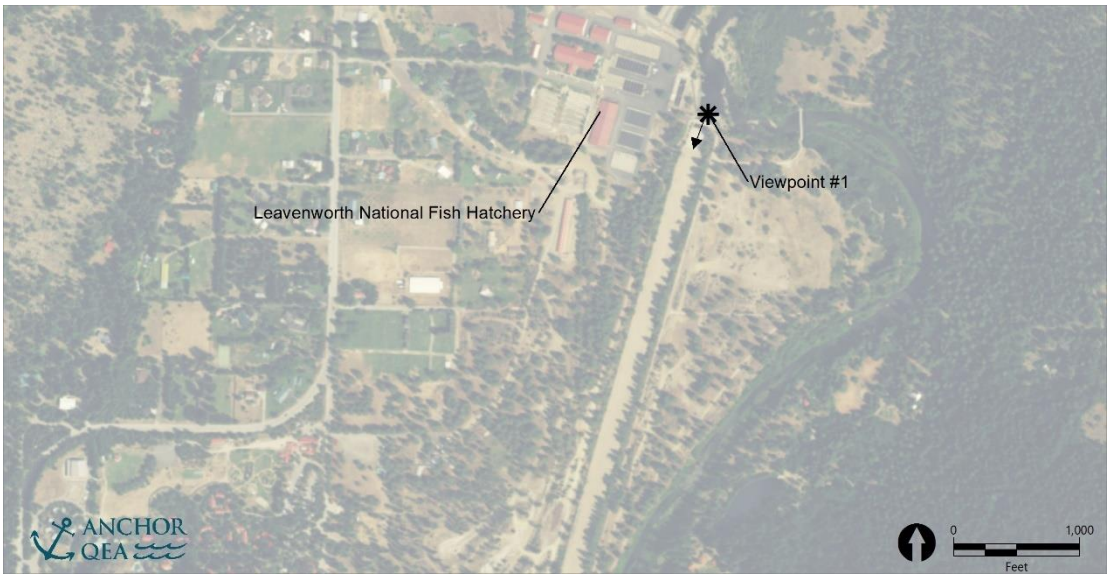


Figure 4-20. Icicle Creek Viewpoint 1: Looking Southwest

This viewpoint is located along the spillway structure of the LNFH. The location features views of the spillway and conifer vegetation in the foreground; the creek, shoreline edge, and coniferous riparian vegetation in the midground; and conifer slopes and sky in the background.

In the short term, project activities would likely include staging equipment, grading, and vegetation removal. Even though some activities may result in short-term aesthetic changes, these activities would be temporary and changes would be consistent with the developed character of the surrounding landscape and are therefore not anticipated to be significant.

In addition, any potentially significant impacts related to removal of riparian vegetation or other vegetation types that constitute important habitat would be addressed prior to construction by compliance with applicable local, state, and federal permits and approvals. This would include riparian vegetation, with potential mitigation requirements providing aesthetic benefits. If additional mitigation is required, it would be developed through project-level review as discussed in greater detail in Section 4.11.7, Mitigation Measures.

Habitat Protection and Enhancement

Habitat protection and enhancement proposed under this project could involve grading; planting and thinning vegetation; hauling and placing logs, rock, soil, and other materials; and some in-water work on lower Icicle Creek. These activities could temporarily impact natural areas for clearing and grading activities; however, enhancement would, over time, benefit aesthetics. Therefore, even though some activities could result in short-term aesthetic changes, these impacts would be temporary. Therefore, it is not anticipated that they would be significant.

In addition, any potentially significant impacts related to removal of riparian vegetation or other vegetation types that constitute important habitat would be addressed prior to construction by compliance with applicable local, state, and federal permits and approvals. This would include riparian vegetation, with potential mitigation requirements providing aesthetic benefits. If additional mitigation is required, it would be developed through project-level review as discussed in greater detail in Section 4.11.7, Mitigation Measures.

Instream Flow Rule Amendment

No short-term aesthetic impacts are anticipated from this project because no construction would be required.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project includes various elements geared towards improving water quality and hatchery rearing conditions at the LNFH. In general, construction of these elements has the potential to affect natural areas and views in the short term, depending on the specific location and type of disturbance. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential short-term impacts under NEPA would be completed once the full scope of the project is determined, which would address in greater detail the potential for aesthetic impacts.

In general, while the magnitude of potential aesthetic impacts would depend on the scale of the proposed construction activities, these changes would occur within an already developed landscape and are anticipated to be less than significant. In addition, any impacts would be further addressed through implementation of mitigation measures as described in Section 4.11.7, Mitigation Measures.

Fish Passage Improvements

The specifics of the Fish Passage Improvements Project are not yet determined; however, it is anticipated that some improvements would be made at three locations on lower Icicle Creek: existing LNFH instream structures and the Boulder Field near RM 5.6. This work would require the use of excavators, dump trucks, and possibly a crane and would result in some disturbance in the short term that would alter existing views along lower Icicle Creek.

The sensitive viewers for this project are predominately recreation users (e.g., hikers and campers) who would be accessing the Snow Lake Trailhead, which passes over the Boulder Field, or recreation users on the trails at the LNFH during construction activities. The viewshed for this project is shown in Figure 4-21 with areas from which it would be possible to see proposed project changes presented in orange. This includes select viewpoints where individuals would be able to see aesthetic changes related to this project. Representative viewpoints were chosen because these are the locations where a relatively high number of individuals are likely to be able to see potential project activities. Figures 4-22 through 4-24 provide representative views from all three viewpoints.

Figure 4-21. Icicle Creek Fish Passage Improvements Viewshed

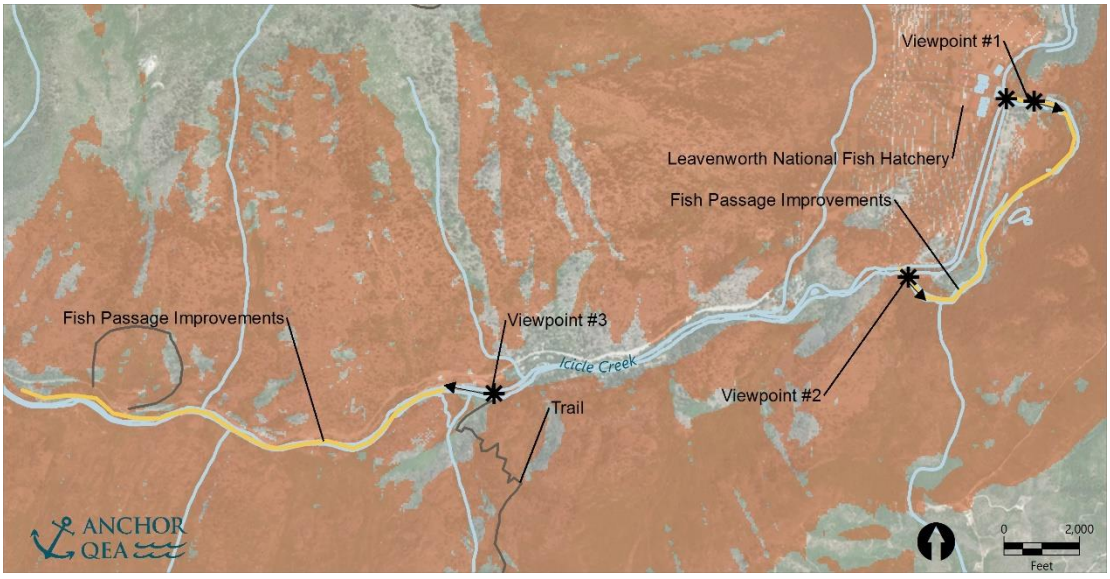


Figure 4-22. Icicle Creek Viewpoint 1: From Structure 5 Looking Upstream (Mid-water, 450 cubic feet per second [cfs])

Viewpoint 1 is accessible from trails within the LNFH. This location includes views of Icicle Creek in the foreground; shrub and herbaceous vegetation along an island and sides of banks as well as conifer forest in the midground; and sloped conifer forest and sky in the background.

Figure 4-23. Icicle Creek Viewpoint 2: From Structure 2 Looking Downstream (Mid-water, 390 cfs)

Viewpoint 2 is accessible from trails within the LNFH. This location includes views of Icicle Creek, Structure 2 infrastructure, and willows and conifers in the foreground; the creek, herbaceous and shrub riparian plants, and the edge of upland forest in the midground; and conifer forested slopes in the background.

Figure 4-24. Icicle Creek Viewpoint 3: From Boulder Field Looking Upstream (Low-water, 85 cfs)

Viewpoint 3 is located at the pedestrian bridge of the Snow Lake Trailhead. This location includes views of channel boulders and the creek in the foreground; boulders, herbaceous vegetation, and conifers in the midground; and vegetated slopes and talus in the background.

Depending on the specific location of the activities, construction activities are likely to be most visible to those who are recreating or fishing along this corridor. For any project elements occurring near LNFH, some aesthetic changes may be visible to trail users and fishers near LNFH or kayakers in Icicle Creek.

In the short-term, project activities would likely include staging equipment, grading, and vegetation removal, which would temporarily change the existing aesthetic character of each work site. Even though some activities could result in short-term aesthetic changes to typical views along lower Icicle Creek (Figures 4-22 through 4-24), these activities would be temporary and not anticipated be significant.

In addition, any potentially significant impacts related to removal of riparian vegetation or other vegetation types that constitute important habitat would be addressed prior to

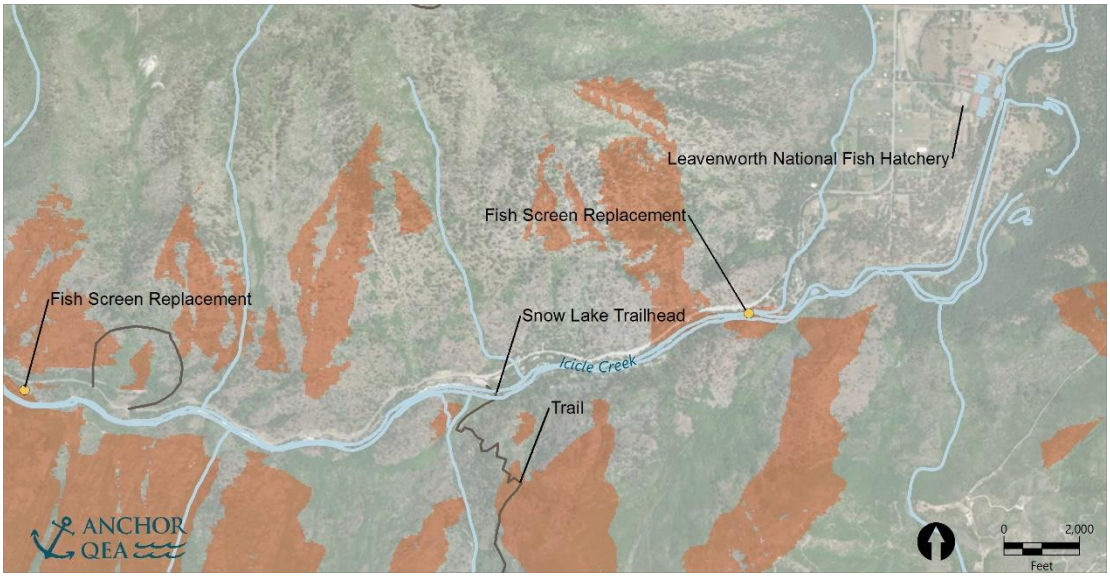
construction by compliance with applicable local, state, and federal permits and approvals. This would include riparian vegetation, with potential mitigation requirements providing aesthetic benefits. If additional mitigation is required, it would be developed through project-level review as discussed in greater detail in Section 4.11.7, Mitigation Measures.

Fish Screen Compliance

The Fish Screen Compliance Project involves replacing fish screens at three different diversions on lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Under this project, screens and associated infrastructure would be improved to bring all three intakes up to compliance with state and federal laws. These activities would involve the use of excavators, dump trucks, compaction equipment, concrete mixers, and other equipment as needed to move earth and other equipment materials. Although there would be some minor impacts to surrounding areas during construction because of removal and replacement of screens as well as inadvertent vegetation trampling, these impacts are anticipated to be less than significant.

In the short term, project activities would likely include staging equipment, grading, and vegetation removal, which would temporarily change the existing aesthetic character of each work site. Even though some activities could result in short-term aesthetic changes to typical views along lower Icicle Creek, these locations are not as visible from key areas used most by recreationalists, such as the trailhead to Upper and Lower Snow Lakes, private resorts, and recreation parking areas (Figure 4-25). Even if these activities are visible, they would not result in extensive changes and would be temporary. For these reasons, they are not anticipated to be significant.

Figure 4-25. Icicle Creek Viewshed



In addition, any potentially significant impacts related to removal of riparian vegetation or other vegetation types that constitute important habitat would be addressed prior to construction by compliance with applicable local, state, and federal permits and approvals. This would include riparian vegetation, with potential mitigation requirements providing aesthetic benefits. If additional mitigation is required, it would be developed through project-level review as discussed in greater detail in Section 4.11.7, Mitigation Measures.

Water Markets

No short-term aesthetic impacts are anticipated from the Water Markets Project because no construction would be required.

4.11.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

The greatest potential for aesthetic impacts over the long term could occur as the result of any permanent changes to the existing aesthetic character as the result of introducing new elements into the viewshed and changes with respect to how lake levels are managed.

This project would result in updates to the existing infrastructure that are not expected to be substantially noticeable in the long term. The proposed updates would include replacing existing mechanical actuators with similar-looking motorized actuators. Power would be supplied by tree- or pole-mounted solar panels and antennas (Figure 4-26), and stamped concrete and plastic boulder utility covers would be used to enclose and protect the actuators and control (Figures 4-27 and 4-28). Because these elements would be incorporated to minimize long-term aesthetic changes and to match the natural character at each lake, infrastructure upgrades are not anticipated to result in significant long-term impacts on aesthetics.

Figure 4-26. Representative Photo: Solar-panel Associated with Existing Trees

Photo credit: ell brown via VisualHunt / CC BY

Figure 4-27. Representative Photo: Actuator

Figure 4-28. Representative Photo: Utility Cover

Photo credit: fekaylius via Visual hunt / CC BY-SA

Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from the affected lakes. Because the facilities would be newer and largely operated remotely by IPID, any trips to and from the lakes, or activities needed to maintain the facilities, are expected to be less frequent and extensive than what would occur compared to existing conditions.

However, this project would result in increased frequency in fluctuations in lake levels compared to existing conditions. This is because lake levels would be drawn down every year instead of rotating one or two lakes per year.

Although the lakes would be drawn down more frequently, the high and low lake levels would not change. The variation in lake levels would be consistent with the general pattern that currently occurs and would continue to occur under the No-action Alternative:

- Highest water levels would continue to occur following spring thaw from April to July.
- Draw down to lower levels would still occur beginning in July or August with the lowest levels reached by early October.
- Autumn precipitation would contribute to lake levels rising slightly until the winter freeze occurs beginning in October or November.

Representative high- and low-water views for all five of the Alpine Lakes are presented below (Figures 4-29 through 4-42). As noted previously, these views would not be altered in terms of an individual's ability to view the lake and surrounding area; however, there would be a greater chance of encountering lower water conditions and greatest amount of shoreline (as shown in the representative low water figures below) during the later summer or early fall.

Specifically, automating the lake infrastructure would involve installed controls and telemetry that would allow for IPID and the USFWS to remotely control releases from the lakes. With better control, IPID and the USFWS would be able to optimize releases to meet water supply needs and help achieve instream flow targets in Icicle Creek. Automation would likely result in more frequent, targeted, controlled releases. However, a majority of the water would still be needed at the same time of year (late summer) to meet water supply and instream flow needs. Overall, the impact to aesthetics in the Alpine Lakes would be less than significant for this project.

Figure 4-29. Colchuck Lake Viewpoint 1: Looking Northeast, High Water

Timing: Water is typically high May to early July.

Figure 4-30. Colchuck Viewpoint 1: Looking Northeast, Low Water

Timing: Water is typically low late September to early October.

Figure 4-31. Colchuck Lake Viewpoint 2: Looking North, High Water

Timing: Water is typically high May to early July.

Figure 4-32. Colchuck Lake Viewpoint 2: Looking North, Low Water

Timing: Water is typically low late September to early October.

Figure 4-33. Eightmile Lake Viewpoint 1: Looking West, High Water

Timing: Water is typically high May to early July.

Figure 4-34. Eightmile Lake Viewpoint 1: Looking West, Low Water

Timing: Water is typically low late September to early October.

Figure 4-35. Lower Klonaqua Lake Viewpoint 1: Looking Southwest, High Water

Timing: Water is typically high May to early July.

Figure 4-36. Lower Klonaqua Viewpoint 1: Looking Southwest, Low Water

Timing: Water is typically low late September to early October.

Figure 4-37. Lower Snow Lake Viewpoint 1: Looking East, High Water

Timing: Water is typically high May to early July.

Figure 4-38. Lower Snow Viewpoint 1: Looking East, Low Water

Timing: Water is typically low late September to early October.

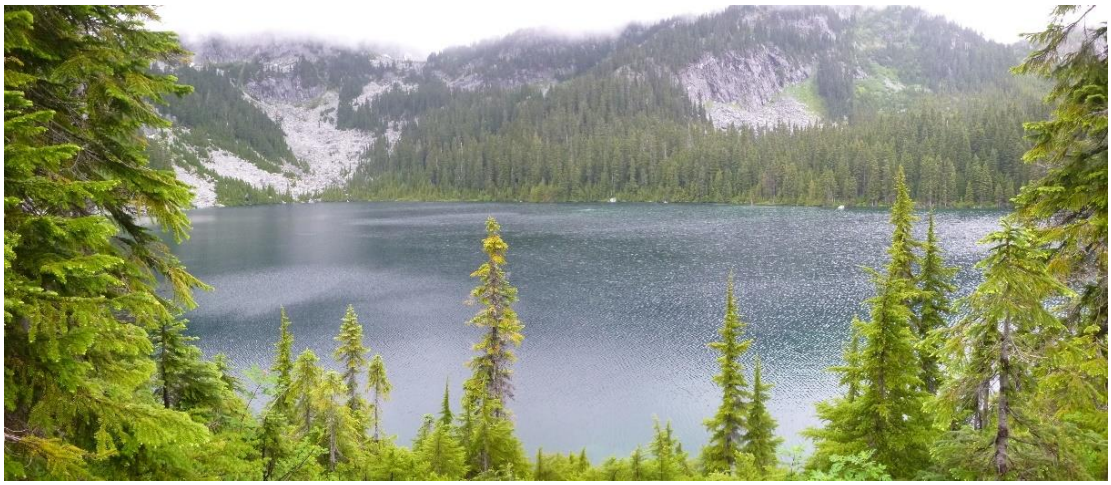
Figure 4-39. Upper Snow Viewpoint 2: Looking West, High Water

Timing: Water is typically high May to early July.

Figure 4-40. Upper Snow Viewpoint 2: Looking West, Low Water

Timing: Water is typically low late September to early October.

Figure 4-41. Square Viewpoint 1: Looking West



Timing: Water is typically high May to early July.

Figure 4-42. Square Viewpoint 1: Looking West

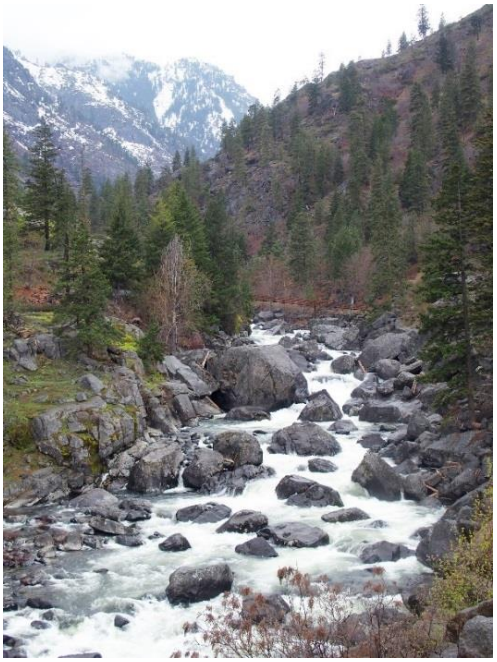
Timing: Water is typically low late September to early October.

Likewise, as discussed in Section 3.3, Surface Water Resources, changes in flows in Icicle Creek would be within the natural variation already occurring within the system. Views of high- and low-water flows that currently occur within at the representative viewpoints are shown in Figures 4-43 through 4-48. With implementation of this project, seasonal flows would remain within this same level of natural variation.

The goal of the proposed project would be to make additional water available to meet Icicle Creek instream flow goals outlined in the Guiding Principles of 100 cfs during normal and wet years and 60 cfs during drought years.

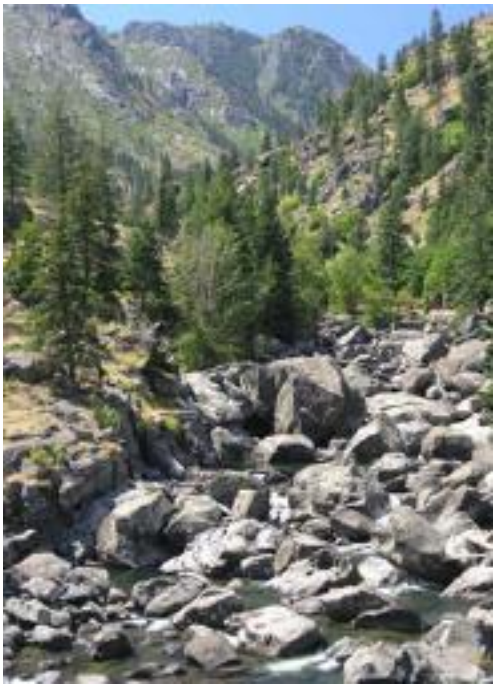
Compared with existing conditions, this would result in additional flows in the later summer and early fall. Overall, the impact to aesthetics on Icicle Creek would be less than significant for this project.

Figure 4-43. Icicle Creek Viewpoint 3: From Boulder Field Looking Upstream, High Water



Timing: High flows in Icicle Creek typically occur from April to June.

Figure 4-44. Icicle Creek Viewpoint 3: From Boulder Field Looking Upstream, Low Water



Timing: Low Flows in Icicle Creek typically occur from August to early October.

Figure 4-45. Icicle Creek Viewpoint 2: From Structure 2 Looking Downstream, High Water

Timing: High flows in Icicle Creek typically occur from April to June.

Figure 4-46. Icicle Creek Viewpoint 2: From Structure 2 Looking Downstream, Low Water

Timing: Low Flows in Icicle Creek typically occur from August to early October.

Figure 4-47. Icicle Creek Viewpoint 1: From Structure 5 Looking Upstream, High Water

Timing: High flows in Icicle Creek typically occur from April to June.

Figure 4-48. Icicle Creek Viewpoint 1: From Structure 5 Looking Upstream, Low Water

Timing: Low Flows in Icicle Creek typically occur from August to early October.

IPID Irrigation Efficiencies

The majority of the IPID Irrigation Efficiencies Project elements include pipelines or canal improvements that would occur in areas that have already been disturbed and would not result in long-term impacts on aesthetics. Over the long term, efficiencies gained would also result in increases in instream flows along lower Icicle Creek downstream of the IPID Diversion at RM 2.4, mainly during late summer and early fall, compared to existing conditions and the No-action Alternative. The potential long-term impacts associated with flow changes on Icicle Creek would result in similar types of impacts to those described as the result of the Alpine Lakes Optimization, Modernization, and Automation Project in this section.

COIC Irrigation Efficiencies and Pump Exchange

In general, the potential impacts associated with the COIC Irrigation Efficiencies and Pump Exchange Project would be similar to those described above. The project would involve replacing an existing ditch that has some aesthetic benefit to those who live near it, with buried pipelines. However, the ditch cover would be restored to a more natural state, which could be viewed as an overall benefit to the general aesthetic of the ditch. In addition, the project would result in construction of a new COIC pump station and intake facilities along the right bank of the Wenatchee River near its confluence with Icicle Creek, or along the left bank of Icicle Creek near its confluence with the Wenatchee River. These facilities would result in the loss of a small area of riparian vegetation and result in a permanent aesthetic change as the result of a new pump station facility similar to the one shown in Figure 4-49. However, the proposed pump station would likely be close to residences and would include a building (Figure 4-50) over the pumps to mitigate for noise and aesthetic impact.

Figure 4-49. Representative Photo: Pump Station Intake Features and Armored Bank

Figure 4-50. Representative Photo: Pump Station Building (Prior to Revegetation)

Depending on the location of the COIC pump station, there is a potential that the new facility would represent a moderate level of contrast between the surrounding natural or pastoral view and the new structure. In addition to a building, additional treatment would likely be included, such as screening with vegetation or fencing. Representative views of areas under consideration are shown in Figures 4-16 through 4-18.

Depending on which location is selected by COIC, the pump station could likely not be very visible to sensitive viewers, except from certain viewpoints on the river. For example, a pump station at Wenatchee River Viewpoint 1 (Figure 4-16) would only be far below the roadway and would likely only be visible from the public river access or residences across the river. A pump station at Wenatchee River Viewpoint 2 (Figure 4-17) would also be visible from the river and residences near the river, but could be hidden by preserving or enhancing riparian vegetation. A pump station near Icicle Creek Viewpoint 3 (Figure 4-18) would be located in a forested area along Icicle Creek and would not likely be visible from any residences. It would only be visible from the creek. Additionally, with a pump station building around the facility, the views would be consistent with the surrounding rural and residential development that currently exists.

Over the long term, relocation of the COIC diversion and efficiencies gained by replacing the delivery system would also result in increases in instream flows along lower Icicle Creek, mainly during late summer and early fall, compared to existing conditions and the No-action Alternative. The potential long-term impacts associated with flow changes on Icicle Creek would result in similar types of impacts to those described as the result of the Alpine Lakes Optimization, Modernization, and Automation Project in this section.

Domestic Conservation Efficiencies

Increased conservation and re-use associated with this project is expected to lead to decreased return flows, which could decrease flows in the Wenatchee River downstream of the Leavenworth Wastewater Treatment Plant; however, the long-term effects on streamflow and any associated aesthetic changes are expected to be negligible.

Eightmile Lake Storage Restoration

The greatest potential for impacts on aesthetics over the long term would occur as the result of replacing the existing dam structure and low-level outlet pipeline at Eightmile Lake with a new dam and spillway facilities, low-level outlet pipeline, and controls. The project would likely decrease maintenance and allow for remote operations with respect to how the lake level is managed. The project would be managed, with the other Alpine Lakes, to meet water supply and instream flow needs in lower Icicle Creek instead of for agricultural purposes alone.

Sensitive viewers for this project are predominately recreation users (e.g., hikers and campers) who would be visiting Eightmile Lake, as discussed in greater detail in Section 3.15, Recreation. Impacts on recreational use are described in greater detail in Section 4.15, Recreation.

The areas from which it is possible to see proposed project changes are presented in orange in Figure 4-2. Viewpoints 1 and 2 (existing views shown in Figures 4-8 and 4-9) were selected as representative because these are the locations from which the most recreational users are likely to be able to see the proposed project changes.

For this project, the existing dam would be rebuilt with new facilities that would restore IPID's ability to store water to the historical spillway elevation. The dam and embankment have been eroded, which has reduced the elevation to which water can be stored and the volume of storage available for release to enhance water supply. The new dam would have a primary spillway elevation equal to the existing dam, but the spillway facilities would be larger, and the top of the dam would be higher in order to meet current dam safety design requirements for spillway facilities and freeboard. The facilities would be constructed with concrete, native rock, and native earth in a manner to minimize contrast with the natural surroundings. As such the new dam facility is expected to result in a less than significant impact to aesthetics because the height of the dam would be similar to existing conditions, degraded elements of the existing dam (e.g. metal debris) would be removed, enhancing the appearance of the feature, and natural materials would be used to the extent feasible in constructing the facility. Additionally, with time,

surrounding vegetation and the weathering properties of the lake and weather would further integrate this feature into the surrounding landscape.

Because the facilities would be newer and largely operated remotely by IPID, any trips to and from the lakes, or activities needed to maintain the facilities, are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative. However, restoration of the facilities and re-operation of the lake would result in the ability to fill the lake to the levels at which water was historically stored, and lower lake levels below the existing low-level outlet would provide access to the useable storage allowed by IPID's water right. These represent changes in lake level compared to existing conditions and the No-action Alternative.

Compared with existing conditions and the No-action Alternative, this means that an additional area of shoreline would be under water mainly in the late spring and early summer, when IPID is trying to capture the last bit of snowmelt runoff. These areas have been historically inundated but have not been under water since deterioration of the embankment. This change in lake level would result in minimal changes in the vegetative community along the fringes of the shoreline, but otherwise there would be very limited changes to aesthetics from existing high water views.

Under current conditions, pumping or siphoning is occasionally used to draw the lake level down below the existing low level outlet; however, in most cases, the low lake levels do not extend below the existing outlet. The project would also result in the potential to expose about 3.6 acres more of lake bed when fully drawn down, compared to these more typical low-water conditions. Draw down would occur mainly in the later summer and early fall, with the lowest lake levels occurring at the end of the release period, generally around the end of September. Figure 4-51 illustrates existing and proposed low- and high-water levels.

Figures 4-52 and 4-53 show existing and simulated views of the lake. Figure 4-52 compares existing and proposed views from Viewpoint 2 under higher lake levels. in Figure 4-53 shows existing and simulated conditions from Viewpoint 1. Although an additional area of lakeshore would be inundated compared to existing conditions, as shown in the simulations of the proposed conditions, these changes mostly occur in the midground to background and are not easily discernible.

Figure 4-54 shows how views would differ when the lake is drawn down. Although foreground views would change because there would be a greater area of exposed lakebed, views during this time already include exposed shoreline. In addition, midground and background views would still provide a natural view of the lake. For these reasons, long-term aesthetic impacts associated with lake level changes are considered to be moderate but not significant.

Figure 4-51. Eightmile Lake Water Levels

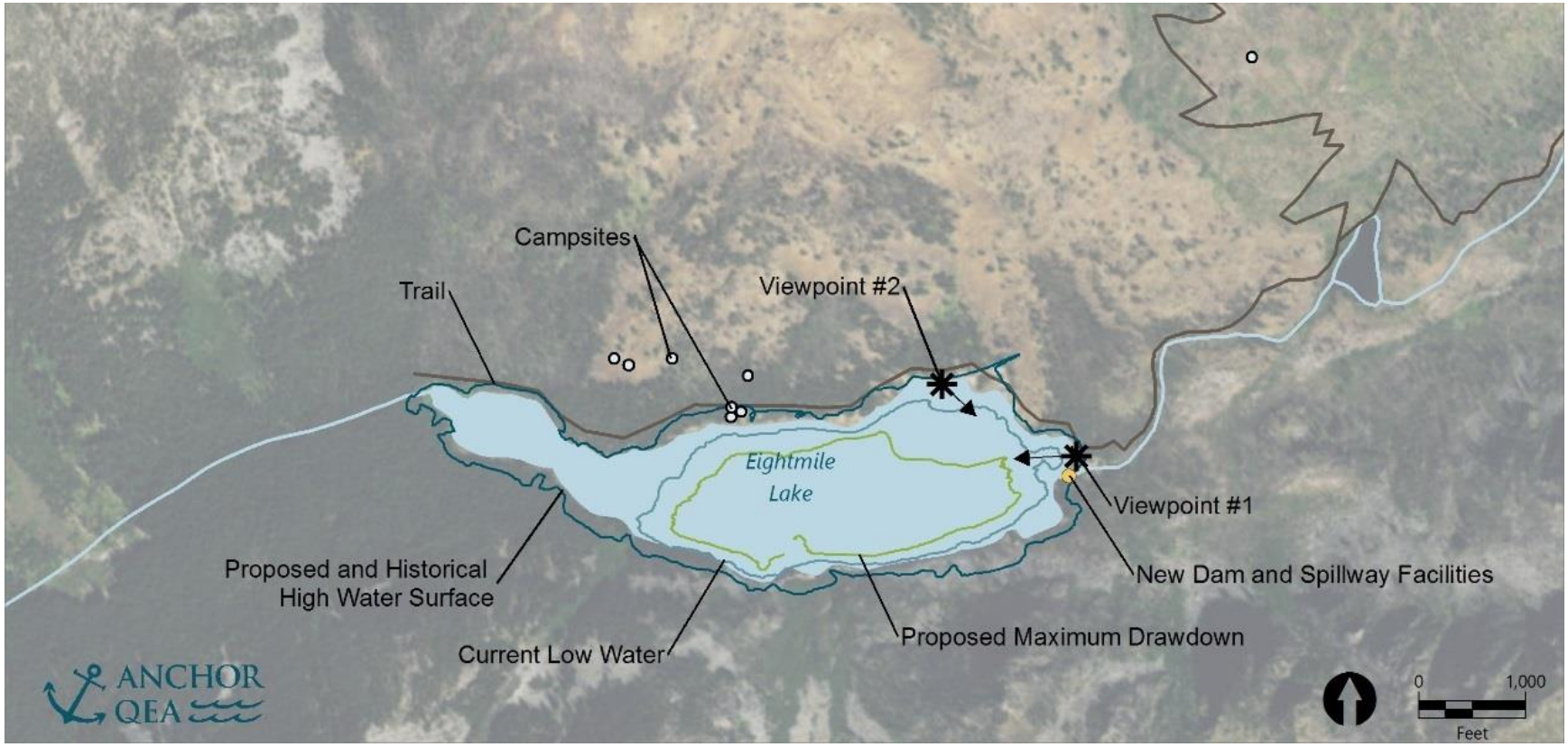


Figure 4-52. Eightmile Lake Viewpoint 2: Eightmile Lake Dam, Existing and Simulated Views

Figure 4-53. Eightmile Lake Viewpoint 1: High Lake Conditions, Existing and Simulated Views

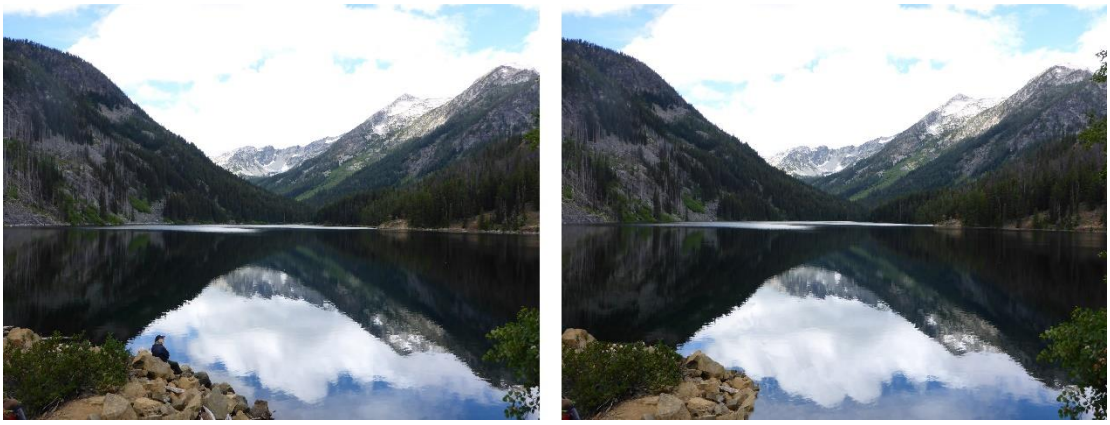


Figure 4-54. Eightmile Lake Viewpoint 1: Low Lake Level, Existing and Simulated Views

Over the long term, this project would also result in increases in instream flows along lower Icicle Creek, mainly during late summer and early fall, compared to existing conditions and the No-action Alternative. The potential long-term impacts associated with flow changes on Icicle Creek would result in similar types of impacts to those described as the result of the Alpine Lakes Optimization, Modernization, and Automation Project in this section.

Tribal Fishery Preservation and Enhancement

The purpose of this project is to protect and enhance the tribal fishery, which, depending on the specific actions, could result in the loss of some small areas of vegetation and possibly the construction of some minor new facilities; however, these project elements are meant to preserve and enhance stream and riparian habitat and would most likely result in long-term beneficial changes to aesthetic resources. Additionally, work within sensitive areas would require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts affecting sensitive areas (Section 4.11.7, Mitigation Measures). These requirements would be developed once project-specific details were available.

Habitat Protection and Enhancement

The purpose of Habitat Protection and Enhancement Project is to protect and enhance habitat within the lower Icicle Creek corridor, which could require work along the natural shoreline project sites. Although these activities could affect small areas of native vegetation, the purpose of this project is to preserve and enhance stream and riparian habitat, which would likely lead to improvement of natural views over time.

Compliance with applicable local, state, and federal regulations would require implementation of BMPs and, if needed, additional mitigation would be developed during project-level review to address potentially significant impacts. Such measures could include generally incorporating improvements into the landscape to minimize contrast between project elements and the surrounding view (Section 4.11.7, Mitigation Measures). With implementation of BMPs and any required mitigation measures, the short-term impacts on aesthetics would be less than significant.

Instream Flow Rule Amendment

Under the Instream Flow Rule Amendment Project, the Icicle Reserve established under Chapter 137-545 WAC would be increased to support future domestic water supply demands projected through 2050. Over the long term, this amendment would ultimately result in the removal of an additional 0.4 cfs water from Icicle Creek after habitat and instream flow restoration elements are implemented. Additional water withdrawals could result in reduced instream flows in Icicle Creek, which could impact natural areas along the shoreline bank because there could be less water to support vegetation. However, potential impacts would be offset by the implementation of required instream flow and

habitat restoration actions under Alternative 1. Changes in flows in Icicle Creek would be within the natural variation already occurring within the system and illustrated in Section 4.11.2.2, Long-term Impacts, Irrigation Efficiencies.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

The potential long-term adverse impacts on natural shoreline areas would occur in areas where new facilities resulted in the conversion or loss of vegetation. Potential adverse impacts would likely be minor because the potential permanent loss of vegetation is expected to affect a relatively small area. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential aesthetic impacts under NEPA would be completed once the full scope of the project is determined.

Fish Passage Improvements

Although the specifics of the Fish Passage Improvements Project have not yet been determined, it is expected that long-term aesthetic changes would occur mainly at the Boulder Field (Figure 4-24) where the existing conditions would be altered to improve fish passage. Other potential project elements under consideration mainly include operational changes at Structures 2 and 5. To improve passage at the Boulder Field, it is anticipated that alteration to the stream channel would be required to create improved conditions for fish passage. Long-term impacts are not anticipated to be significant because the design does not include the introduction of any new elements or facilities but rather would maintain the overall natural conditions at this location.

Fish Screen Compliance

No impacts on aesthetics are anticipated from the Fish Screen Compliance Project over the long term because the project would replace degraded fish screens with updated models.

Depending on the location of the proposed new facilities, this project could result in the loss of some small areas of vegetation and possibly the construction of some minor new facilities; however, these project elements would be similar to the existing facilities and are not anticipated to result in a substantial change to the surrounding environment.

Additionally, work within sensitive areas would require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential long-term impacts affecting sensitive areas (Section 4.11.7, Mitigation Measures). These requirements would be developed once project-specific details were available.

Water Markets

Proposed Water Markets Project elements would result in increased flows in lower Icicle Creek, especially in years when mitigation water is not required for interruptible water

users. Over the long term, efficiencies gained would also result in increases in instream flows along lower Icicle Creek, mainly during late summer and early fall, compared to existing conditions and the No-action Alternative. The potential long-term impacts associated with flow changes on Icicle Creek would result in similar types of impacts to those described as the result of the Alpine Lakes Optimization, Modernization, and Automation Project in this section.

4.11.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would also be included while the Alpine Lakes Optimization, Modernization, and Automation project would not. Compliance with the Guiding Principles addresses aesthetic views in general by enhancing Icicle Creek aquatic and riparian habitat. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Potential impacts associated with other projects proposed under Alternative 2 are discussed under Alternative 1.

4.11.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction of a new pump station under this project would require both in-water and riverbank work on the Wenatchee River. Such activities could result in many of the same construction-related short-term impacts on aesthetics described for the COIC Irrigation Efficiencies and Pump Exchange Project (4.11.2.1, Short-term Impacts), including clearing of vegetation along the bank of the Wenatchee River and along the delivery pipeline route.

4.11.3.2 Long-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project would result in the loss of a small area of riparian vegetation and the construction of a new pump exchange and associated intake facilities. Although the specific location is not yet determined, it is planned to be constructed along the banks of the Wenatchee River. A viewshed map is presented in Figure 4-55 with the areas from which it would be possible to see proposed project changes presented in orange and a representative view is shown in Figure 4-56. Representative photographs of what these facilities would likely look like are presented in Figures 4-49 and 4-50.

Figure 4-56 shows the view near the Highway 2 bridge at Dryden. This location includes views of an armored slope and willow trees and grasses in the foreground; the river, building debris, and a shoreline structure and upland vegetation in the midground; and the bend of the river and forested slope in the background.

Figure 4-55. Wenatchee River Viewshed: Viewpoint 4

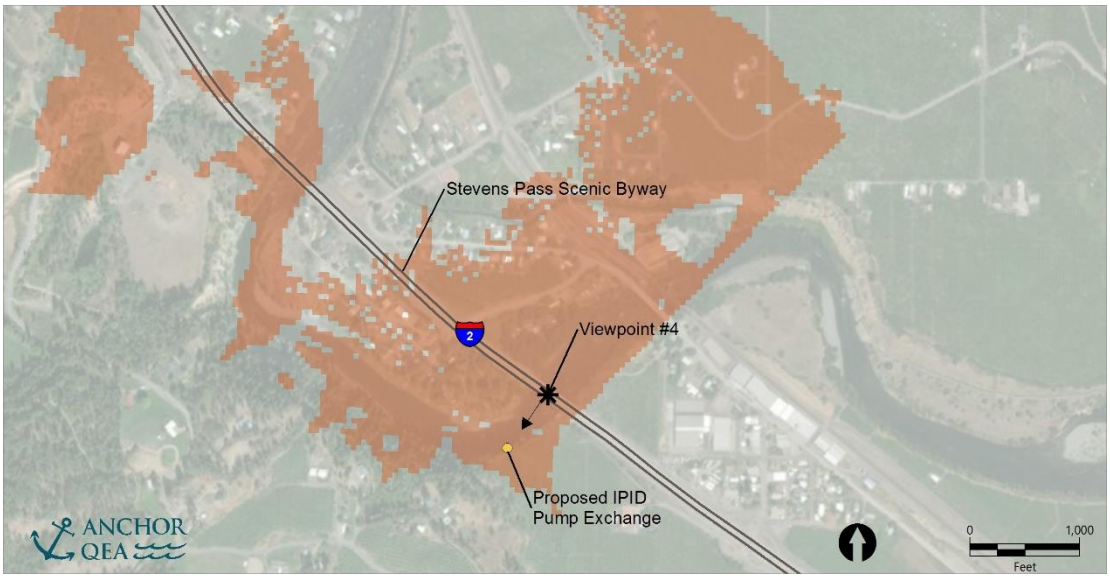


Figure 4-56. Wenatchee Viewpoint 4: Looking Southwest (July)

Sensitive viewers for this project could include recreationalists (e.g., walkers, kayakers) using public access points along the Wenatchee River during construction activities. Drivers along the Stevens Pass Scenic Byway could also be able to see the new facilities.

Representative photos of the pump station infrastructure are provided through the COIC Efficiencies Project (Figures 4-49 and 4-50). Viewers may notice a moderate level of contrast between the surrounding pastoral view and the new structure; however, the project site includes an existing degraded structure already affecting this view and the view from the Dryden bridge is accessed predominately by vehicular drivers limiting the amount of time this infrastructure could be noticed.

Over the long term, efficiencies gained would also result in increases in instream flows along lower Icicle Creek, mainly during late summer and early fall, compared to existing conditions and the No-action Alternative. The potential impacts would be similar to those described as the result of the Alpine Lakes Optimization, Modernization, and Automation Project (Section 4.11.2.2, Long-term Impacts).

4.11.4 Alternative 3

The potential impacts associated with Alternative 3 are similar to those discussed above with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 would be implemented and the Alpine Lakes Optimization, Modernization, and Automation Project would not.

4.11.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

No short-term aesthetic impacts are anticipated from this project because no construction would be required.

4.11.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

If the proposed Legislative Change Creating OCPI Authority Project for Alternative 3 were enacted, there could be potential conflicts with instream flow allocations. Under the proposed changes, junior domestic water rights could be exercised even when the instream flow rule is not met, resulting in the potential for lower instream flows and associated aesthetic changes.

4.11.5 Alternative 4

The potential impacts associated with Alternative 4 are similar to those discussed for Alternative 1 with the exception that the Eightmile Lake Storage, Upper Klonaqua Lake Storage, and Upper and Lower Snow Lakes Storage Enhancement Projects are included. The potential aesthetic impacts associated with these projects are described below.

4.11.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would involve demolishing the existing dam, installing new piping, and constructing new impoundment and water control structures that would allow for an increase in the accessible storage at Eightmile Lake to 3,500 acre-feet. The new dam structure would increase the normal high operating water surface elevation by 11 feet to 4,682 feet to allow for storage at a higher level than current or historical water storage levels and the project would also allow for additional draw down of the lake.

Construction activity would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down. Short-term impacts on aesthetics would be limited because most of the work would occur within areas that are already disturbed and developed. However, a 100-foot-long spillway northeast of the dam face and a 75-foot-long spillway south of the existing dam would disturb natural vegetation.

As noted in Section 4.8, Vegetation, any potentially significant impacts related to the removal of riparian vegetation or other vegetation types that constitute important habitat would be addressed prior to construction by compliance with applicable local, state, and federal permits and approvals. This would include riparian vegetation, with potential mitigation requirements providing aesthetic benefits. With implementation of required mitigation measures, the short-term impacts on aesthetics would be less than significant.

Upper Klonaqua Lake Storage Enhancement

Short-term impacts on aesthetics from this project would primarily be associated with construction activities required to provide a low-level outlet from Upper Klonaqua Lake to Lower Klonaqua Lake using one of the three conceptual connection options discussed in Chapter 2. Construction activity would occur between the lakes and along the banks within the dry areas of the lake margins once the lakes had been drawn down.

As noted in Section 4.8, Vegetation, any potentially significant impacts related to removal of riparian vegetation or other vegetation types that constitute important habitat would be addressed prior to construction by compliance with applicable local, state, and federal permits and approvals. This would include riparian vegetation, with potential mitigation requirements providing aesthetic benefits. With implementation of required mitigation measures, the short-term impacts on aesthetics would be less than significant.

Upper and Lower Snow Lakes Storage Enhancement

Short-term impacts on aesthetics from the Upper and Lower Snow Lakes Storage Enhancement Project would be primarily related to construction activities, and the impacts are similar in type and mechanism to those discussed in Sections 4.11.5.1, Short-term Impacts, Eightmile Lake Storage Enhancement and Upper Klonaqua Lake Storage Enhancement. Specific construction activities that could result in impacts include the transportation of construction equipment and materials to the project site; draw down of the

lakes to isolate in-water work areas; demolition of the existing dams and water control structures; removal of vegetation, excavation, and fill placement to install new low-level outlet piping; and the placement of concrete and other materials to construct new dams.

As noted in Section 4.8, Vegetation, any potentially significant impacts related to removal of riparian vegetation or other vegetation types that constitute important habitat would be addressed prior to construction by compliance with applicable local, state, and federal permits and approvals. This would include riparian vegetation, with potential mitigation requirements providing aesthetic benefits. With implementation of required mitigation measures, the short-term impacts on aesthetics would be less than significant.

4.11.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Operation of the proposed facilities for the Eightmile Lake Storage Enhancement Project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. The greatest potential for impacts on aesthetics over the long term would occur as the result of permanent conversion of any natural areas, disturbance during maintenance, and any changes in operations with respect to how lake levels are managed.

The sensitive viewers for this project, representative viewpoints, and viewsheds are the same as under Alternative 2 Eightmile Lake Storage Restoration (Section 4.11.2.2).

Because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative. However, this project would result in the ability to maintain the lake at higher than historical levels compared to existing conditions and the No-action Alternative.

Under existing conditions, the maximum fill height of the lake is approximately 4,667 feet because the embankment portion of the dam has deteriorated. After the dam is restored, the lake would be able to fill to a new high water surface of 4,682 feet. Under this project, lake levels would be managed to rise beginning in the late fall and would continue to approximately 4,677 feet to the height of a notch in the proposed dam. The lake would remain at this height until stop logs are placed in the notch in the early summer. Placement of the stop logs would allow the lake level to continue to rise to the spillway elevation of 4,682 feet. The lake would stay at this level for less than a month in the early summer, after which time IPID would begin drawing down the lake by releasing water.

Compared with existing conditions and the No-action Alternative, this means that an additional area of shoreline would be under water. Shoreline areas up to 4,671 feet have been historically inundated, but areas above 4,671 feet to 4,682 feet have not been inundated. The additional area would be under water for a little less than a month each summer. This change in lake levels could result in some changes to the vegetative community at the water's edge but would otherwise represent limited changes to aesthetics from existing high water views.

The project would also allow for the lake to be drawn down below existing lake levels to an elevation of 4,620 feet, which is approximately 25 feet lower than the existing low. This change would result in the exposure of 13.6 acres of additional lake bed, mainly in the later summer month and early fall up to the point when the water would no longer be drawn down, generally around the end of September.

The dam infrastructure updates would have a temporary impact on views as a result of vegetation removal and impacts because of earthwork and clearing associated with construction of the primary and secondary spillways. The new dam facility would represent a moderate impact to aesthetics because the height of the dam would be increased, requiring additional earthwork (compared to Eightmile Lake Storage Restoration) and greater impact to surrounding vegetation. As with the Eightmile Lake Storage Restoration Project, degraded elements of the existing dam (e.g., metal debris) would be removed, enhancing the appearance of the area. Additionally, with time the surrounding vegetation and the weathering properties of the lake and weather would further integrate this feature into the surrounding landscape.

These draw down surface water-level changes represent moderate impacts to aesthetics through the change between existing and proposed views. However, the draw down conditions would still provide a natural view of the lake, but with a greater proportion of rock and sediment exposed compared to the existing view. The higher surface water changes represent a less than significant impact to aesthetics. The higher water would affect vegetation at portions of the shoreline; however, existing conditions include snags and ample large wood in the lake supplied by the forested slopes.

Simulations of the high water and dam infrastructure updates are provided below in Figures 4-57 and 4-58. Draw down conditions are similar to those shown in Alternative 2 Eightmile Lake Storage Restoration, but the lowest draw down level would include an additional 2 feet (Figure 4-59).

Figure 4-57. Eightmile Lake Storage Enhancement: Dam, Existing and Simulated Views

Figure 4-58. Eightmile Lake Storage Enhancement: Higher Lake Level, Existing and Simulated Views

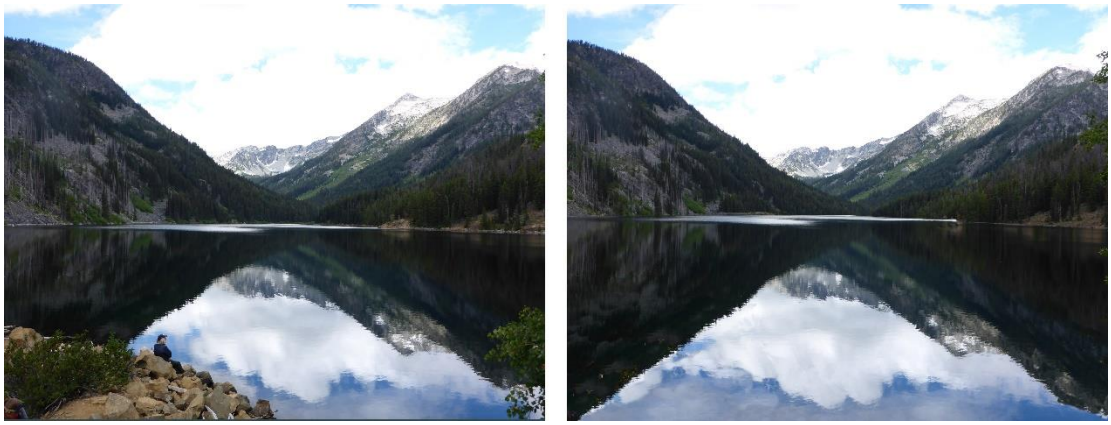


Figure 4-59. Eightmile Lake Storage Enhancement: Low Lake Level, Existing and Proposed Conditions

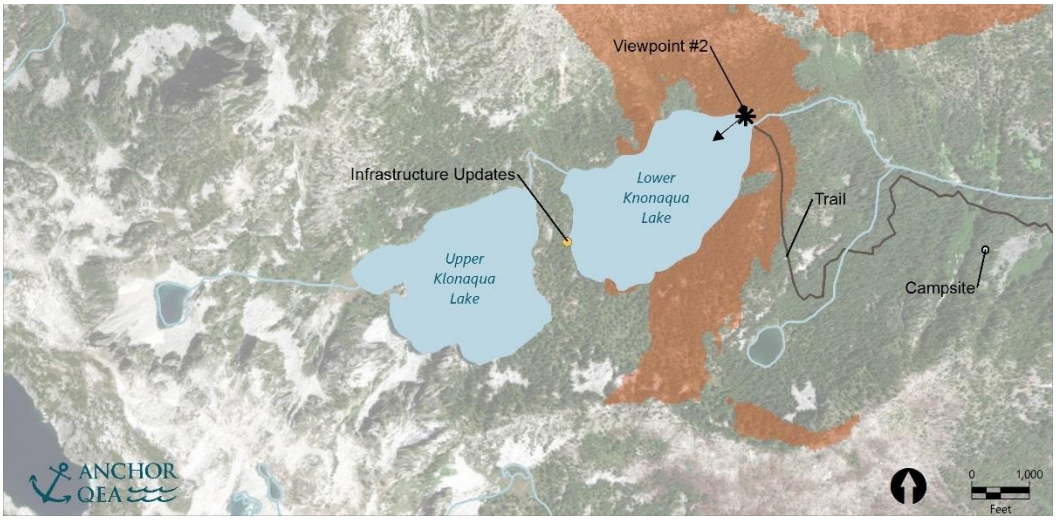
Changes in flows in Icicle Creek would be within the natural variation already occurring within the system and illustrated in Section 4.11.2.2, Long-term Impacts, IPID Irrigation Efficiencies. The main changes would be beneficial from increased flows during times when water levels would otherwise be low.

Any potentially significant impacts related to removal of riparian vegetation or other vegetation types that constitute important habitat would be addressed prior to construction by compliance with applicable local, state, and federal permits and approvals. This would include riparian vegetation, with potential mitigation requirements providing aesthetic benefits. Additional mitigation measures may include stamping or facing infrastructure with natural materials, screening with vegetation, and generally incorporating facilities into the landscape to minimize contrast between project elements and the surrounding view (Section 4.11.7, Mitigation Measures).

Upper Klonaqua Lake Storage Enhancement

The sensitive viewers for this project are predominately recreation users (e.g. hikers and campers) who would be visiting Upper Klonaqua Lake. Representative viewpoints where recreation users would see aesthetic changes are presented and described below. Figure 4-60 provides viewshed results with the locations of the representative viewpoint and the areas from which it would be possible to see proposed project changes presented in orange.

Figure 4-60. Upper Klonaqua Lake Storage Enhancement Viewshed



Potential long-term impacts to aesthetics would be similar to those described under the Eightmile Lake Storage Enhancement Project (Section 4.11.5.2, Long-term Impacts). Potential benefits would mainly occur in Icicle Creek and would include an increased ability to augment stream flow in the late summer or during drought years, with flow augmentation primarily benefitting the section of Icicle Creek between Upper Klonaqua Lake and the IPID diversion. Simulations of this project condition with the outlet structure are provided in Figure 4-61 below.

Figure 4-61. Viewpoint 2: Upper Klonaqua Lake Outlet Visible from Lower Klonaqua Lake, Existing and Proposed Conditions

The outlet structure and water flows would change the existing view as shown in the simulation; however, the view change would occur far from sensitive viewers who might be hiking on the surrounding trails and camping nearby. Additionally, the changes would largely look natural and would not introduce any new manmade elements into the viewshed that would conflict with the natural feel of the view. Further, changes to water levels would be limited to Upper Klonaqua Lake and would not be visible to sensitive viewers. Therefore, this project is not expected to result in significant aesthetic impacts in the long term at the lakes.

Over the long term, this project would also result in increases in instream flows along lower Icicle Creek, mainly during late summer and early fall, compared to existing conditions and the No-action Alternative. The potential long-term impacts associated with flow changes on Icicle Creek would result in similar types of impacts to those described as the result of the Alpine Lakes Optimization, Modernization, and Automation Project in this section.

Upper and Lower Snow Lakes Storage Enhancement

The Upper and Lower Snow Lakes Storage Enhancement Project would result in the construction of new facilities that would allow for an increase in the high-water storage levels at both Upper and Lower Snow Lakes by 5 feet compared with existing conditions. The project would also allow for Lower Snow Lake to be drawn down 3 feet below the current lake level, which would result in the exposure of slightly more lake bed. The infrastructure changes for this project would not be visible to recreationalists at Upper and Lower Snow Lake as they would be located within a currently existing gatehouse. Changes in water pressure from the existing outlet would likewise be indistinguishable from existing conditions (Figure 4-13). Simulations of the water-level changes associated with the project are provided below in Figures 4-62 through 4-65.

Figure 4-62. Viewpoint 1: Lower Snow Lake High Water, Existing and Proposed Conditions

Figure 4-63. Viewpoint 1: Lower Snow Lake Low Water, Existing and Proposed Conditions

Figure 4-64. Viewpoint 2: Upper Snow Lake High Water, Existing and Proposed Conditions

Figure 4-65. Viewpoint 2: Upper Snow Lake Low Water, Existing and Proposed Conditions

The draw down and high water levels would change the existing view during a portion of the peak recreation time period. More specifically, those accessing the lakes in late summer are more likely to experience lower lake levels (Figures 4-62 and 4-64); however, the view would largely remain intact and have the same natural character. This would be consistent with the surrounding landscape. Therefore, it is expected that this project would not result in significant aesthetic impacts over the long term.

Over the long term, this project would also result in increases in instream flows along lower Icicle Creek, mainly during late summer and early fall, compared to existing conditions and the No-action Alternative. The potential long-term impacts associated with flow changes on Icicle Creek would result in similar types of impacts to those described as the result of the Alpine Lakes Optimization, Modernization, and Automation Project in this section.

4.11.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange Project would be included.

4.11.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange Project

This project would involve converting the IPID delivery systems to pressurized pipelines, removing the existing intakes on Icicle and Peshastin Creeks, and constructing three new pump stations and intakes on the Wenatchee River. Conversion of the IPID delivery systems and removal of the existing intakes would require the use of excavators, compactors, and other heavy equipment, such as dump trucks that would represent short-term changes to the aesthetic surroundings. However, construction activities would be occurring in areas that are already developed and in agricultural use. As a result, it is expected that there would be limited sensitivity of viewers to short-term changes and the potential impacts would not be significant.

Construction of the three new pump stations and associated facilities would require both in-water and riverbank work on the Wenatchee River. Such activities could result in many of the same construction-related short-term impacts on aesthetics described for the COIC Irrigation Efficiencies Project (4.11.2.1, Short-term Impacts), including clearing of vegetation along the bank of the Wenatchee River and along the delivery pipeline route. As noted previously, any vegetation removal would be mitigated through compliance with local, state, and federal requirements. If additional mitigation is required, it would be developed through project-level review as discussed in greater detail in Section 4.11.7, Mitigation Measures.

4.11.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange Project

Conversion of the existing delivery systems would likely mean that canals and flumes would be abandoned in place or removed. New sections of pipelines would be buried. Therefore, it is expected that there would be limited sensitivity of viewers to long-term changes and the potential impacts would not be significant.

The Full IPID Full Piping and Pump Exchange Project would also result in the loss of a small area of riparian vegetation associated with the pump exchanges and intake facilities.

Potential impacts associated with one of the three pump stations would be the same as those described for the IPID Full Piping and Pump Exchange Project (Viewpoint 4) in Figure 4-56. The likely location of the two additional pump stations are shown in Figure 4-66 with representative views of the current conditions at those locations shown in Figure 4-67 and Figure 4-68.

Figure 4-66. Wenatchee River Viewshed: Viewpoints 5 and 6

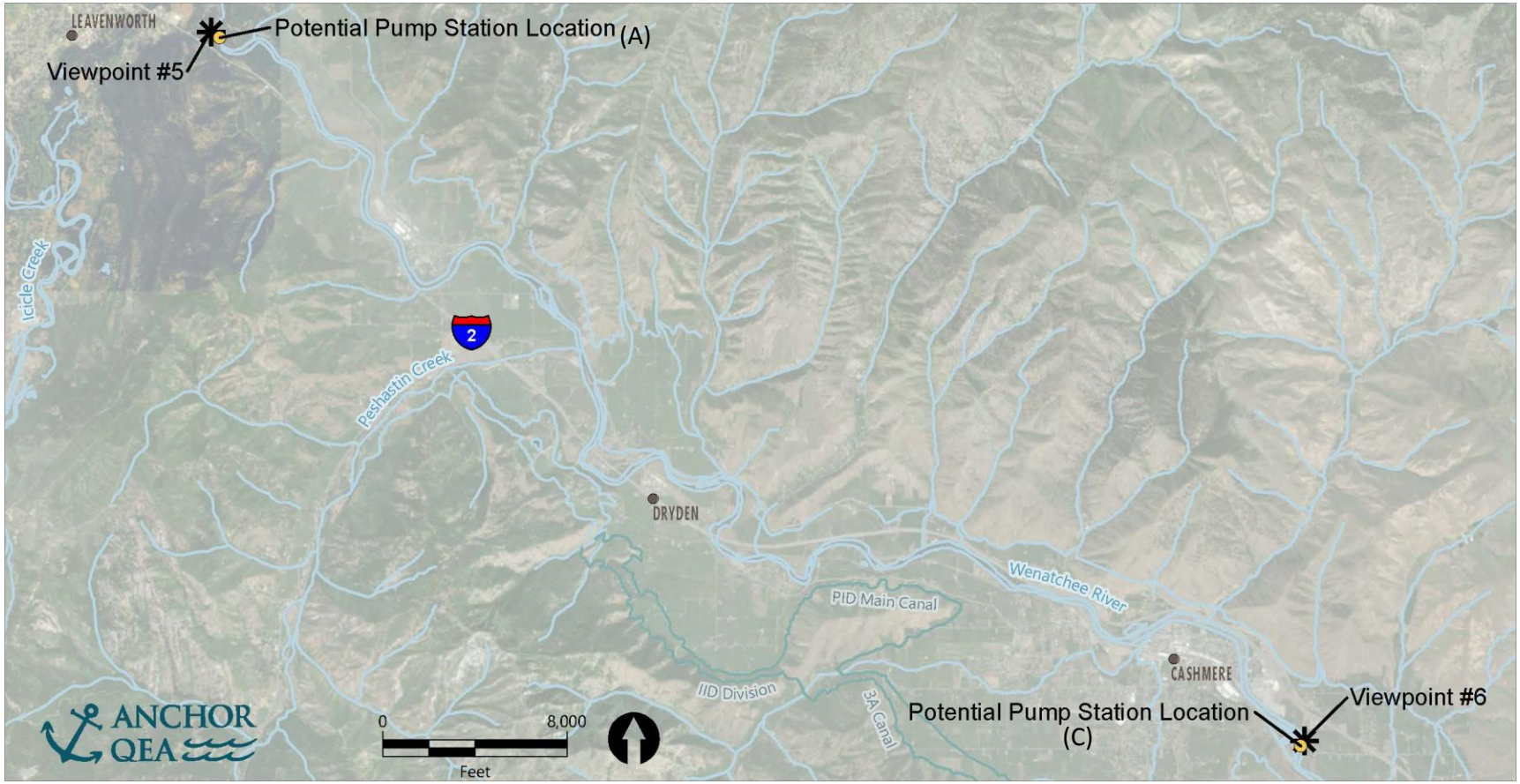


Figure 4-67. Wenatchee Viewpoint 5: Looking Southwest

Figure 4-68. Wenatchee Viewpoint 6: Looking Southwest

Sensitive viewers at the two additional pump station locations (Viewpoints 5 and 6) could include recreationalists (e.g., walkers, kayakers) using public access points along the Wenatchee River. Drivers along the Stevens Pass Scenic Byway could also be able to see the new facilities near Viewpoint 5 but not at Viewpoint 6.

Viewers from these locations may notice a low to moderate level of contrast between the surrounding view and the new pump station or intake, depending on the specific location. Representative photographs of what these facilities would likely look like are presented in Figures 4-49 and 4-50. From Viewpoint 5, there is an existing degraded structure already affecting this view and the view from the Dryden bridge is accessed predominately by vehicular drivers limiting the amount of time this infrastructure could be noticed. Viewpoint 6 represent views from a private property where the surroundings include other manmade structures. Because the new facilities would represent less of a change to the aesthetics at that location and are not easily accessible to the public, changes to this location would represent less of an aesthetic change.

Over the long term, efficiencies gained through relocation intakes on Icicle and Peshastin Creeks would also result in increases in instream flows up to the new diversion points, mainly during late summer and early fall, compared to existing conditions and the No-action Alternative. The potential long-term impacts associated with flow changes on Icicle Creek would result in similar types of impacts to those described as the result of the Alpine Lakes Optimization, Modernization, and Automation Project in this section.

4.11.7 Mitigation Measures

This section describes the BMPs that would be required and would help to mitigate the potential environmental impacts identified above.

4.11.7.1 Short-term Impacts

Short-term aesthetic impacts are often largely addressed through the implementation of BMPs that are typically required by local, state, and federal regulations and project-specific permits and approvals. Common BMPs include conducting work in a manner to minimize potential disturbance of native vegetation, minimizing dust, implementing thorough site cleanup activities, and possibly compensating for loss of any important habitat, which indirectly affects aesthetics.

If deemed necessary, specific mitigation measures would be developed as part of future project-level review and permitting. Mitigation measures to address potential short-term impacts on aesthetics are expected to be the same as those described for vegetation and wetlands in Section 4.8.6, Mitigation Measures.

4.11.7.2 Long-term Impacts

Long-term impacts on aesthetics would be mitigated in part by complying with the terms and conditions of local, state, and federal regulations and project-specific permits and approvals to restore or compensate for the loss of sensitive vegetative areas. However,

specific mitigation measures would be developed as part of future project-level review and permitting if needed. Implementation of the following additional measures would ensure impacts would be less than significant.

- Design and locate to the extent feasible permanent facilities outside of publicly accessible viewpoints and avoid or minimize to the extent possible the permanent removal of native vegetative communities.
- Minimize the aesthetic impacts of new facilities by designing them to visually fit into the surrounding landscape by:
  - Selecting materials to blend into surrounding views. Avoid the use of reflective coatings or paints.
  - Painting grouped infrastructure the same color to reduce contrast and visual complexity.
  - Siting infrastructure away from ridgelines such that views of the new facilities would not have high contrast against the sky.
  - Minimize the need for nighttime lighting. Use motion detectors to minimize the need for lights to be on continually.
  - Use natural topography and vegetation to screen infrastructure from publicly accessible vantage points where possible.

4.12 Air Quality

This section describes the potential short- and long-term impacts that could affect the resources identified in Section 3.12, Air Quality, from construction and operation related to the No-action Alternative and Program Alternatives.

4.12.1 No-action Alternative

4.12.1.1 Short-term Impacts

Under the No-action Alternative, various entities and agencies would undertake individual actions that could result in short-term impacts on air quality in the Icicle Creek Watershed project area. construction of water diversion modifications, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure at the Alpine Lakes including the restoration of the Eightmile Lake Dam, and improvements to existing irrigation systems to support agricultural reliability.

Short-term impacts on air quality would primarily occur as the result of construction-related activities. Emissions would result from the transport of construction materials and the operation of construction equipment. In addition, fugitive dust as a result of the

exposure or transport of soil during construction may also contribute to short-term air quality impacts. In general, short-term construction emissions are expected to be less than significant because any emissions would be temporary and minimal. Further, the majority of construction activities would be anticipated to be minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110). In addition, incorporation of the standard BMPs outlined in Section 4.12.7, Mitigation Measures, would help to further reduce emissions.

4.12.1.2 Long-term Impacts

Under the No-action Alternative, individual project implementation would result in increased air emissions compared to existing conditions. Emissions from any new stationary sources, (e.g., a diesel-powered backup generator for pumping), would have the potential to result in long-term air quality impacts if the emissions exceed the applicable regulatory standards described in Section 3.12, Air Quality. However, compliance with the applicable regulatory processes described in Section 5.2, Table 5-2, would ensure any new sources of emissions would remain within acceptable thresholds.

In general, small-scale water resources projects would most likely either not result in longer-term sources of emissions or would likely fall below WAC stationary source permit requirements (WAC 173-400-110); however, if permitting was required, individual projects would be required to incorporate additional emissions controls as described in Section 4.12.7, Mitigation Measures. Therefore, the No-action Alternative is not anticipated to result in significant long-term air quality impacts.

4.12.2 Alternative 1

Implementation of Alternative 1 has the potential to result in an increase in emissions compared with the No-action Alternative because there would be greater likelihood that certain projects would be implemented, and the scale of certain efforts would likely be greater.

4.12.2.1 Short-term Impacts

This section addresses the potential for short-term impacts on air quality anticipated with implementation of individual projects under Alternative 1.

Alpine Lakes Optimization, Modernization, and Automation

Construction activities associated with this project would result in minor short-term increases in air emissions from transporting workers and equipment to the five lakes and possibly operating a generator to power hand tools. No heavy equipment would be used related to this project. Transportation would involve helicopter trips to and from the lakes and related construction activity over a brief (likely just a few days) period at each lake. No campfires are allowed at the lakes and no other burning activities are planned related to this project.

Although there would be some minor increases in air emissions during construction, anticipated levels would be considered minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110).

IPID Irrigation Efficiencies

Construction activities associated with the IPID Irrigation Efficiencies Project include the conversion of IPID canals to pipelines and lining of irrigation canals with concrete. These activities could require the use of excavators, compactors, and other heavy equipment, such as dump trucks. Although there would be some minor increases in air emissions in the short term, anticipated levels would be considered minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110).

COIC Irrigation Efficiencies and Pump Exchange

Construction activities associated with COIC Irrigation Efficiencies and Pump Exchange Project would include piping canals and laterals and installation of a pump station and would also be considered exempt per WAC 173-400-110. Short-term impacts on air quality would not be significant.

Domestic Conservation Efficiencies

Certain components of the Domestic Conservation Efficiencies Project, such as evaluating conservation-oriented rate structures and expanding conservation education, xeriscape, and rebate programs, would not result in air emissions; however, the construction-related activities associated with this project, such as replacing leaky water mains and residential meters, could result in some minor, short-term increases in air emissions related to the use of generators to power tools and operation of heavy equipment, including trucks, as needed. Although there would be some minor increases in air emissions during construction, anticipated levels would be minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110).

Eightmile Lake Storage Restoration

Construction activities associated with the Eightmile Lake Storage Restoration Project would result in minor short-term increases in air emissions from transporting workers and equipment to Eightmile Lake and general construction activity, including operating an excavator and a generator to power hand tools and dewatering equipment. Transportation would involve periodic helicopter trips to and from the lake during the construction period, which is anticipated to last approximately 2 to 3 months. An excavator, which would be required for construction, may also be walked in along the Eightmile Lake Trail or transported by helicopter, which would also result in some short-term emissions.

Although there would be some minor increases in air emissions during construction, anticipated levels would be minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110). If burning activities are required, they would be conducted in compliance with the appropriate regulations or

permit conditions, as discussed in Section 4.12.7, Mitigation Measures, to ensure that potential impacts on air quality would remain minimal.

Tribal Fishery Preservation and Enhancement

The focus of this project is to ensure that there would be no adverse effects on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. The specifics of this project are not yet determined, but would likely involve the operation of construction equipment, resulting in some minor short-term emissions. At this stage, the primary options under consideration include the construction of facilities, such as a pipeline, bubble curtain, or sprayer, near the spillway in front of the LNFH to promote favorable fishing conditions. Most construction activities are expected to be minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110). Any new sources of emissions would be subjected to regulation as discussed in greater detail in Section 4.12.7, Mitigation Measures, which would ensure emissions would not exceed applicable thresholds.

Habitat Protection and Enhancement

The Habitat Protection and Enhancement Project could involve grading; planting and thinning vegetation; hauling and placing logs, rock, soil, and other materials; and some in-water work on lower Icicle Creek. These activities would require construction equipment, including trucks, excavators, and hand-held equipment, the use of which would result in minor air emissions. Most construction activities are expected to be minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110). Any new sources of emissions would be subjected to regulation as discussed in greater detail in Section 4.12.7, Mitigation Measures, which would ensure emissions would not exceed applicable thresholds.

Instream Flow Rule Amendment

No short-term air quality impacts are anticipated from this project because no construction would be required.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project includes various elements geared towards improving water quality and hatchery rearing conditions at the LNFH. In general, construction of these elements would result in some increase in short-term air emissions. Because this facility is owned by Reclamation and operated by the USFWS, an evaluation of the potential air quality impacts under NEPA would be completed once the full scope of the project is determined. In general, while the magnitude of potential air quality impacts would depend on the scale of the proposed construction activities, it is anticipated that construction-related emissions for this project would be similar in nature to those described above and would be addressed through implementation of BMPs similar to those described in Section 4.12.7, Mitigation Measures.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek, as well as instream modifications to the Boulder Field near RM 5.6. This work would require the use of excavators, dump trucks, and possibly a crane. Although there would be some minor increases in air emissions during construction, anticipated levels would be minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110).

Fish Screen Compliance

This project involves replacing fish screens at three different diversions on lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Under this project, screens and associated infrastructure would be improved to bring all three intakes up to compliance with state and federal laws. These activities would involve the use of excavators, dump trucks, compaction equipment, concrete mixers, and other equipment as needed to move earth and other equipment materials. Although there would be some minor increases in air emissions during construction, anticipated levels would be minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110)

Water Markets

No short-term air quality impacts are anticipated from the Water Markets Project because no construction would be required.

4.12.2.2 Long-term Impacts

This section addresses the potential for long-term impacts on air quality anticipated with implementation of individual projects under Alternative 1.

Alpine Lakes Optimization, Modernization, and Automation

Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from the affected lakes. Because the facilities would be operated largely by desktop and would rely in part on solar energy, the greatest potential for impact to air emissions over the long term would occur as the result of maintenance trips to and from the lakes, which are anticipated to likely be less frequent than would occur under the No-action Alternative. For this reason, this project is not anticipated to result in significant long-term impacts on air quality.

IPID Irrigation Efficiencies

The IPID Irrigation Efficiencies Project does not involve new emission-generating facilities or changes in operation of the existing facilities and therefore would not result in any significant long-term increases in air emissions.

COIC Irrigation Efficiencies and Pump Exchange

The long-term impacts of the COIC Irrigation Efficiencies and Pump Exchange Project on air quality would be similar to those described for the IPID Irrigation Efficiencies

Project with the exception of those associated with the new COIC pump station. As a new facility, the pump station would be required to comply with applicable regulations described in Section 3.12, Air Quality, which would ensure any new sources of emissions would remain within acceptable thresholds.

Domestic Conservation Efficiencies

No long-term impacts are anticipated from this project because no new emissions would be generated.

Eightmile Lake Storage Restoration

Operation of the proposed facilities for the Eightmile Lake Storage Restoration Project would result in the ability to store and withdraw additional water consistent with historical levels at Eightmile Lake. Because the facilities would be operated largely by desktop at the IPID offices and would rely in part on solar energy, the greatest potential for increased air emissions over the long term would occur as the result of maintenance trips to and from the lakes, which are anticipated to be less than would occur under the No-action Alternative. For this reason, this project is not anticipated to result in significant long-term impacts on air quality.

Tribal Fishery Preservation and Enhancement

No impacts on air quality are anticipated from this project over the long term because no new emissions-generating facilities are proposed.

Habitat Protection and Enhancement

No impacts on air quality are anticipated from this project over the long term because no new emissions-generating facilities are proposed.

Instream Flow Rule Amendment

No impacts on air quality are anticipated from this project over the long term because no new emissions-generating facilities are proposed.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

Operation of the LNFH over the long term has the potential to result in changes in air emissions compared to the No-action Alternative. The extent of the changes depends on the specifics of the proposed project; however, in general, it is anticipated that long-term impacts would be minor because any proposed facilities would be required to operate consistent with applicable local, state, and federal air quality regulations, as noted in Section 4.12.7, Mitigation Measures. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential air quality impacts under NEPA would be completed once the full scope of the project is determined.

Fish Passage Improvements

No impacts on air quality are anticipated from this project over the long term because no new emissions-generating facilities are proposed.

Fish Screen Compliance

No impacts on air quality are anticipated from this project over the long term because no new emissions-generating facilities are proposed.

Water Markets

No impacts on air quality are anticipated from this project over the long term because no new emissions-generating facilities are proposed.

4.12.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project compared to Alternative 1 and the No-action Alternative.

4.12.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction of the IPID Dryden Pump Exchange Project would require the use of excavators, compactors, and other heavy equipment, such as dump trucks, which would result in short-term increases in air emissions. Construction is anticipated to last up to 3 months. Although there would be some minor increases in air emissions associated with this activity, anticipated levels would be considered minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110).

4.12.3.2 Long-term Impacts

IPID Dryden Pump Exchange

Long-term operation of the IPID Dryden Pump Exchange Project would result in some increased emissions primarily associated with powering the pump. As a new facility, the pump exchange would be required to comply with the applicable regulatory processes described in Section 4.12.7, Mitigation Measures. This would ensure any new sources of emissions would remain within acceptable thresholds.

4.12.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 1 and Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 Project would be included while the Eightmile Lake Storage Restoration Project would not. This section describes the specific short- and long-term impacts associated with the Legislative Change Creating OCPI Authority for Alternative 3 Project.

4.12.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

No impacts on air quality are anticipated from this project in the short term because no new emissions-generating activities are proposed.

4.12.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

No impacts on air quality are anticipated from this project over the long term because no new emissions-generating activities are proposed.

4.12.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1 with the exception that the Eightmile Lake, Upper Klonaqua Lake, and Upper and Lower Snow Lakes Enhancement Projects would be included. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.12.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

Construction activities associated with the Eightmile Lake Storage Enhancement Project would result in minor short-term increases in air emissions from transporting workers and equipment to Eightmile Lake and general construction activity, including operating an excavator and a generator to power hand tools and dewatering equipment. Transportation would involve periodic helicopter trips to and from the lake during the construction period, which is anticipated to last approximately 2 to 3 months. An excavator may also be walked in along the Eightmile Lake Trail or transported by helicopter, which would also result in some short-term emissions.

Although there would be some minor increases in air emissions during construction, anticipated levels would be minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110). If burning activities are required, they would be conducted in compliance with the appropriate regulations or permit conditions, as discussed in Section 4.12.7, Mitigation Measures, to ensure that potential impacts on air quality would remain minimal.

Upper Klonaqua Lake Storage Enhancement

Construction activities associated with this project would result in minor short-term increases in air emissions from transporting workers and equipment to the lake and general construction activity, including operating an excavator and a generator to power hand tools and dewatering equipment. Transportation would involve periodic helicopter trips to and from the lake during the construction period.

Although there would be some minor increases in air emissions during construction, anticipated levels would be minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110). If burning activities are required, they would be conducted in compliance with the appropriate regulations or permit conditions, as discussed in Section 4.12.7, Mitigation Measures, to ensure that potential impacts on air quality would remain minimal.

Upper and Lower Snow Lakes Storage Enhancement

Construction activities associated with this project would result in minor short-term increases in air emissions from transporting workers and equipment to the lake and general construction activity, including operating an excavator and a generator to power hand tools and dewatering equipment. Transportation would involve periodic helicopter trips to and from the lakes during the construction period.

Although there would be some minor increases in air emissions during construction, anticipated levels would be minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110). If burning activities are required, they would be conducted in compliance with the appropriate regulations or permit conditions, as discussed in Section 4.12.7, Mitigation Measures, to ensure that potential impacts on air quality would remain minimal.

4.12.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Operation of the proposed facilities for the Eightmile Lake Storage Enhancement Project would result in the ability to store and withdraw additional water at Eightmile Lake. Because the facilities would be operated largely by desktop at the IPID offices and would rely in part on solar energy, the greatest potential for increased air emissions over the long term would occur as the result of maintenance trips to and from the lake, which are anticipated to be the same as or less than would occur under the No-action Alternative. For this reason, this project is not anticipated to result in significant long-term impacts on air quality.

Upper Klonaqua Lake Storage Enhancement

Operation of the proposed facilities for the Upper Klonaqua Lake Storage Enhancement Project would result in the ability to store and withdraw additional water at Klonaqua Lake. Because the facilities would be operated largely by desktop at the IPID offices and would rely in part on solar energy, the greatest potential for increased air emissions over the long term would occur as the result of any maintenance trips to and from the lake. Because these facilities would be new and require less maintenance, and because travel to and from the site would largely be done on foot, the potential long-term impacts are anticipated to be minimal. For this reason, this project is not anticipated to result in significant long-term impacts on air quality.

Upper and Lower Snow Lakes Storage Enhancement

Operation of the proposed facilities for the Upper and Lower Snow Lakes Storage Enhancement Project would result in the ability to store and withdraw additional water from Upper and Lower Snow Lakes. The facilities would be operated remotely by USFWS personnel at the LNFH. Releases from the lakes would be automated, with electronic actuators that would rely on solar energy. The greatest potential for increased air emissions over the long term would occur as the result of maintenance trips to and from the lakes, which are anticipated to be the same as or less than would occur under the No-action Alternative. For this reason, this project is not anticipated to result in significant long-term impacts on air quality.

4.12.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange project would be included.

4.12.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange Project

Construction of the IPID Full Piping and Pump Exchange Project would require the use of excavators, compactors, and other heavy equipment, such as dump trucks, which would result in short-term increases in air emissions. Construction is anticipated to be phased over several years. Although there would be some minor increases in air emissions associated with this activity, anticipated levels would be considered minimal such that they would not trigger the need for a notice of construction permit from Ecology (WAC 173-400-110).

Construction activities specifically associated with installing the pressurized pump delivery system would also be considered exempt per WAC 173-400-110. Short-term impacts on air quality would not be significant.

4.12.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

Long-term operation of the IPID Full Piping and Pump Exchange Project would result in some increased emissions primarily associated with powering the pumps. As new facilities, the pump stations would be required to comply with the applicable regulatory processes described in Section 4.12.7, Mitigation Measures. This would ensure any new sources of emissions would remain within acceptable thresholds.

4.12.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.12.7.1 Short-term Impacts

Air quality regulations are set forth in Chapter 173-400 WAC. Construction permits for activities that are not otherwise exempt per WAC 173-400-110 are required to comply with the standards set forth in Chapter 173-400 WAC to ensure that air quality levels do not exceed acceptable thresholds.

Even though the construction activities associated with the Program Alternatives are expected to be minimal and otherwise exempt from regulation, implementation of the following BMPs would ensure that emissions were further reduced.

- Ensure all equipment is in good repair to minimize potential emissions.
- Minimize unnecessary idling of emission-generating equipment.
- Cover any areas of bare stockpiled soil when not in use.
- Limit any burn piles to an area of 10 feet by 10 feet and follow any other applicable limitations set forth by Washington Department of Natural Resources, Chelan County, and Ecology.

4.12.7.2 Long-term Impacts

New sources of emissions are also required to comply with the requirements set forth in Chapter 173-400 WAC. Compliance with required permit conditions would ensure that any long-term air emissions do not exceed acceptable thresholds.

4.13 Climate Change

This section describes the potential short- and long-term impacts of climate change on the proposed projects. Additionally, it describes any possible effects of the projects on climate change. Effects on climate change are assumed to primarily occur during construction activities and are discussed in the short-term impacts section. The impacts are related to emissions from construction equipment. The amount of carbon emissions resulting from construction projects depend on the type, quantity, and duration of heavy equipment use. None of the projects' construction plans are developed enough to calculate carbon emissions. Ecology guidance suggests that increased carbon emissions of less than 25,000 metric tons per year are presumed not to be significant (Ecology, 2011).

Effects of climate change on projects are discussed in the long-term impacts sections. Many of the impacts of climate change on streamflow, as discussed in Section 3.13, are expected to be reduced if Program Alternatives are implemented. Table 4-3 indicates if the instream flow goal of 100 cfs is met by the various Program Alternatives under low, medium, and high climate change scenarios in 2080. These climate change scenarios are related to modeled changes based on the amount of future greenhouse gas releases. More

detail regarding the difference climate change scenarios is available in Changing Streamflow in Icicle, Peshastin, and Mission Creeks (UW CIG, 2017) in Appendix G.

Table 4-3
Ability to Maintain Minimum Flow Target of 100 cfs
Under 2080 Climate Change Conditions?

	Present	Low Change	Medium Change	High Change
Alternative 0	No	No	No	No
Alternative 1	Yes	Yes	Yes	Yes
Alternative 2	Yes	Yes	Yes	Yes
Alternative 3	Yes	No	No	No
Alternative 4	Yes	Yes	Yes	Yes
Alternative 5	Yes	Yes	Yes	Yes

Note: If guiding principles could be met both in drought and non-drought years per climate change scenario, yes. If guiding principles are not expected to be met in either drought or non-drought years per climate change scenario, no. This table is based on flow charts developed with the estimated percent change (average output of CIG model work) and the average weekly stream flow as recorded at the USGS gaging station (1997-2016). Projected streamflow benefits were added to these data to estimate the performance of the alternatives for projects available in both drought and non-drought years under predicted climate change conditions. These flow charts are provided in Appendix G.

4.13.1 No-action Alternative

4.13.1.1 Short-term Impacts

Under the No-action Alternative, various agencies and other entities would continue to undertake individual actions to restore and enhance fish and aquatic resources in the Icicle Creek Watershed project area, but those actions would not be part of a coordinated program implemented with the support of the IWG. Actions implemented by individual agencies and entities could include construction of diversion improvements, irrigation system upgrades, LNFH improvements, and fish passage work.

Short-term impacts to climate change would result from increased greenhouse gas emissions during the construction of ongoing projects. At this point in the planning process, it is not possible to calculate the greenhouse gas emissions resulting from projects built under the No-action Alternative. However, it is assumed that the No-action Alternative would result in the lowest level of greenhouse gas emissions because the fewer projects would be constructed compared to the Program Alternatives.

4.13.1.2 Long-term Impacts

As discussed in Section 3.13, climate change is expected to have significant impacts on the timing of the hydrograph, with peak flows occurring earlier in the season and having a lower magnitude as well as lower summer and early fall flows. These changes in the

hydrograph would likely have significant negative consequences for aquatic species and water availability for out-of-stream uses. Without an integrated water resource management strategy, individual project efficacy could reduce the potential to address these issues.

Several projects will likely proceed under the No-action Alternative that will help secure supplies of out-of-stream use. These include improvements at points of diversions, efficiency/conservation upgrades, and continued maintenance and operation of storage facilities. While these projects might continue under the No-action Alternative, the focus of these projects would likely be focused on out-of-stream beneficiaries and not on streamflow.

Long-term impacts to climate change resulting from this project that would have increased energy demands, such as the COIC pump station, could include increases in greenhouse gas emissions. However, Chelan PUD, which generates power primarily through hydroelectric projects, will provide the electricity for this project, so greenhouse gas emissions are expected to be relatively low. Significant increases in greenhouse gas emissions are not expected to result from implementation of the No-action Alternative.

4.13.2 Alternative 1

As discussed in Section 3.13, research on climate change indicates there will likely be significant changes in the magnitude and timing of the hydrograph in Icicle Creek over time. Implementation of Alternative 1 has the potential partially to offset the impacts associated with increased variability in water flows and increase adaptable water management strategies in response to changing climatic conditions. Appendix G provides graphs of modeled streamflow under low, medium, and high climate change scenarios, with additional flows provided by Alternative 1 augmenting the climate change base flow. These models were built from data available in the University of Washington Climate Impacts Group report on Icicle Creek streamflow under various greenhouse gas scenarios and climate change models (CIG, 2017). These graphs use an average of models to predict stream flow based on low greenhouse gas release scenarios. Based on these analyses, Alternative 1 would meet the instream flow targets established in the Guiding Principles in 2080 under the low, medium and high climate change scenarios.

There is also the potential for greenhouse gas releases in association with construction activities.

4.13.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Construction activities associated with the Alpine Lakes Optimization, Modernization, and Automation Project would involve replacing existing gates and installing solar panels, actuators, flow monitoring equipment, and other new equipment. Some of these

activities could require the use of gasoline/diesel powered equipment, which could be flown in via helicopter during normal maintenance trips. The use of heavy equipment for construction would likely be limited for this project. As discussed in Section 4.12.2.1 emissions from construction equipment would be considered minimal. Greenhouse gas emissions would be limited to the construction window and are not expected to cause appreciable impacts on climate change.

IPID Irrigation Efficiencies

Construction activities associated with the IPID Irrigation Efficiencies Project include the conversion of irrigation canals to pipelines, lining of irrigation canals with concrete, and installation of on-farm efficiency upgrades. These construction activities would require the use of gasoline/diesel powered heavy equipment. As discussed in Section 4.12.2.1 emissions from construction equipment would be considered minimal. Greenhouse gas emissions would be limited to the construction window and are not expected to cause appreciable impacts on climate change.

COIC Irrigation Efficiencies and Pump Exchange

Construction activities associated with the COIC Irrigation Efficiencies and Pump Exchange Project include the conversion of irrigation canals and laterals to pipelines and construction of a new surface water intake and pump station on the Wenatchee River. These construction activities would require the use of gasoline/diesel powered heavy equipment. As discussed in Section 4.12.2.1 emissions from construction equipment would be minimal. Greenhouse gas emissions would be limited to the construction window and are not expected to cause appreciable impacts on climate change.

Domestic Conservation Efficiencies

Construction activities under the Domestic Conservation Efficiencies Project would likely be associated with upgrading leaky infrastructure, such as replacing watermains and installing meters. These construction activities would require the use of gasoline/diesel powered heavy equipment, but as discussed in Section 4.12.2.1 emissions from construction equipment would be considered minimal. Greenhouse gas emissions would be limited to the construction window and are not expected to cause appreciable impacts on climate change.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project would involve demolishing the existing dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures. These construction activities would likely require the use of gasoline/diesel powered heavy equipment, but as discussed in Section 4.12.2.1 emissions from construction equipment would be considered minimal. Greenhouse gas emissions would be limited to the construction window and are not expected to cause appreciable impacts on climate change.

Tribal Fishery Preservation and Enhancement

The focus of this project is to ensure that there would be no adverse effects on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. At this stage, the primary options under consideration include the construction of facilities, such as plumbing to create a bubble curtain, a sprayer, or other minor modifications to the Hatchery Channel spillway at LNFH to promote favorable fishing conditions in the pool at the bottom of the spillway. These construction activities would require the use of gasoline/diesel powered equipment, but as discussed in Section 4.12.2.1 emissions from construction equipment would be considered minimal. Greenhouse gas emissions would be limited to the construction window and are not expected to cause appreciable impacts on climate change.

Habitat Protection and Enhancement

The Habitat Protection and Enhancement Project includes planting vegetation, grading, and installing logs, rocks, and other materials. These construction activities would require the use of gasoline/diesel powered equipment, but as discussed in Section 4.12.2.1 emissions from construction equipment would be considered minimal. Greenhouse gas emissions would be limited to the construction window and are not expected to cause appreciable impacts on climate change.

Instream Flow Rule Amendment

There are no construction activities associated with this project, and no potential for greenhouse gas emissions.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project includes various elements that would require the use of gasoline/diesel powered equipment during construction, including the installation of circular tanks, implementation of effluent pump-back, and groundwater augmentation. These construction activities would result in some increase in short-term greenhouse gas emissions. Because this facility is owned by the Reclamation and operated by the USFWS, an evaluation of the potential air quality impacts under NEPA would be completed once the full scope of the project is determined. In general, while the magnitude of potential greenhouse gas emissions would depend on the scale of the proposed construction activities, it is anticipated that construction-related emissions for this project would be similar in nature to other projects described in this section.

Fish Passage Improvements

The Fish Passage Improvements Project would involve modification of existing LNFH instream structures in Icicle Creek as well as instream modifications to the Boulder Field near RM 5.6. These construction activities would require the use of gasoline/diesel powered heavy equipment, but as discussed in Section 4.12.2.1 emissions from construction equipment would be considered minimal. Greenhouse gas emissions would

be limited to the construction window and are not expected to cause appreciable impacts on climate change.

Fish Screen Compliance

The Fish Screen Compliance Project involves installing fish screens at three different diversions on Icicle Creek. These construction activities would require the use of gasoline/diesel powered equipment, but as discussed in Section 4.12.2.1 emissions from construction equipment would be considered minimal. Greenhouse gas emissions would be limited to the construction window and are not expected to cause appreciable impacts on climate change.

Water Markets

There are no construction activities associated with this project, and no potential for greenhouse gas emissions.

4.13.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

As discussed in Section 3.13, climate change is predicated to impact the timing of the hydrograph, leading to increased streamflow in the winter and decreased streamflow in the summer, over time. The Alpine Lakes Optimization, Modernization, and Automation Project is designed to release up to 30 cfs to augment low flows in Icicle Creek. This project would be expected to help offset the impacts of climate change and provide the flexibility for adaptive management of water resources within the basin, reducing impacts on fish and out-of-stream users.

Under climate change scenarios, the likelihood that lakes will still be able to fully recharge remains relatively unchanged or improves in 2030 across model types. However, the timing of when runoff from rain or snowmelt occurs changes, which leads to increased recharge in the winter and spring, and decreased runoff to the lakes during the summer months (CIG, 2017).

Long-term impacts to climate change resulting from greenhouse gas emission is not expected from this project. The project would be operated via solar power and gravity works.

IPID Irrigation Efficiencies

The IPID Irrigation Efficiencies Project would reduce IPID's diversion on Icicle Creek by approximately 10 cfs in summer months through canal piping and lining, and on-farm efficiency upgrades. This would have positive effects on stream flow, which climate change models indicate would decrease in the summer months. These decreased flows are not anticipated to have impacts on the project's operation or viability. Long-term demand forecasting predicts that agriculture demand could decrease overall in the Wenatchee River Watershed, with peak use shifting to earlier in the season (WSU, 2016),

meaning climate change may not have long-term impacts on the efficacy of this project. This change in demand is based on changes in crop type.

The IPID diversion and canal is a gravity system. This project is not anticipated to contribute to greenhouse gas emission through its operation. Long-term changes in greenhouse gas emissions are not expected to result from this project.

COIC Irrigation Efficiencies and Pump Exchange

The COIC Irrigation Efficiencies and Pump Exchange Project involves piping the system and replacing the gravity feed point of diversion on Icicle Creek with a pump station on the Wenatchee River. This project is anticipated to provide 8.0 to 11.9 cfs in Icicle Creek during summer months when climate change models predict lower flows. These decreased flows are not anticipated to have impacts on the project's operation or viability. Long-term demand forecasting predicts that agricultural demand may decrease overall in the Wenatchee River Watershed, with peak use shifting to earlier in the season (WSU, 2016), meaning climate change may not have long-term impacts on the efficacy of this project. This change in demand is based on changes in crop type.

Long-term impacts to climate change resulting from this project could include increases in greenhouse gas emissions. However, Chelan PUD, which generates power primarily through hydroelectric projects, will provide the electricity for this project, so greenhouse gas emissions are expected to be relatively low. Long-term changes in greenhouse gas emissions are not expected to result from this project. This project is currently undergoing pre-design and feasibility, which will help inform how many tons of carbon per year may result from this project.

Domestic Conservation Efficiencies

The Domestic Conservation Efficiencies Project involves upgrading meters, increased leak detection, replacing leaking infrastructure, and providing incentives to reduce water use such as conservation education, conservation rebate programs, and conservation-oriented rate structures. It is not anticipated that climate change would impact the project's operation, viability, or efficacy. Additionally, this project is not anticipated to increase greenhouse gas emissions.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project is designed to release up to 12.6 cfs and 900 acre-feet of additional storage (2,500 acre-feet total). This additional water would go to instream flows and improved domestic supply, but if the City of Leavenworth is able to withdraw the additional water from the Wenatchee River well field, the project would provide an additional 12.6 cfs to Icicle Creek in all reaches of the creek. This project would be expected to help ameliorate the impacts of climate change and provide the flexibility for adaptive management of water resources within the basin, reducing impacts on fish and out-of-stream users.

Under low, medium, and high climate change scenarios, the likelihood for lake recharge remains relatively unchanged or increases. However, the timing of runoff changes, which leads to increased recharge in the winter and spring, and decreased inflow during the summer months (Aspect, 2015).

Long-term impacts to climate change resulting from this project could include increases in greenhouse gas emissions. However, Chelan PUD, which generates power primarily through hydroelectric projects, will provide the electricity for the municipal/domestic component of this project, via increased pumping from City wells, so greenhouse gas emissions are expected to be relatively low.

Gate operations at the dam would be powered by solar panels, allowing for the automated releases of water for increased instream flows. Long-term changes in greenhouse gas emissions are not expected to result from this project.

Tribal Fishery Preservation and Enhancement

This project would include measures to minimize the impacts of other projects implemented through the Icicle Strategy on tribal, as well as non-tribal, fisheries. It is expected that climate change will result in increased variability of water flows and temperatures, which can make water use reliability more tenuous and fish habitat lower quality. This project, by definition will help address potential adverse impacts of the Program on fisheries, which will in part offset adverse climate change impacts. As flow conditions change in response to climate change, the effectiveness of project elements may change. The efficacy of projects would require long-term monitoring based on changing flow conditions.

A long-term increase in greenhouse gas emissions from project operations is not anticipated.

Habitat Protection and Enhancement

The Habitat Protection and Enhancement Project includes riparian plantings, installation of woody debris and rocks, reconnection and protection of the flood plain, and conserving upland forested habitat. While climate change may impact riparian areas and vegetation dynamics, it is believed this project would still be viable and effective.

The project has the potential to reduce the carbon in the atmosphere by conserving forest lands and planting riparian vegetation. There would be no long-term greenhouse gas emissions resulting from this project.

Instream Flow Rule Amendment

This project involves amending the Instream Flow Rule. Climate change is predicted to create even more variabilities in flows and increase periods when the instream flow rule is not met. Increasing the reserve has the potential to exacerbate this issue. However, as noted in Section 4.7.2, Fish, other flow and habitat restoration project under Alterative 1 are meant to collectively address this problem.

This project could result in additional greenhouse gas emissions resulting from increased pumping. However, the power source for any additional pumping from the City's well field would likely be provided by Chelan PUD, which supplies hydropower throughout Chelan County. Long-term changes in greenhouse gas emissions are not expected to result from this project.

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Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

Operation of the LNFH over the long-term has the potential to result in changes in greenhouse gas emissions. The extent of the changes depends on the specifics of the proposed project; however, in general, it is anticipated that long-term impacts would be minor because any proposed facilities would be required to operate consistent with applicable local, state, and federal air quality regulations. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential greenhouse gas emissions under NEPA would be completed once the full scope of the project is determined.

Fish Passage Improvements

The Fish Passage Improvements Project involves improving fish passage in Icicle Creek. There are no long-term greenhouse gas emissions associated with the project. Reduced summer flows resulting from climate change could impact the efficacy of this project. However, with the instream flow improvements proposed under Alternative 1, these impacts to efficacy are unlikely. Long-term changes in greenhouse gas emissions are not expected to result from this project.

Fish Screen Compliance

The Fish Screen Compliance Project involves upgrading the IPID, City of Leavenworth, and the LNFH/COIC fish screens. The operation of this project is not expected to result in long-term increases of greenhouse gas emissions. The efficacy of this project is not expected to be impacted by climate change. Long-term changes in greenhouse gas emissions are not expected to result from this project.

Water Markets

The Water Markets Project would provide mitigation to interruptible water users. This project is expected to provide instream flow benefit in several Icicle Creek and Wenatchee River reaches in drought years and benefit in all reaches in non-drought years. The instream flow benefit would be 3.4 cfs during the summer months when stream flow is expected to be at its lowest. Long-term demand forecasting predicts that agricultural demand could decrease overall in the Wenatchee River Watershed, with peak use shifting to earlier in the season (WSU, 2016), meaning climate change may not have long-term impacts on the efficacy of this project.

Long-term changes in greenhouse gas emissions are not expected to result from this project.

4.13.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would also be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. Implementation of Alternative 2 has the potential to offset some of the impacts of climate change on stream flow and increase adaptable water management strategies in response to changing conditions. Appendix G provides graphs of modeled streamflow under low, medium, and high climate change scenarios, with additional flows provided by Alternative 2 augmenting the climate change base flow. Based on this analysis, Alternative 2 would meet the instream flow targets established in the Guiding Principles in 2080 under the low and medium climate change scenario, but not under the high climate change scenario.

4.13.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction activities associated with the IPID Dryden Pump Exchange Project includes construction of a new surface water intake and pump station on the Wenatchee River. These construction activities would require the use of gasoline/diesel powered equipment. However, greenhouse gas emissions would be limited to the construction window and are not expected to cause appreciable impacts on climate change.

4.13.3.2 Long-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project involves piping the system and replacing the gravity feed point of diversion on Icicle Creek with a pump station on the Wenatchee River. This project is anticipated to provide 8.0 to 11.9 cfs in Icicle Creek during summer months when climate change models predict lower flows. These decreased flows are not anticipated to have impacts on the project's operation or viability. Long-term demand forecasting predicts that agricultural demand could decrease overall in the Wenatchee River Watershed, with peak use shifting to earlier in the season (WSU, 2016), meaning climate change may not have long-term impacts on the efficacy of this project. This change in demand is based on changes in crop type.

Long-term impacts to climate change resulting from this project could include increases in greenhouse gas emissions. However, Chelan PUD, which generates power primarily through hydroelectric projects, will provide the electricity for this project, so greenhouse gas emissions are expected to be relatively low. This project is currently undergoing pre-design and feasibility, which will help inform how many tons of carbon per year may

result from this project. However, it is not anticipated to have significant impacts on climate change.

4.13.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 Project would also be included while the Eightmile Lake Storage Restoration Project would not. Implementation of Alternative 3 has the potential to offset some of the impacts of climate change on streamflow and water resource management and increase adaptable water management strategies in response to changing conditions. However, under Alternative 3, the flow targets established in the Guiding Principles would not be obtainable in 2080 under low, medium, and high climate change scenarios. Appendix G provides graphs of modeled streamflow under low, medium, and high climate change scenarios, with additional flows provided by Alternative 3 augmenting the climate change base flow.

4.13.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

There are no construction activities associated with this project, and no potential for greenhouse gas emissions. This project will not have significate short-term climate change impacts.

4.13.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

This project involves a legislative change to provide for domestic water use when the Instream Flow Rule is not met. This is because the timing of instream flow improvement projects may not be timed perfectly to match domestic demand, making it difficult to provide in-time mitigation to impacts on the Instream Flow Rule. This project could result in additional greenhouse gas emissions resulting from increased pumping. Calculating these impacts is not possible at this time. However, the power source will likely be hydropower provided by Chelan PUD, which would minimize greenhouse gas emissions. This project is not anticipated to have significate long-term climate change impacts.

4.13.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1. The Eightmile Lake Storage Restoration Project would be replaced with the Eightmile Lake Storage Enhancement Project, and the Upper Klonaqua Lake and Upper and Lower Snow Lakes Storage Enhancement Projects would be included. Implementation of Alternative 4 has the potential to offset some of the impacts of climate change on stream flow and increase adaptable water management strategies in response to changing conditions. Appendix G provides graphs of modeled streamflow under low,

medium, and high climate change scenarios, with additional flows provided by Alternative 4 augmenting the climate change base flow. Based on this analysis, Alternative 4 would meet the instream flow targets established in the Guiding Principles in 2080 under the low, medium, and high climate change scenarios.

4.13.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would involve demolishing the existing dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures that would allow for an increase in the accessible storage at Eightmile Lake. These construction activities would require the use of gasoline/diesel powered equipment. Greenhouse gas emissions would be limited to the construction window and are not expected to cause appreciable impacts on climate change. Overall, the project is a not anticipated to result in significant short-term climate change impacts.

Upper Klonaqua Lake Storage Enhancement

The Upper Klonaqua Lake Storage Enhancement Project would involve installing a conveyance system between Upper Klonaqua Lake and Lower Klonaqua Lake to allow draw down of Upper Klonaqua Lake. Construction activities have not been determined but would require the use of gasoline/diesel powered equipment. Greenhouse gas emissions would be limited to the construction period and are not expected to cause appreciable impacts to climate change. Overall, the project is a not anticipated to result in significant short-term climate change impacts.

Upper and Lower Snow Lakes Storage Enhancement

The Upper and Lower Snow Lakes Storage Enhancement Project would require altering the dam at Snow Lake and the outlet structure to increase accessible storage. Construction activities have not been determined but would require the use of gasoline/diesel powered equipment. Greenhouse gas emissions would be limited to the construction period and are not expected to cause appreciable impacts to climate change. Overall, the project is a not anticipated to result in significant short-term climate change impacts.

4.13.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project is designed to release up to 17.9 cfs and 1,000 acre-feet of additional storage (2,500 acre-feet total). This additional water would go to instream flows and improved domestic supply, but if the City of Leavenworth is able to withdraw the additional water from the Wenatchee River well field, the project would provide an additional 17.9 cfs to Icicle Creek in all reaches of the creek. This project would be expected to help ameliorate the impacts of climate change

and provide the flexibility for adaptive management of water resources within the basin, reducing impacts on fish and out-of-stream users.

Long-term greenhouse gas emissions from project operations could occur if the additional domestic supply is provided via the Wenatchee River well field rather than the Icicle Creek diversion, because power use would increase. These increased emissions are discussed under the Eightmile Lake Storage Restoration project. Gate operations at the dam would be powered by solar panels. Overall, the project is a not anticipated to result in significant long-term climate change impacts.

Upper Klonaqua Lake Storage Enhancement

The Upper Klonaqua Lake Storage Enhancement Project is designed to release up to 20 cfs and 2,448 acre-feet of additional storage. This additional water would go to instream flows and improved domestic supply. This project would be expected to help ameliorate the impacts of climate change and provide the flexibility for adaptive management of water resources within the basin, reducing impacts on fish and out-of-stream users.

Gate operations at the dam would be powered by solar panels. Overall, the project is a not anticipated to result in significant long-term climate change impacts.

Upper and Lower Snow Lakes Storage Enhancement

The Upper and Lower Snow Lakes Storage Enhancement Project is designed to release up to 18 cfs and 1,079 acre-feet. This additional water would go to instream flows and improved domestic supply. This project would be expected to help ameliorate the impacts of climate change and provide the flexibility for adaptive management of water resources within the basin, reducing impacts on fish and out-of-stream users.

Gate operations at the dam would be powered by solar panels. Overall, the project is a not anticipated to result in significant long-term climate change impacts.

4.13.6 Alternative 5

Alternative 5 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Full Piping and Pump Exchange Project would replace the IPID Irrigation Efficiencies Project. Implementation of Alternative 5 has the potential to offset some of the impacts of climate change on stream flow and increase adaptable water management strategies in response to changing conditions. Appendix G provides graphs of modeled streamflow under low, medium, and high climate change scenarios, with additional flows provided by Alternative 5 augmenting the climate change base flow. Based on this analysis, Alternative 5 would meet the instream flow targets established in the Guiding Principles in 2080 under the low, medium, and high climate change scenario.

4.13.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

Construction activities associated with the IPID Full Piping and Pump Exchange Project includes construction of a new surface water intakes and pump stations on the Wenatchee River. These construction activities would require the use of gasoline/diesel powered equipment. However, greenhouse gas emissions would be limited to the construction window and are not expected to cause appreciable impacts on climate change. Overall, the project is a not anticipated to result in significant short-term climate change impacts.

4.13.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

The IPID Dryden Pump Exchange Project involves piping the system and replacing the gravity feed point of diversion on Icicle Creek with three pump stations on the Wenatchee River. This project is anticipated to provide up to 117 cfs in Icicle Creek during summer months when climate change models predict lower flows. These decreased flows are not anticipated to have impacts on the project's operation or viability. Long-term demand forecasting predicts that agricultural demand could decrease overall in the Wenatchee River Watershed, with peak use shifting to earlier in the season (WSU, 2016), meaning climate change may not have long-term impacts on the efficacy of this project. This predicted change in demand is based on anticipated changes in crop type.

Long-term impacts to climate change resulting from this project could include increases in greenhouse gas emissions. However, the primary power supply for the pump stations would be Chelan PUD, which generates power primarily through hydroelectric projects, so greenhouse gas emissions are expected to be relatively low. This project is currently undergoing pre-design and feasibility, which will help inform how many tons of carbon per year may result from this project. Overall, the project is a not anticipated to result in significant long-term climate change impacts.

4.13.7 Mitigation Measures

This section describes mitigation measures to minimize the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.13.7.1 Short-term Impacts

While construction activities are not expected to have a significant effect on global climate change, construction-related greenhouse gas emissions should be reduced by the following BMPs.

- Ensure all equipment is in good repair to minimize potential emissions.
- Minimize unnecessary idling of emission-generating equipment.

- Minimize the number of trips to/from construction sites and use local materials when possible.

4.13.7.2 Long-term Impacts

As discussed in Section 3.13, climate change is anticipated to impact stream flow and, consequently, water resource management in the Icicle Creek Subbasin. There may be increases in greenhouse gas emissions associated with the implementation of some projects, which BMPs relating to equipment maintenance can help minimize. The expected increase in greenhouse gas emissions is considered less than significant.

4.14 Noise

This section describes potential short- and long-term impacts that could affect the resources identified in Section 3.14, Noise, from construction and operations related to the No-action Alternative and the Program Alternatives.

4.14.1 No-action Alternative

4.14.1.1 Short-term Impacts

Under the No-action Alternative, various entities and agencies would undertake individual actions that could result in short-term noise impacts in short-term impacts in the ALWA and in riparian areas along Icicle Creek and the Wenatchee River. Short-term noise impacts would largely result from operating mechanized construction equipment but may also include blasting related to maintenance activities at the existing irrigation structures at the Alpine Lakes. Table 4-4 presents noise levels associated with typical mechanized construction activities. The magnitude of short-term construction impacts in each case would depend on specific types of equipment used, the distance between construction activities and the nearest noise-sensitive receptor, and existing background noise levels.

Table 4-4
Typical Construction Noise Levels

Construction Activity	Equipment	Maximum Noise Level (dBA)[1]
Construction Preparation	Air compressors, power plants, pickup trucks, tractor trailers	55 to 85
Clearing and Grading	Air compressors, backhoe, blasting, dozer, excavator, forklifts, dump trucks, frontend loader, pumps, power plants, pickup trucks, rock drill, tractor trailers	55 to 94

Construction Activity	Equipment	Maximum Noise Level (dBA)[1]
Structure Construction	Air compressors, auger drill rig, backhoe, crane, excavator, forklifts, dump trucks, frontend loader, pumps, power plants, pickup trucks, tractor trailers, vibratory pile driver	55 to 95
Planting/Revegetation	Backhoe, dump trucks, frontend loader, pickup trucks, tractor trailers	55 to 84
Demobilization	Air compressors, backhoe, excavator, forklifts, dump trucks, loader, pumps, power plants, pickup trucks, tractor trailers	55 to 85

Source: Federal Highway Administration Construction Noise Handbook (FHWA 2006)
1) Noise is measured as A-weighted decibels (dBA) at 50 feet from the source.

In general, construction noise limited activities occurring between 7 a.m. and 10 p.m. (daytime hours) are exempt from regulations per WAC 173-60-050 and Chelan County Code Title 7. Any construction activities that may occur at the Alpine Lakes associated with upgrading the existing irrigation infrastructure are considered allowable uses consistent with the Wilderness Act as discussed further in Section 4.17.

4.14.1.2 Long-term Impacts

Under the No-action Alternative, most of the anticipated projects would not result in the creation of facilities that would generate ongoing sources of noise; however, any projects involving ongoing use of equipment, such as pumps or compressors would result in potential increases in long-term noise.

As discussed further in Section 4.14.7, Mitigation Measures, the state imposes limits on the allowable environmental noise levels from a variety of sources as described in Chapter 173-60 WAC. If permitting is required, individual projects would be required to incorporate additional controls consistent with those regulations. Therefore, the No-action Alternative is not anticipated to result in significant long-term noise impacts.

4.14.2 Alternative 1

Implementation of Alternative 1 has the potential to result in greater noise impacts compared with the No-action Alternative because there would be a higher likelihood that certain projects would be implemented, and the scale of certain efforts would likely be greater. The following sections describe the short- and long-term impacts that would occur under Alternative 1.

4.14.2.1 Short-term Impacts

This section describes the potential for short-term increases in noise anticipated with implementation of Alternative 1.

Alpine Lakes Optimization, Modernization, and Automation

Construction activities associated with this project would result in less than significant short-term increases in noise from transporting workers and equipment to the five lakes and from general construction activity, including operation of a generator to power hand tools. No heavy equipment would be used related to this project. Transportation would involve helicopter trips to and from the lakes over a brief period (likely a few days to a couple of weeks) at each lake. Noise levels associated with typical construction activities at 50 feet from the source are presented in Table 4-4.

Background noise levels at the project sites are generally quiet and mainly include sounds associated with the natural environment. Although there are no permanently occupied residences, recreationalists are granted access to camp and hike within and around the project sites based on a lottery system managed by the USFS. For additional information about recreational use, refer to Section 3.15, Recreation.

Depending on the location of recreationalists relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4. Although most camping sites are located farther than 50 feet from the proposed construction activities, anticipated noise levels could be a nuisance to recreationalists in the general vicinity. However, the increases in noise would not represent a permanent increase. Rather, nuisance noise would occur intermittently over a period of 2 to 4 weeks at each lake. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. As discussed in Section 4.17, the proposed project is an allowed use consistent with the Wilderness Act. Therefore, increased noise from construction is not anticipated to be significant.

IPID Irrigation Efficiencies

Construction activities associated with the IPID Irrigation Efficiencies Project include the conversion of IPID canals to pipelines and lining of irrigation canals with concrete. These activities could require the use of excavators, compactors, and other heavy equipment, such as dump trucks. Noise levels associated with typical construction activities at 50 feet from the source are presented in Table 4-4.

Construction activities are anticipated to occur within rural agricultural areas but could also occur in more developed urban settings. Background noise levels would vary but are generally anticipated to be representative of noise levels associated with agricultural and urban development. Sensitive noise receptors that could be affected by these activities are likely to include agricultural workers, residents, and other workers or individuals present at the time of construction.

Depending on the location of noise-sensitive receptors relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4. Anticipated noise levels could be a nuisance but would not represent a permanent increase. Rather, nuisance noise would occur intermittently during construction activities. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m.

is exempt from local regulation. Therefore, increased noise from construction is not anticipated to be significant.

COIC Irrigation Efficiencies and Pump Exchange

Construction activities associated with COIC Irrigation Efficiencies and Pump Exchange Project would be similar to those described above for the IPID Irrigation Efficiencies Project and are not anticipated to be significant.

Domestic Conservation Efficiencies

Certain components of the Domestic Conservation Efficiencies Project, such as evaluating conservation-oriented rate structures and expanding conservation education, xeriscape, and rebate programs, would not result in increased noise; however, construction-related activities associated with this project, such as replacing leaky water mains and residential meters, could result in some minor, short-term increases in noise. These activities include the use of generators to power tools and operation of heavy equipment, including trucks, as needed.

Construction activities are anticipated to occur within already developed residential settings. Background noise levels would vary but are generally anticipated to be representative of noise levels associated with urban development and general residential activity. Sensitive noise receptors that could be affected are likely to include residents or workers present at the time of construction.

Depending on the location of noise-sensitive receptors relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4. Anticipated noise levels could be a nuisance but would not represent a permanent increase. Rather, nuisance noise would occur intermittently during construction activities. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. Therefore, increased noise from construction is not anticipated to be significant.

Eightmile Lake Storage Restoration

Construction activities associated with the Eightmile Lake Storage Restoration Project would result in increases in noise from transporting workers and equipment to Eightmile Lake and general construction activity, including operating an excavator and a generator to power hand tools. Transportation would involve periodic helicopter trips to and from the lakes during the construction period, which is anticipated to last approximately 2 to 3 months. An excavator could also be walked in along the Eightmile Lake Trail, which would also result in brief activity and associated noise along the trail.

Noise levels associated with typical construction activities at 50 feet from the source are presented in Table 4-4. In addition, some blasting could be required to break up rock at the site. Prior to any blasting, IPID would develop a blasting plan, as described in Section 4.14.7, Mitigation Measures, and in conjunction with USFS, which would establish notification procedures so the public is informed that blasting might occur.

Background noise levels at the project site are generally quiet and mainly include sounds associated with the natural environment. Although there are no permanently occupied residences, recreationalists are granted access to camp and hike within and around the project site based on a lottery system managed by the USFS. For additional information about recreational use, refer to Section 3.15, Recreation.

Depending on the location of recreationalists relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4 related to the majority of construction activity. Although most camping sites are located farther than 50 feet from the proposed construction activities, anticipated noise levels could be a nuisance to recreationalists in the general vicinity, particularly if any blasting were to occur. Implementation of the blasting plan described in Section 4.14.7, Mitigation Measures, would help to minimize these impacts.

Increases in noise would not be permanent. Rather, nuisance noise would occur intermittently over a period of 2 to 4 weeks at the lake. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. As discussed in Section 4.17, the proposed project is an allowed uses consistent with the Wilderness Act. Therefore, with incorporation of the measures identified in Section 4.14.7, Mitigation Measures, increased noise from construction is not anticipated to be significant.

Tribal Fishery Preservation and Enhancement

The focus of this project is to ensure that there would be no adverse effects on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. The specifics of this project are not yet determined but would involve elements of restoration along lower Icicle Creek that could result in localized construction-related noise. At this stage, the primary options under consideration include the construction of facilities such as a bubble curtain, sprayer, or other minor modifications near the spillway in front of the LNFH to promote favorable fishing conditions.

Construction activities are anticipated to occur along the lower Icicle Creek. Background noise levels would vary but are generally anticipated to be representative of noise levels associated with natural sounds near the creek edge and some urban development. Sensitive noise receptors that could be affected are likely to include any residents who may live nearby, workers, or other individuals, including recreationalists, present at the time of construction.

Depending on the location of noise-sensitive receptors relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4. Anticipated noise levels could be a nuisance but would not represent a permanent increase. Rather, nuisance noise would occur intermittently during construction activities. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. Therefore, increased noise from construction is not anticipated to be significant.

Habitat Protection and Enhancement

The Habitat Protection and Enhancement Project could involve grading; planting and thinning vegetation; hauling and placing logs, rock, soil, and other materials; and some in-water work on lower Icicle Creek. These activities would require construction equipment, including trucks, excavators, and hand-held equipment, the use of which would result in increased noise. Construction activities are anticipated to occur along the lower Icicle Creek. Background noise levels would vary but are generally anticipated to be representative of levels associated with natural sounds near the creek edge and some urban development. Sensitive noise receptors that could be affected are likely to include any residents that may live nearby, workers, or other individuals, including recreationalists, present at the time of construction.

Depending on the location of noise-sensitive receptors relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4. Anticipated noise levels could be a nuisance but would not represent a permanent increase. Rather, nuisance noise would occur intermittently during construction activities. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. Therefore, increased noise from construction is not anticipated to be significant.

Instream Flow Rule Amendment

No short-term noise impacts are anticipated from this project because no construction would be required.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project includes various elements geared toward improving water quality and hatchery rearing conditions at the LNFH. In general, construction of these elements would result in some increase in short-term noise. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential short-term noise impacts under NEPA would be completed once the full scope of the project is determined.

Background noise levels are generally representative of levels associated with natural sounds near the creek edge and some urban development. Sensitive noise receptors that could be affected are likely to include workers or other individuals, including recreationalists, present at the time of construction.

Depending on the location of noise-sensitive receptors relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4. Anticipated noise levels could be a nuisance but would not represent a permanent increase. Rather, nuisance noise would occur intermittently during construction activities. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. Therefore, increased noise from construction is not anticipated to be significant.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek as well as instream modifications to the Boulder Field near RM 5.6. This work would require the use of excavators, dump trucks, and possibly a crane.

Background noise levels are generally representative of levels associated with natural sounds near the creek edge and some urban development. Sensitive noise receptors that could be affected are likely to include workers or other individuals, including recreationalists, present at the time of construction.

Depending on the location of noise-sensitive receptors relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4. Anticipated noise levels could be a nuisance but would not represent a permanent increase. Rather, nuisance noise would occur intermittently during construction activities. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. Therefore, increased noise from construction is not anticipated to be significant.

Fish Screen Compliance

The Fish Screen Compliance Project involves replacing fish screens at three different diversions on lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Under this project, screens and associated infrastructure would be improved to bring all three intakes up to compliance with state and federal laws. These activities would involve the use of excavators, dump trucks, compaction equipment, concrete mixers, and other equipment as needed to move earth and other equipment materials.

Background noise levels are generally representative of levels associated with natural sounds near the creek edge and some urban development. Sensitive noise receptors that could be affected are likely to include workers or other individuals, including recreationalists, present at the time of construction.

Depending on the location of noise-sensitive receptors relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4. Anticipated noise levels could be a nuisance but would not represent a permanent increase. Rather, nuisance noise would occur intermittently during construction activities. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. Therefore, increased noise from construction is not anticipated to be significant.

Water Markets

No short-term noise impacts are anticipated from this project because no construction would be required.

4.14.2.2 Long-term Impacts

This section addresses the potential for long-term noise impacts anticipated with implementation of individual projects under Alternative 1.

Alpine Lakes Optimization, Modernization, and Automation

Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from the affected lakes. Because the facilities would be largely operated remotely by IPID and would rely in part on solar energy, the greatest potential for increased noise over the long term would occur as the result of maintenance trips to and from the lakes. For this reason, this project is not anticipated to result in significant long-term noise impacts.

IPID Irrigation Efficiencies

The IPID Irrigation Efficiencies Project does not involve new emission-generating facilities or changes in operation of the existing facilities and would therefore, not result in any significant long-term increases in noise.

COIC Irrigation Efficiencies and Pump Exchange

Under the COIC Irrigation Efficiencies and Pump Exchange Project, the long-term impacts from noise would be similar to those described above for the IPID Irrigation Efficiencies Project with the exception of the new COIC pump station. Because the pump station would generate additional noise over the long-term, the design would incorporate features to reduce noise, including the use of variable frequency drives, which reduce the mechanical noise of the pumps, and placement within an insulated building.

In addition, as discussed in Section 3.14.7, Noise, the state imposes limits on the allowable environmental noise levels from a variety of sources consistent with Chapter 173-60 WAC. As such, individual projects, including the COIC pump station, would be required to incorporate additional controls consistent with those regulations. Therefore, this project is not anticipated to result in significant long-term noise impacts.

Domestic Conservation Efficiencies

No long-term noise impacts are anticipated from this project because no new noise-generating facilities or activities would occur.

Eightmile Lake Storage Restoration

Operation of the proposed facilities for the Eightmile Lake Storage Restoration Project would result in the ability to store and withdraw additional water consistent with historical levels at Eightmile Lake. Because the facilities would be largely operated remotely by IPID and would rely in part on solar energy, there would be potential for an overall reduction in noise impacts over the long term that would occur as the result of maintenance trips to and from the lakes, which are anticipated to be less than would occur under the No-action Alternative. For this reason, this project is not anticipated to result in significant noise impacts.

Tribal Fishery Preservation and Enhancement

The only potential noise impact that may occur as part of this project could be some minor from a bubbler or other equipment designed to create conditions that attract and keep fish in the pool near the hatchery spillway. No other long-term noise impacts are anticipated from this project because no new noise-generating facilities or activities would occur.

Habitat Protection and Enhancement

No long-term noise impacts are anticipated from this project because no new noise-generating facilities or activities would occur.

Instream Flow Rule Amendment

No long-term noise impacts are anticipated from this project because no new noise-generating facilities or activities would occur.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

Operation of the LNFH over the long term has the potential to result in changes in noise levels compared to the No-action Alternative. The extent of the changes depends on the specifics of the proposed project; however, in general, it is anticipated that long-term impacts would be less than significant because any proposed facilities would be required to operate consistent with applicable local, state, and federal noise regulations, as described in Section 3.14, Noise. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential noise impacts under NEPA would be completed once the full scope of the project is determined.

Fish Passage Improvements

No long-term noise impacts are anticipated from this project over the long term because no noise-generating facilities or activities would occur.

Fish Screen Compliance

No long-term noise impacts are anticipated from this project over the long term because no new noise-generating facilities or activities would occur.

Water Markets

No long-term noise impacts are anticipated from this project over the long term because no new noise-generating facilities or activities would occur.

4.14.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would be included while the Alpine Lakes Optimization, Modernization, and Automation project would not. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Impacts associated with other projects proposed under Alternative 2 are discussed under Alternative 1.

4.14.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction of the IPID Dryden Pump Exchange Project would require the use of excavators, compactors, and other heavy equipment, such as dump trucks, which would result in short-term increases in noise. Construction is anticipated to last up to 3 months.

Construction activities would occur along the bank of the Wenatchee River. Background noise levels would vary but are generally anticipated to be representative of levels associated with natural sounds near the creek edge and some urban development. Sensitive noise receptors that could be affected by these activities are likely to include agricultural workers, residents, and other workers or individuals, including recreationalists, present at the time of construction.

Depending on the location of noise-sensitive receptors relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4. Anticipated noise levels could be a nuisance but would not represent a permanent increase. Rather, nuisance noise would occur intermittently during construction activities. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. Therefore, increased noise from construction is not anticipated to be significant.

4.14.3.2 Long-term Impacts

IPID Dryden Pump Exchange

Under the IPID Dryden Pump Exchange Project, the operation of a new IPID pump station could result in increased noise emissions compared to existing conditions and the No-action Alternative. Increased noise would occur as the result of operating the pump station during the irrigation season. The pumps would operate with variable frequency drives, which would reduce the mechanical noise from the pumps. The pumps would also be enclosed in an insulated structure, which would help to further reduce noise, resulting in levels anticipated to be similar to other urban utility pump stations in the Icicle Creek area.

In addition, as discussed further in Section 4.14.7, Mitigation Measures, the state imposes limits on the allowable environmental noise levels from a variety of sources as described in Chapter 173-60 WAC. As such, individual projects, including the pump station, would be required to incorporate additional controls consistent with those regulations. Therefore, this project is not anticipated to result in significant long-term noise impacts.

4.14.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 Project would also be included while the Eightmile Lake Storage Restoration Project would not. This section describes the specific short- and long-term

impacts associated with the Legislative Change Creating OCPI Authority for Alternative 3 Project. Impacts associated with other projects proposed under Alternative 3 are discussed under Alternative 1 and Alternative 2.

4.14.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

No noise impacts are anticipated from this project in the short-term because no new noise-generating facilities or activities would occur.

4.14.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

No noise impacts are anticipated from this project in the long-term because no new noise-generating facilities or activities would occur.

4.14.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1. The Eightmile Lake Storage Restoration Project would be replaced with the Eightmile Lake Storage Enhancement Project, and the Upper Klonaqua Lake and Upper and Lower Snow Lakes Storage Enhancement Projects would be included. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.14.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

Construction activities associated with the Eightmile Lake Storage Enhancement Project would result in less than significant short-term increases in noise from transporting workers and equipment to Eightmile Lake and from general construction activity, including operating an excavator and a generator to power hand tools. Transportation would involve periodic helicopter trips to and from the lake during the construction period, which is anticipated to last approximately 2 to 3 months. An excavator may also be walked in along the Eightmile Lake Trail, which would also result in some increased activity and associated noise along the Eightmile Trail.

Noise levels associated with typical construction activities at 50 feet from the source are presented in Table 4-4. In addition, some blasting may be required to break up rock at the site. Prior to any blasting, IPID would develop a blasting plan, as described in Section 4.14.6, Mitigation Measures, and in conjunction with the USFS, which would establish notification procedures so the public is informed that blasting might occur.

Background noise levels at the project site are generally quiet and mainly include sounds associated with the natural environment. Although there are no permanently occupied residences, recreationalists are granted access to camp and hike within and around the

project site based on a lottery system managed by the USFS. For additional information about recreational use, refer to Section 3.15, Recreation.

Depending on the location of recreationalists relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4 related to the majority of construction activity. Although most camping sites are located farther than 50 feet from the proposed construction activities, anticipated noise levels could be a nuisance to recreationalists in the general vicinity, particularly if any blasting were to occur. Implementation of the blasting plan described in Section 4.14.6, Mitigation Measures, would help to minimize these impacts.

Increases in noise would not be permanent. Rather, nuisance noise would occur intermittently during construction. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. Therefore, with incorporation of the measures identified in Section 4.14.7, Mitigation Measures, increased noise from construction is not anticipated to be significant.

Upper Klonaqua Lake Storage Enhancement

Construction activities associated with the Upper Klonaqua Lake Storage Enhancement Project would result in less than significant short-term increases in noise from transporting workers and equipment to the project site and operating an excavator and a generator to power hand tools. Transportation would involve periodic helicopter trips to and from the lake during the construction period.

Noise levels associated with typical construction activities at 50 feet from the source are presented in Table 4-4. In addition, some blasting may be required to break up rock at the site. Prior to any blasting, IPID would develop a blasting plan, as described in Section 4.14.7, Mitigation Measures, and in conjunction with USFS, which would establish notification procedures so the public is informed that blasting might occur.

Background noise levels at the project site are generally quiet and mainly include sounds associated with the natural environment. Although there are no permanently occupied residences, recreationalists are granted access to camp and hike within and around the project site based on a lottery system managed by the USFS. For additional information about recreational use, refer to Section 3.15, Recreation.

Depending on the location of recreationalists relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4 related to the majority of construction activity. Although most camping sites are located farther than 50 feet from the proposed construction activities, anticipated noise levels could be a nuisance to recreationalists in the general vicinity, particularly if any blasting were to occur. Implementation of the blasting plan described in Section 4.14.7, Mitigation Measures, would help to minimize these impacts.

Increases in noise would not be permanent. Rather, nuisance noise would occur intermittently during construction. In addition, construction activity occurring between the

hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. Therefore, with incorporation of the measures identified in Section 4.14.7, Mitigation Measures, increased noise from construction is not anticipated to be significant.

Upper and Lower Snow Lakes Storage Enhancement

Construction activities associated with the Upper and Lower Snow Lakes Storage Enhancement Project would result in less than significant short-term increases in noise from transporting workers and equipment to the lakes and general construction activity, including operating an excavator and a generator to power hand tools. Transportation would involve periodic helicopter trips to and from the lakes during the construction period.

Noise levels associated with typical construction activities at 50 feet from the source are presented in Table 4-4. In addition, some blasting may be required to break up rock at the site. Prior to any blasting, USFWS would develop a blasting plan, as described in Section 4.14.7, Mitigation Measures, and in conjunction with USFS, which would establish notification procedures so the public is informed that blasting might occur.

Background noise levels at the project site are generally quiet and mainly include sounds associated with the natural environment. Although there are no permanently occupied residences, recreationalists are granted access to camp and hike within and around the project site based on a lottery system managed by the USFS. For additional information about recreational use, refer to Section 3.15, Recreation.

Depending on the location of recreationalists relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4 related to the majority of construction activity. Although most camping sites are located farther than 50 feet from the proposed construction activities, anticipated noise levels could be a nuisance to recreationalists in the general vicinity, particularly if any blasting were to occur. Implementation of the blasting plan described in Section 4.14.6, Mitigation Measures, would help to minimize these impacts.

Increases in noise would not be permanent. Rather, nuisance noise would occur intermittently during construction. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. Therefore, with incorporation of the measures identified in Section 4.14.7, Mitigation Measures, increased noise from construction is not anticipated to be significant.

4.14.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Operation of the proposed facilities for the Eightmile Lake Storage Enhancement Project would result in the ability to store and withdraw additional water at the lake. Because the facilities would be largely operated remotely by IPID and would rely in part on solar energy, the greatest potential for increased noise over the long term would occur as the result of maintenance trips to and from the lakes, which are anticipated to be less than would occur

under the No-action Alternative. For this reason, this project is not anticipated to result in significant noise impacts.

Upper Klonaqua Lake Storage Enhancement

Operation of the proposed facilities for the Upper Klonaqua Lake Storage Enhancement Project would result in the ability to store and withdraw additional water at the lake. Because the facilities would be largely operated remotely by IPID and would rely in part on solar energy, the greatest potential for increased noise over the long term would occur as the result of maintenance trips to and from the lakes. Because these facilities would be new, requiring less maintenance, and because travel to and from the site would largely be done on foot, the potential long-term impacts are anticipated to be minimal. For this reason, this project is not anticipated to result in significant noise impacts.

Upper and Lower Snow Lakes Storage Enhancement

Operation of the proposed facilities for the Upper and Lower Snow Lakes Storage Enhancement Project would result in the ability to store and withdraw additional water from Upper and Lower Snow Lakes. The facilities would be operated remotely by USFWS personnel at LNFH. Releases from the lakes would be automated, with electronic actuators that would rely on solar energy. The greatest potential for increased noise over the long term would occur as the result of maintenance trips to and from the lakes, which are anticipated to be less than would occur under the No-action Alternative. For this reason, this project is not anticipated to result in significant noise impacts.

4.14.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange project would be included.

4.14.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange Project

Construction of the IPID Full Piping and Pump Exchange Project would require the use of excavators, compactors, and other heavy equipment, such as dump trucks, which would result in short-term increases in noise. Construction is anticipated to be completed in phases over several years.

Construction activities would occur throughout the IPID service area for piping the entire conveyance system and at specific locations on Icicle and Peshastin Creeks and the Wenatchee River. Background noise levels would vary but are generally anticipated to be representative of levels associated with natural sounds near the creek edge and some urban development. Sensitive noise receptors that could be affected by these activities are likely to include agricultural workers, residents, and other workers or individuals, including recreationalists, present at the time of construction.

Depending on the location of noise-sensitive receptors relative to construction activity, they could be exposed to increased noise similar to the levels shown in Table 4-4. Anticipated noise levels could be a nuisance but would not represent a permanent increase. Rather, nuisance noise would occur intermittently during construction activities. In addition, construction activity occurring between the hours of 7:00 a.m. to 10:00 p.m. is exempt from local regulation. Therefore, increased noise from construction is not anticipated to be significant.

4.14.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange Project

Under the IPID Full Piping and Pump Exchange Project, the operation of three new IPID pump stations could result in increased noise emissions compared to existing conditions and the No-action Alternative. Increased noise would occur as the result of operating the pump stations during the irrigation season. The pumps would operate with variable frequency drives, which would reduce the mechanical noise from the pumps. The pumps would also be enclosed in an insulated structure, which would help to further reduce noise, resulting in levels anticipated to be similar to other urban utility pump stations in the Icicle Creek area.

In addition, as discussed further in Section 4.14.7, Mitigation Measures, the state imposes limits on the allowable environmental noise levels from a variety of sources as described in Chapter 173-60 WAC. As such, individual projects, including the pump station, would be required to incorporate additional controls consistent with those regulations. Therefore, this project is not anticipated to result in significant long-term noise impacts.

4.14.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.14.7.1 Short-term Impacts

Noise regulations are set forth in Chapter 173-60 WAC and rules applicable to blasting are set forth in Chapter 296-52 WAC. Construction activities are generally exempt but otherwise are required to comply with the standards set forth in this chapter of the WAC to ensure noise levels do not exceed acceptable thresholds.

Even though the majority of construction activities associated with the Program Alternatives are expected to be minimal and otherwise exempt from regulation, implementation of the following BMPs would ensure that noise levels were further reduced.

- Ensure all equipment is in good repair to minimize noise.
- Minimize unnecessary idling of emission-generating equipment.

In addition, compliance with applicable state and federal blasting regulations would ensure blasting was completed in a manner to reduce potential impacts. Implementation of the following measure would help to further reduce the potential noise impacts.

- Develop a blasting plan in coordination with USFS to ensure that recreationalists within affected areas are informed of the potential for blasting.

4.14.7.2 Long-term Impacts

New noise sources are also required to comply with the requirements set forth in Chapter 173-60 WAC. Compliance with required permit conditions would ensure that any long-term noise levels do not exceed acceptable thresholds.

- Insulated pump houses.
- Use of solar panels in the Wilderness Areas.
- Use of lower noise producing pumps (i.e. variable speed pumps).

4.15 Recreation

The recreational activities most likely to be affected by the projects in the Program Alternatives are those that are water-dependent. Alterations to lake levels in the four IPID-managed Alpine Lakes and the USFWS-managed Snow Lakes system, and to instream flows in Icicle Creek and the mainstem Wenatchee River, could affect fishing, rafting, kayaking, and other water-based recreation. Additionally, portions of existing trails and campsites surrounding Eightmile Lake, Upper Klonaqua Lake, and Upper and Lower Snow Lakes could be affected by inundation.

Short-term recreation impacts are those things that could temporarily alter the ability to use the recreational resource. For example, if construction activities block access to a trailhead, this would be considered a short-term impact until access is restored. Long-term recreation impacts are those things that could permanently alter the ability to use the recreational resource. For example, if water level of a lake is raised such that an existing campsite is permanently inundated, that would be considered a long-term impact.

4.15.1 No-action Alternative

4.15.1.1 Short-term Impacts

Under the No-action Alternative, various agencies and other entities would continue to undertake individual actions to restore and enhance fish and aquatic resources in the Icicle Creek Watershed project area, but those actions would not be part of a coordinated program implemented with the support of the IWG. Actions implemented by individual agencies and entities could include construction of diversion improvements, irrigation system upgrades, LNFH improvements, and fish passage work.

Short-term impacts to recreational opportunities would result from construction related activities, including maintenance at the alpine lakes, reconstruction of Eightmile Lake Dam, irrigation efficiency and domestic conservation work, upgrades at LNFH, and implementing improvements at points of diversions.

Construction-related activity in the Alpine Lakes area could result in short-term disruption to recreational users near the individual lakes outlets while work is ongoing.

Any in- or near-water projects would have associated construction-related activities could disrupt water based recreation. Staging of heavy equipment and supplies near access points to Icicle Creek could result in temporary disruption to water-dependent recreational activities such as recreational fishing, kayaking, and tubing. Many instream construction projects would occur at low flow, which would minimize impacts on some of these activities.

4.15.1.2 Long-term Impacts

Under the No-action Alternative, long-term impacts to recreation could result from implementation of certain projects.

If IPID restored Eightmile Lake Dam to its original height, existing trails, campsites, and lakeshore access routes would largely remain unchanged as a result of this project. Long-term operational impacts could change the timing and duration of water releases from the lake, with increased draw down levels. No significant long-term impacts to existing recreational opportunities in or around Eightmile Lake, such as hiking, horseback riding, and overnight camping, are expected.

Improvements at LNFH that would likely occur under the No-action Alternative could have minor long-term impacts on recreation. Installation of wells and an infiltration gallery on Hatchery Island could have impacts on current hiking and skiing trails. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential recreation impacts under NEPA would be completed once the full scope of the project is determined.

4.15.2 Alternative 1

The expected impacts of implementing Alternative 1 involve short-term construction-related impacts that are generally temporary, and long-term impacts resulting from the operation of proposed projects. Potential short-term impacts include temporary limited access to trails based on construction activities and impacts to water-based recreation resulting from in-stream work. The long-term impacts of implementing Alternative 1 are associated with stream flow increases, which are expected to improve water-based recreation in Icicle Creek.

4.15.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Construction-related activity to upgrade existing outlet infrastructure may result in short-term, temporary limited access at the construction sites at each lake. Construction activity at each outlet could result in short-term disruption to recreational users near the individual lakes outlets while work is ongoing. Recreational use in the vicinity of construction sites includes day use (e.g., hiking, horseback riding, and recreational fishing) and overnight camping.

IPID currently performs regular maintenance activities on the outlet structures at each of the four managed reservoir lakes and these activities have some related equipment and helicopter traffic. New delivery of construction-related supplies and equipment by helicopter would be consistent with existing operations. Helicopter trips would utilize existing landing areas and are not expected to result in obstruction of trails or camping sites. As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

IPID Irrigation Efficiencies

Under IPID Irrigation Efficiencies Project, IPID would update its Comprehensive Water Conservation Plan to control the volume, frequency, and rate of water for efficient irrigation. This plan update is currently underway. This is an administrative action that would have no short-term impacts to existing recreational opportunities.

Conservation projects with construction-related activities could include some canal to pipeline conversion, canal lining, and on-farm efficiencies. These actions would all occur in upland areas on private lands and easements. Any temporary disturbance within these areas would not affect existing recreational opportunities or access to public lands. As noted in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

COIC Irrigation Efficiencies and Pump Exchange

COIC is considering relocating their point of diversion from Icicle Creek to a location on the Wenatchee River. Construction-related activities would include installing a new diversionary structure near or on the Wenatchee River, installing conveyance piping, and decommissioning COIC-specific diversionary works on Icicle Creek. Most of this work would occur in upland areas on private lands and easements, and any temporary disturbance within these areas would not affect existing recreational opportunities. It is expected that any in- or near-water construction would occur within a small physical footprint required for pumps and conveyance infrastructure. Construction would likely

occur during the late summer and fall when water levels are low and less recreational use is occurring. A cofferdam would also be installed during construction of intake facilities to separate the river and the work area.

Water-dependent activities that may be temporarily affected by construction activities along the shoreline of the Wenatchee River or Icicle Creek, which could include recreational fishing, kayaking, rafting, and tubing. Based upon the small footprint of these projects and the temporary nature of the disturbance, meaningful impacts to existing water-dependent recreational activities are unlikely.

As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

Domestic Conservation Efficiencies

Under the Domestic Conservation Efficiencies Project, the City of Leavenworth and rural areas of the Icicle Creek Watershed would upgrade conveyance infrastructure and promote water-use conservation practices among municipal and domestic users. This work would be limited primarily to administrative and maintenance actions and could include limited installation or replacement of pipes and meters. This work would all occur within existing easements and rights-of-way and would not result in short-term impacts to existing recreational opportunities.

As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

Eightmile Lake Storage Restoration

Under the Eightmile Lake Storage Restoration Project, construction-related activity to replace Eightmile Lake Dam would result in short-term, temporary limited access at the construction sites at the lake. Construction activity at the lake outlet could result in short-term disruption to recreational users near the lake outlet while work is ongoing. The lake will likely be drawn down for construction and a temporary cofferdam may be used to separate the lake from the work area. Recreational use in the vicinity of construction sites includes day use (e.g., hiking and horseback riding) and overnight camping.

IPID currently performs regular maintenance activities at Eightmile Lake and these activities have some related equipment and helicopter traffic. Delivery of construction-related supplies and equipment by helicopter would be consistent with existing operations. Helicopter trips would utilize an existing landing area and are not expected to result in obstruction of trails or camping sites. As noted in Sections 4.11, Aesthetics, and

4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

Tribal Fishery Preservation and Enhancement

Under the Tribal Fishery Preservation and Enhancement Project, the IWG would evaluate actions to preserve and enhance tribal treaty harvest rights and recreational fishing on Icicle Creek. Some construction activities near the plunge pool may occur, such as installation of a sprayer. However, construction activities are likely to occur outside the prime fishing window. Specific impacts to recreational use will be identified in environmental review and permitting once project details are known but are expected to be related to on-water recreation, such as tubing.

While no specific improvements are suggested for the recreational fishery, protecting the recreational fishery is one of the IWG's Guiding Principles. Mitigation measures, including construction when the recreational fishery is closed, would be employed to minimize any potential impact to the recreational fishery.

Habitat Protection and Enhancement

Under the Habitat Protection and Enhancement Project, the IWG is working with Chelan County and the USFWS to implement recommended habitat improvement actions and land acquisition projects throughout Icicle Creek. All habitat enhancement projects are located along lower Icicle Creek, between RM 0.0 and 4.3.

Construction-related activities associated with habitat protection and enhancement could result in temporary restrictions to public access and passage through lower Icicle Creek as a result of staging of heavy equipment and supplies or active in-water work. Depending upon the timing and duration of the individual projects, construction could result in short-term effects to tubing or stand-up paddle boarding (SUP); construction would be timed not to conflict with recreational fishing.

As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

Instream Flow Rule Amendment

Amending the Wenatchee Instream Flow Rule is an administrative action that would have no short-term impacts to existing recreational opportunities.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

The IWG has identified several high-priority water-quality and conservation improvement projects for LNFH that would be implemented over the next 10 years. Many of these projects are limited in scope to upgrading existing fish-rearing systems within the hatchery itself (e.g., water-quality treatment, circular tanks) and would have no effect on existing recreational opportunities. Actions with associated construction-related activities may include installation of new wells and conveyance piping. This work would occur in upland areas within and adjacent to the existing LNFH complex and may result in short-term disruption to recreational opportunities in the immediate vicinity of LNFH, such as wildlife viewing, walking trails, tubing, recreational fishing, and SUP activities. Impacts on Nordic skiing, which is a popular winter activity in the area, are not expected because of the timing of construction. Construction would also be timed not to conflict with recreational fishing. Other specific recreational impacts will be identified during the NEPA process when project details are known.

Fish Passage Improvements

Fish passage improvements are proposed at LNFH and in upper Icicle Creek to include improving or replacing Structure 2 and improving passage through the Boulder Field. These projects would include in- and near-water construction.

Improvements to Structure 2 would occur completely within the LNFH complex and are not expected to conflict with existing recreational opportunities, although staging of heavy equipment and supplies could temporarily block access for wildlife viewing and walking trails. Passage improvement activities in the Boulder Field could result in short-term impacts with fishing, although mitigation measures such as construction timing will be utilized to minimize any potential impacts on recreational fishing; this area is generally not utilized by kayakers and is above/upstream of the area suitable for tubing and SUP activities.

As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

Fish Screen Compliance

Upgrading fish screens to meet current requirements is planned for three existing diversions on Icicle Creek. These actions are expected to occur within the existing physical footprint of the structure. Construction-related activity is not expected to alter or impact adjacent areas utilized for water-dependent recreational activities such as fishing, and to a lesser extent, kayaking.

As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes

would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

Water Markets

Creation of a voluntary Icicle Water Market is an administrative action that would have no short-term impacts to existing recreational opportunities.

4.15.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Upgrades to existing infrastructure at Colchuck, Eightmile, Square, and Klonaqua Lakes would not alter lake levels. Existing trails, campsites, and lakeshore access routes would remain unchanged as a result of this project. Long-term operational impacts could change the timing and duration of water releases from each lake but would not change the range of water levels that currently occurs. Hiking, horseback riding, overnight camping, and other recreational uses would still be possible under modified release scenarios. Therefore, no significant long-term impacts to existing recreational opportunities in and around the Alpine Lakes are expected.

Improved water management of the Alpine Lakes reservoir lakes is expected to increase stream flow in Icicle Creek, especially during the late season. In comparison to existing conditions, this is expected to result in benefits to kayaking, tubing and SUP activities, and fishing in Icicle Creek by increasing the length of time during which flows for those respective activities are suitable.

IPID Irrigation Efficiencies

Improved water management through on-farm practices and conveyance infrastructure is expected to increase stream flow in Icicle Creek and the Wenatchee River. In comparison to existing conditions, this is expected to result in benefits to kayaking, rafting, tubing and SUP activities, and fishing in both water bodies by increasing the length of time during which flows for those respective activities are suitable.

COIC Irrigation Efficiencies and Pump Exchange

Under the COIC Irrigation Efficiencies and Pump Exchange project, relocating the COIC point of diversion would increase streamflow in Icicle Creek. In comparison to existing conditions, this is expected to result in benefits to late-season water-dependent activities such as tubing and SUP by increasing the length of time during which flows for those respective activities are suitable. This project may also benefit the recreational fishery.

Domestic Conservation Efficiencies

Improved water management through domestic and municipal upgrades and practices is expected to have no impact on recreation in Icicle Creek and the Wenatchee River, with water saving going towards expanded domestic use. No long-term impacts are anticipated.

Eightmile Lake Storage Restoration

Under the Eightmile Lake Storage Restoration Project, upgrades to existing infrastructure at Eightmile Lake would restore lake levels to authorized, historical levels. Existing trails, campsites, and lakeshore access routes would largely remain unchanged as a result of this project. Long-term operational impacts could change the timing and duration of water releases from the lake, with increased draw down levels. No significant long-term impacts to existing recreational opportunities in or around Eightmile Lake, such as hiking, horseback riding, and overnight camping, are expected. To the extent possible, new infrastructure improvements would be designed to fit into the surrounding landscape and minimize impacts to recreational users' visual experience.

Improved water management of the Eightmile Lake reservoir is expected to increase stream flow in Icicle Creek, especially during the late season. In comparison to existing conditions, this is expected to result in benefits to kayaking, tubing and SUP activities, and fishing in Icicle Creek by increasing the length of time during which flows for those respective activities are suitable.

Tribal Fishery Preservation and Enhancement

Promoting tribal fishery preservation and enhancement is expected to improve long-term fishing opportunities in Icicle Creek. Long-term operation of this project is not expected to limit access for recreational opportunities. No significant impacts are expected to result from this project.

While no specific improvements are suggested for the recreational fishery, protecting the recreational fishery is one of the IWG's Guiding Principles. No significant impacts are expected to result from this project.

Habitat Protection and Enhancement

Improvements to instream and floodplain habitat is expected to improve the overall ecological value of Icicle Creek. In comparison to existing conditions, this is expected to result in benefits to the quality of recreational fishing and wildlife viewing activities, and to the aesthetic experience for those participating in tubing and SUP activities.

Instream Flow Rule Amendment

Amending the Instream Flow Rule to increase the Icicle Creek reserve would have small impacts on stream flow (approximately 0.4 cfs). However, it is not anticipated that this process would significantly impact water recreation in Icicle Creek. Additionally, stream flow impacts would be offset by instream flow benefits from other projects.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

Improved water quality and conservation at LNFH is expected to improve the instream habitat and ecological value of Icicle Creek. In comparison to existing conditions, this is expected to result in benefits to fishing in both Icicle Creek and the Wenatchee River, and would improve wildlife viewing and the aesthetic experience for those participating in

tubing and SUP activities. However, the installation of wells and an infiltration gallery could have impacts on current hiking and skiing trails located on hatchery island. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential recreation impacts under NEPA would be completed once the full scope of the project is determined.

Fish Passage Improvements

Improved fish passage in lower and upper Icicle Creek would promote long-term health and recovery of multiple fisheries. In comparison to existing conditions, this is expected to result in long-term benefits to fishing in both Icicle Creek and the Wenatchee River through improved quality and duration of sport/recreational fishing opportunities and reduced limitations/regulations.

Fish Screen Compliance

Improved fish screens would improve the ecological health of juvenile fish in Icicle Creek. In comparison to existing conditions, this is expected to result in long-term benefits to fishing in both Icicle Creek and the Wenatchee River through improved quality and duration of sport fishing opportunities and reduced limitations/regulations.

Water Markets

Improved water management through use of water markets is expected to increase stream flow in Icicle Creek and the Wenatchee River. In comparison to existing conditions, this is expected to result in benefits to kayaking, rafting, tubing and SUP activities, and fishing in both water bodies by increasing the length of time during which flows for those respective activities are suitable.

4.15.3 Alternative 2

The expected impacts of implementing Alternative 2 are similar to those identified for Alternative 1 because of the commonality of project, with the exception of the IPID Dryden Pump Exchange and the removal of the Alpine Lakes Optimization, Modernization, and Automation project. Potential short-term impacts include impacts to land use related to access during construction. There are no anticipated long-term impacts associated with the IPID Dryden Pump Exchange Project.

4.15.3.1 Short-term Impacts

IPID Dryden Pump Exchange

IPID is considering locating a pump station on the right bank of the Wenatchee River near Dryden as an alternative to the existing IPID diversion on Peshastin Creek. Relocating their point of diversion would involve construction of a new pump station and installation of new pipeline and associated conveyance infrastructure. Most of this work would occur in upland areas on private lands and easements, and any temporary disturbance within these areas would not affect existing recreational opportunities. It is

expected that any in- or near-water construction would occur within a small physical footprint required for pumps and conveyance infrastructure.

Water-dependent activities that could be temporarily affected by construction activities along the shoreline of the Wenatchee River could include fishing, kayaking, and rafting. Based upon the small footprint of the project and the temporary nature of the disturbance, meaningful impacts to existing water-dependent recreational activities are unlikely.

As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

4.15.3.2 Long-term Impacts

IPID Dryden Pump Exchange

Relocating the IPID point of diversion to the Wenatchee River would increase streamflow in Icicle Creek and the Wenatchee River. In comparison to existing conditions, this is expected to result in benefits to late-season water-dependent activities such as tubing and SUP by increasing the length of time during which flows for those respective activities are suitable. There would also be instream flow benefit in Peshastin Creek resulting from this project.

4.15.4 Alternative 3

This alternative includes the same project actions as Alternative 2, with the exception that the Eightmile Lake Restoration project actions are removed and the OCPI Legislative Change project action is added. The discussion of short- and long-term impacts focuses on impacts associated with changes from Alternatives 1 and 2.

4.15.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

Amending the OCPI determination is an administrative action that would have no short-term impacts to existing recreational opportunities.

4.15.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

Legislative change to OCPI to allow the Instream Flow Rule to be impaired by domestic use when instream flow targets adopted in Chapter 173-545 WAC are not met would lead to decreased stream flow during low flow periods. This has the potential to impact water-based recreation, such as kayaking, rafting, tubing and SUP activities, and fishing in Icicle Creek. However, impacts are expected to be very minor when considering the flow and habitat improvements proposed under Alternative 3.

4.15.5 Alternative 4

This alternative includes all the project actions of Alternative 1 but calls for increasing storage at Eightmile Lake to above the historic high water mark and enhancing storage and release at Upper Klonaqua and Upper Snow Lakes. The discussion of short- and long-term impacts focuses on impacts associated with these changes similar to those listed in Alternative 1.

4.15.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

Under the Eightmile Lake Storage Enhancement Project, storage capacity in Eightmile Lake would be increased by increasing both the height of the existing dam and draw down level. This would be accomplished by rebuilding the existing dam to a higher overflow elevation and installing a low-level siphon.

Construction-related activity to upgrade and replace existing outlet infrastructure at Eightmile Lake could result in short-term, temporary limited access at the construction sites at the lake. Construction activity at the lake outlet could result in short-term disruption to recreational users near the lake outlet while work is ongoing. The lake will likely be drawn down for construction and a temporary cofferdam may be used to separate the lake from the work area. Recreational use in the vicinity of construction sites includes day use (e.g., hiking, fishing, and horseback riding) and overnight camping.

IPID currently performs regular maintenance activities at Eightmile Lake and these activities have some related equipment and helicopter traffic. Delivery of construction-related supplies and equipment by helicopter would be consistent with existing operations. Helicopter trips would utilize an existing landing area and are not expected to result in obstruction of trails or camping sites. As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

Upper Klonaqua Lake Storage Enhancement

Upper Klonaqua Lake is currently used by IPID to augment water supply. The Upper Klonaqua Lake Storage Enhancement Project would increase the ability to draw down Upper Klonaqua Lake by installing new conveyance infrastructure to siphon, pump, or drain water into Lower Klonaqua Lake.

Construction-related activity to release more water from Upper Klonaqua Lake could result in short-term, temporary limited access to the construction site on the lake. Construction activities at the lake outlet could result in short-term disruption to recreational users near the lake outlet while work is ongoing. Upper Klonaqua Lake is not believed to be a popular

recreational use location. However, types of uses that may occur at Upper Klonaqua Lake are hiking and overnight camping.

As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

Upper and Lower Snow Lakes Storage Enhancement

Under this project, existing infrastructure at Upper and Lower Snow Lakes would be improved to provide additional storage capacity. This would be accomplished by rebuilding the two existing Snow Lakes dams and installing new, lower-level outlets and gates at each structure.

Construction-related activity to upgrade and replace existing outlet infrastructure at Upper and Lower Snow Lakes could result in short-term, temporary limited access at the construction sites at the lakes. Construction activity at the lake outlet could result in short-term disruption to recreational users near the lake outlet while work is ongoing. Recreational use in the vicinity of construction sites includes hiking and overnight camping.

USFWS currently performs regular maintenance activities at Upper and Lower Snow Lake and these activities have some related equipment and helicopter traffic. New delivery of construction-related supplies and equipment by helicopter would be consistent with existing operations. Helicopter trips would utilize an existing landing area and are not expected to result in obstruction of trails or camping sites. As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

4.15.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Upgrades to existing infrastructure at Eightmile Lake would increase lake levels above historical levels. Existing trails, campsites, and lakeshore access routes could experience some limited seasonal inundation as a result of this project. In comparison to existing conditions, long-term operational impacts could change the timing and duration of water releases from the lake and would result in an increased range of water levels. Therefore, some long-term impacts to existing recreational opportunities in and around Eightmile Lake are expected. To the extent possible, new infrastructure improvements would be designed to fit into the surrounding landscape and minimize impacts to recreational users' visual experience.

Improved water management of the Eightmile Lake reservoir is expected to increase stream flow in Icicle Creek, especially during the late season. In comparison to existing conditions, this is expected to result in benefits to kayaking, tubing and SUP activities, and fishing in Icicle Creek by increasing the length of time during which flows for those respective activities are suitable.

Upper Klonaqua Lake Storage Enhancement

Upgrades to existing infrastructure at Upper Klonaqua Lake would draw lake levels down below historical levels. Additionally, changes to storage capacity could result in some limited seasonal inundation of existing trails, campsites, and lakeshore access routes when storage is at maximum capacity. In comparison to existing conditions, long-term operational impacts could change the timing and duration of water releases from the lake and would result in an increased range of water levels. Therefore, some long-term impacts to existing recreational opportunities in and around Upper Klonaqua Lake are expected.

Improved water management of Upper Klonaqua Lake is expected to increase stream flow in Icicle Creek, especially during the late season. In comparison to existing conditions, this is expected to result in benefits to kayaking, tubing and SUP activities, and fishing in Icicle Creek by increasing the length of time during which flows for those respective activities are suitable.

Upper and Lower Snow Lakes Storage Enhancement

Upgrades to existing infrastructure at Upper and Lower Snows Lakes would draw lake levels down below historical levels. Additionally, changes to storage capacity could result in some limited seasonal inundation of existing trails, campsites, and lakeshore access routes when storage is at maximum capacity. In comparison to existing conditions, long-term operational impacts could change the timing and duration of water releases from the lake and would result in an increased range of water levels. Therefore, some long-term impacts to existing recreational opportunities in and around Upper and Lower Snow Lakes are expected.

Improved water management of Upper and Lower Snows lakes is expected to increase stream flow in Icicle Creek, especially during the late season. In comparison to existing conditions, this is expected to result in benefits to kayaking, tubing and SUP activities, and fishing in Icicle Creek by increasing the length of time during which flows for those respective activities are suitable.

4.15.6 Alternative 5

The expected impacts of implementing Alternative 5 are similar to those identified for Alternative 1 because of the commonality of project, with the exception that IPID Full Piping and Pump Exchange would replace the IPID Irrigation Efficiencies project. Potential short-term impacts include impacts to land use related to access during construction. There are no anticipated long-term impacts associated with the IPID Full Piping and Pump Exchange project.

4.15.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

This project would involve replacing the IPID diversion on Icicle and Peshastin Creeks with three pump stations located on the Wenatchee River near Leavenworth, Dryden, and Cashmere. Relocating their point of diversion would involve construction of a new pump station and installation of new pipeline and associated conveyance infrastructure. Most of this work would occur in upland areas on private lands and easements, and any temporary disturbance within these areas would not affect existing recreational opportunities. It is expected that any in- or near-water construction would occur within a small physical footprint required for pumps and conveyance infrastructure.

Water-dependent activities that could be temporarily affected by construction activities along the shoreline of the Wenatchee River could include fishing, kayaking, and rafting. Based upon the small footprint of the project and the temporary nature of the disturbance, meaningful impacts to existing water-dependent recreational activities are unlikely.

As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

4.15.7 Mitigation Measures

4.15.7.1 Short-term Impacts

Construction-related mitigation measures to minimize and protect against impacts to recreation would include timing work windows to avoid certain recreational activities and communicating with user groups months ahead of construction, so trips can be scheduled outside of construction windows, which would be particularly important to backcountry uses in the ALWA. Phased project construction at back country sites would also help minimize impacts. For example, installing automated gates and solar panels at different lakes during different years would allow for users to plan trips around construction activities.

For in-water work, approved work windows are expected to occur during the late season (summer/fall) when flows are low. This time frame generally coincides with the period when water-dependent activities include tubing and SUP activities; kayaking and rafting generally occur during early season, high-flow periods. Some overlap between work windows and fishing seasons in the Wenatchee River could occur but are expected to be limited in physical footprint to localized areas of the river shoreline.

4.15.7.2 Long-term Impacts

Operational mitigation measures to minimize and protect against impacts to recreation would include relocating those portions of trails and campsites that would be inundated by increased lake levels. In regard to recreation, the majority of projects are expected to have

positive long-term impacts on water-dependent recreation opportunities in Icicle Creek and the Wenatchee River.

4.16 Land Use

This section describes the potential short- and long-term impacts affecting land use, described in Section 3.16 Land Use, from the No-action Alternative and Program Alternatives. Consistency with the Wilderness Act and related land uses is addressed in Section 4.17, Wilderness Area.

4.16.1 No-action Alternative

4.16.1.1 Short-term Impacts

Under the No-action Alternative, various agencies and other entities would continue to undertake individual actions to restore and enhance fish and aquatic resources in the Icicle Creek Watershed project area, but those actions would not be part of a coordinated program implemented with the support of the IWG. Actions implemented by individual agencies and entities could include construction of diversion improvements, irrigation system upgrades, LNFH improvements, and fish passage work.

Under the No-action Alternative, short-term land use impacts could occur during project construction. For work near water, such as improving points of diversions and habitat and fish passage work, construction-related activities could temporarily impact public access at construction locations because staging of heavy equipment and supplies, or active in-water work.

All construction-related activities would adhere to applicable federal, state, and local land use regulations and permitting, as well as BMPs to minimize any impacts. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of projects, including compliance with CAO and SMP.

4.16.1.2 Long-term Impacts

The long-term impacts under the No-action Alternative would likely result from operation of several of the projects.

For projects that require the use of riparian lands, such as the COIC Irrigation Efficiencies and Pump Exchange Project and potential habitat projects, easements could be required. If these projects require the acquisition of land or easements, appropriate compensation would be required in accordance with applicable federal or state regulations.

Water made available through the Domestic Conservation Efficiencies Project would benefit improved domestic supply. This could lead to further population growth and urbanization of lands within the urban growth boundary. It could also lead to increased water availability for rural domestic growth if reserve accounting finds more water available in the reserve based on rural domestic conservation. However, long-term domestic supply projections through 2050 might not be met. Litigation over water supply between the City of Leavenworth and Ecology would likely resume. It is unclear if this would result in City of Leavenworth meeting projected water demand. Residential development that would occur if 400 acre-feet of water were conserved (Icicle Strategy goal) would have an estimated development impact of 56.1 acres based on assumptions described in section 1.5.1.4, and a development impact of 4,000 square feet (sq. ft.) per ERU (City of Leavenworth, 2013). Development under the No-action Alternative is expected to be less than this impact, but difficult to quantify.

Any land use conversion that may result from increased domestic supply would comply with all federal, state, and local land use regulations and zoning restrictions.

4.16.2 Alternative 1

Short-term land use impacts would primarily be related to temporary access restrictions. The overall expected long-term land use impacts associated with Alternative 1 include increased residential development as a result of increased water available for domestic growth. Additionally, there would be an increase in public land ownership in the uplands of the Icicle Creek Subbasin as a result of protection efforts associated with the Habitat Enhancement projects. All Program Alternatives would be required to comply with land use regulations, local zoning, and permitting. Consistency with applicable land use planning would occur at project level review or permitting.

4.16.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Construction-related activity to upgrade or replace existing outlet infrastructure could result in short-term, temporary obstruction of recreational access as described in Section 4.15, Recreation. Construction activities would need to comply with Chelan Counties Critical Area Ordinance (CAO) and Shoreline Master Plan (SMP). Consultation with Chelan County Community Development Department would be required to determine if this project would fall under the maintenance exemption provided in County Code 14.10(B)(2).

IPID Irrigation Efficiencies

Conservation projects with construction-related activities could include some canal to pipeline conversion, canal lining, and on-farm efficiencies. These actions are not expected to impact short-term land use. The construction zones would not likely be within the critical area or covered under the SMP. However, consultation with Chelan

County Community Development Department would confirm land use regulations pertaining to construction of this project.

COIC Irrigation Efficiencies and Pump Exchange

Under the COIC Irrigation Efficiencies and Pump Exchange Project, construction-related activities would include installing a new diversionary structure on the Wenatchee River or Icicle Creek and installing conveyance piping within the current canal's right-of-way. Installing a new pump station could temporarily impact public access of the Wenatchee River or Icicle Creek, depending on site location and equipment staging needs.

All construction-related activities would adhere to applicable federal, state, and local land use regulations and permitting, as well as BMPs to minimize any impacts. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP.

There are no anticipated construction-related impacts to land use associated with installing new conveyance piping within the current canal's right-of-way.

Domestic Conservation Efficiencies

The City of Leavenworth and Chelan County are proposing implementing a municipal and rural water efficiency project that includes project elements such as pipe replacements, meter installation, and water use conservation to improve the domestic supply. Construction-related activities are not expected to have any substantial impact on land use.

Eightmile Lake Storage Restoration

Construction-related activity related to upgrading infrastructure at Eightmile Lake may result in short-term, temporary obstruction of recreational access to the lake for equipment transportation, storage, and staging. To minimize access impacts, construction activities could occur in the fall after peak use. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP.

Tribal Fishery Preservation and Enhancement

Proposed activities under the Tribal Fishery Preservation and Enhancement Project would ensure that no negative effects occur to the tribal, as well as non-tribal, fishery on Icicle Creek. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP.

Habitat Protection and Enhancement

The IWG is working with Chelan County and the USFWS to implement recommended habitat improvement actions and land acquisition projects throughout Icicle Creek. All habitat enhancement projects are located along lower Icicle Creek, between RM 0.0 and 4.3.

Construction-related activities associated with habitat protection and enhancement could result in temporary restrictions to public access and passage through lower Icicle Creek because of staging of heavy equipment and supplies, or active in-water work. All construction-related activities would adhere to applicable federal, state, and local land use regulations and permitting as well as BMPs to minimize any impacts. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP.

Instream Flow Rule Amendment

This is an administrative action and no construction-related impacts to land use are expected.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

While much of the construction related to this project is anticipated to occur in the uplands, some of the construction projects could include work in and near streams, and in the floodplain on hatchery-owned lands. All construction-related activities would adhere to applicable federal, state, and local land use regulations and permitting as well as BMPs to minimize any impacts. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP.

Fish Passage Improvements

Construction-related activities associated with fish passage could result in temporary restrictions to public access and passage through lower Icicle Creek because of staging of heavy equipment and supplies or active in-water work. All construction-related activities would adhere to applicable federal, state, and local land use regulations and permitting as well as BMPs to minimize any impacts. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP. More detail on the impacts to shorelines is discussed in Section 4.18, Shorelines.

Fish Screen Compliance

Construction-related activities associated with upgrading fish screens could result in temporary restrictions to public access and passage through lower Icicle Creek because of staging of heavy equipment and supplies or active in-water work. All construction-related activities would adhere to applicable federal, state, and local land use regulations and permitting as well as BMPs to minimize any impacts. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP.

Water Markets

There are not construction components to this proposal, therefore no short-term land use impacts are anticipated.

4.16.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

There are no anticipated long-term changes to land use associated with the Alpine Lakes Optimization, Modernization, and Automation Project. As discussed in Section 3.17, Wilderness Area, IPID has easements to operate and maintain their dams on these lakes, and use would remain consistent with current operation. The only difference would be how often the lakes are drawn down. All water made available through this project would benefit instream flow.

IPID Irrigation Efficiencies

There are no anticipated long-term impacts to land use associated with the IPID Irrigation Efficiencies Project. All water made available through this project would benefit instream flow.

COIC Irrigation Efficiencies and Pump Exchange

There are no anticipated long-term impacts to land use associated with the COIC Irrigation Efficiencies and Pump Exchange Project. All water made available through this project would benefit instream flow.

Easements could be required for the pump station site. If this project requires the acquisition of land or easements, appropriate compensation would be required in accordance with applicable federal or state regulations.

Domestic Conservation Efficiencies

Water made available through the Domestic Conservation Efficiencies Project would benefit improved domestic supply. This could lead to further population growth and urbanization of lands within the urban growth boundary. It could also lead to increased water availability for rural domestic growth if reserve accounting finds more water available in the reserve based on rural domestic conservation.

Under this element, 400 acre-feet of water would be conserved and made available for new domestic uses. Making this quantity of water available for new residential development that would have an estimated development impact of 56.1 acres based on assumptions described in section 1.5.1.4, and a development impact of 4,000 sq. ft. per ERU (City of Leavenworth, 2013). Some development impacts are likely irrespective of the development of this Icicle Strategy. To what extent is unclear at this point and would likely depend on the outcome of litigation between City of Leavenworth and Ecology.

Any land use conversion that may result from increased domestic supply would comply with all federal, state, and local land use regulations and zoning restrictions.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project would make 900 acre-feet of domestic water available for projected future growth. This could lead to further population growth

and urbanization of lands within the urban growth boundary. It could also lead to increased rural domestic growth.

Resident development that would occur if 900 acre-feet of water were made available would have an estimated development impact of 208.8 acres based on assumptions described in section 1.5.1.4, and a development impact of 4,000 sq. ft. per ERU for urban development at 4,600 sq. ft. per ERU for rural development (City of Leavenworth, 2013; Chelan County, 2014b). Some development impacts are likely irrespective of the development of this Icicle Strategy. To what extent is unclear at this point and would likely depend on the outcome of litigation between City of Leavenworth and Ecology.

Any land use conversion that may result from increased domestic supply would comply with all federal, state, and local land use regulations, and zoning restrictions.

Tribal Fishery Preservation and Enhancement

There would be no long-term land use impacts associated with tribal fishery protections and enhancements.

Habitat Protection and Enhancement

As part of the Habitat Protection and Enhancement Project, the IWG would seek to acquire conservation lands in the uplands of the watershed. This would increase the amount of public land in the Icicle Creek Subbasin. A likely source of land acquisition would be private timber land. This would reduce the acres of working forest lands in the watershed. Use would likely pivot to recreation and habitat conservation.

Some instream and riparian habitat projects could have impacts on the function and extent of the floodplain, which could have long-term land use impacts.

All land use changes would comply with federal, state, and local land use regulations and zoning restrictions. Easements and/or property purchases could be required for conservation lands. If this project requires the acquisition of land or easements, appropriate compensation would be required in accordance with applicable federal or state regulations.

Instream Flow Rule Amendment

The Instream Flow Rule Amendment Project would make an additional 0.4 cfs from the Wenatchee Reserve available for projected future growth in the Icicle Creek Subbasin. This could lead to increased rural domestic growth. Any land use conversion that may result from increased domestic supply would comply with all federal, state, and local land use regulations and zoning restrictions.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

There are no long-term effects from the LNFH Conservation and Water Quality Improvements Project on land use. Water made available through this project would benefit instream flows.

Fish Passage Improvements

The Fish Passage Project would not have any long-term effect on land use in the Icicle project area.

Fish Screen Compliance

There would be no long-term land use impacts associated with the fish screen improvements.

Water Markets

Under the Water Markets Project, irrigation water rights would be retired in the Icicle Creek Subbasin to mitigate interruptible users when the Instream Flow Rule is not met. This would change land use within the watershed by moving some land use away from irrigated agriculture to other uses. The lands that would be mitigated through the Water Markets Project are already in agricultural use. Any land use conversion that may result from this project would comply with all federal, state, and local land use regulations and zoning restrictions.

4.16.3 Alternative 2

The expected impacts of implementing Alternative 2 involve short-term construction-related impacts that are temporary, and long-term impacts resulting from the operation of proposed projects. These impacts are similar to those identified in Alternative 1 because of the commonality of projects, with the exception of the inclusion of the IPID Dryden Pump Exchange Project and the removal of the Alpine Lakes Optimization, Modernization, and Automation Project. Potential short-term impacts include impacts to land use related to access during construction. There are no anticipated long-term impacts associated with the IPID Dryden Pump Exchange Project.

4.16.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction-related activities would include installing a new diversionary structure on the Wenatchee River. Installing a new pump station on the Wenatchee River could temporarily impact public access of the Wenatchee River, depending on site location and equipment staging needs. All construction-related activities would adhere to applicable federal, state, and local land use regulations and permitting as well as BMPs to minimize any impacts. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP.

4.16.3.2 Long-term Impacts

IPID Dryden Pump Exchange

There are no anticipated long-term impacts to land use associated with the IPID Dryden Pump Exchange Project. All water made available through this project would benefit instream flow.

Easements could be required for the pump station site. If this project requires the acquisition of land or easements, appropriate compensation would be required in accordance with applicable federal or state regulations.

4.16.4 Alternative 3

The expected impacts of implementing Alternative 3 are similar to those identified in Alternative 2 because of the commonality of projects, with the exception of the inclusion of the Legislative Change Creating OCPI Authority for Alternative 3 Project and the removal of the Eightmile Lake Storage Restoration Project. Potential short-term impacts include impacts to land use related to access during construction. Potential long-term impacts include domestic growth resulting from more water being available for domestic use.

4.16.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

This is an administrative action with no construction activities, therefore no short-term impacts to land use are anticipated.

4.16.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

The Legislative Change Creating OCPI Authority for Alternative 3 Project would allow for new domestic use in the Icicle Creek Subbasin at times when the Instream Flow Rule is not met. This is because instream flow improvement and mitigation projects would not perfectly align when the highest instream and out-of-stream demand occurs. This project could result in increases to population growth and urbanization of lands within the urban growth boundary. It could also lead to increased rural domestic growth. Any land use conversion that may result from increased domestic supply would comply with all federal, state, and local land use regulations and zoning restrictions.

4.16.5 Alternative 4

Alternative 4 includes all the projects proposed in Alternative 1 with the exception of the Eightmile Lake Storage Restoration Project, which is replaced with the Eightmile Lake Storage Enhancement Project, and the addition of the Klonaqua Lake and Upper and Lower Snow Lakes Storage Enhancement Projects. The anticipated short-term land use impacts are related to restricted access during construction. The anticipated long-term impacts are related to increased domestic growth resulting from water availability.

4.16.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project differs from the Eightmile Lake Storage Restoration Project in that it calls for increasing the useable storage by

approximately 1,000 acre-feet. This would be accomplished by rebuilding the dam and raising the crest and increasing available draw down. The short-term impacts would be to the result of construction of the dam and would primarily affect recreational land use, as detailed in Section 4.15, Recreation. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP.

Upper Klonaqua Storage Enhancement

The Upper Klonaqua Storage Enhancement Project takes advantage of the potential storage in Upper Klonaqua Lake by installing infrastructure to facilitate draw down. It is in the conceptual stages, but short-term impacts would primarily be to recreational land use as a result of construction. For details on recreational land use refer to Section 4.15, Recreation. These impacts are related to transporting, storing, and staging construction equipment. To minimize access impacts, construction activities could occur in the fall after peak use. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP.

Upper and Lower Snow Lakes Storage Enhancement

The Upper and Lower Snow Lakes Storage Enhancement Project would raise the dam on Upper Snow Lake to increase its storage capacity by 1,079 acre-feet. The short-term land use impacts would primarily affect recreational land use as a result of dam construction. These impacts are further detailed in Section 4.15.5.2, Short-term Impacts, Recreation. Consultation with Chelan County Community Development Department would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP.

4.16.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would raise the level of Eightmile Lake and increase the draw down, impacting its shoreline used primarily for recreation, as discussed in Sections 4.15.5.2, Long-term Impacts, Recreation, and 4.18.5.2, Long-term Impacts, Shorelines.

This project would make water available for instream uses and projected future municipal/domestic demand. This could lead to further population growth and urbanization of lands within the urban growth boundary. It could also lead to increased rural domestic growth. Any land use conversion that may result from increased domestic supply would comply with all federal, state, and local land use regulations and zoning restrictions.

Upper Klonaqua Lake Storage Enhancement

The Upper Klonaqua Lake Storage Enhancement Project would draw down Upper Klonaqua Lake, impacting its shoreline used primarily for recreation, as discussed in sections 4.15 and 4.18.

This project would make water available for instream uses and projected future municipal/domestic demand. This could lead to further population growth and urbanization of lands within the urban growth boundary. It could also lead to increased rural domestic growth. Any land use conversion that may result from increased domestic supply would comply with all federal, state, and local land use regulations and zoning restrictions.

Upper and Lower Snow Lakes Storage Enhancement

The Upper and Lower Snow Lakes Storage Enhancement Project would raise the level of Upper Snow Lake and increase draw down, impacting its shoreline used primarily for recreation, as discussed in Sections 4.15.5.2, Long-term Impacts, Recreation, and 4.18.5.2, Long-term Impacts, Shorelines.

This project would make water available for instream uses and projected future municipal/domestic demand. This could lead to further population growth and urbanization of lands within the urban growth boundary. It could also lead to increased rural domestic growth. Any land use conversion that may result from increased domestic supply would comply with all federal, state, and local land use regulations and zoning restrictions.

4.16.6 Alternative 5

The expected impacts of implementing Alternative 5 involve short-term construction-related impacts that are temporary, and long-term impacts resulting from the operation of proposed projects. These impacts are similar to those identified in Alternative 1 because of the commonality of projects, with the exception of the IPID Irrigation Efficiencies project would be replaced by the IPID Full Piping and Pump Exchange. Potential short-term impacts include impacts to land use related to access during construction. There are no anticipated long-term impacts associated with the IPID Dryden Pump Exchange Project.

4.16.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

Construction-related activities would include installing three new diversionary structures on the Wenatchee River. Installing new pump stations on the Wenatchee River could temporarily impact public access of the Wenatchee River, depending on site location and equipment staging needs. All construction-related activities would adhere to applicable federal, state, and local land use regulations and permitting as well as BMPs to minimize any impacts. Consultation with Chelan County Community Development Department

would confirm land use regulations pertaining to construction of this project, including compliance with CAO and SMP.

4.16.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

There are no anticipated long-term impacts to land use associated with the IPID Full Piping and Pump Exchange Project. All water made available through this project would benefit instream flow.

Easements could be required for the pump station site. If this project requires the acquisition of land or easements, appropriate compensation would be required in accordance with applicable federal or state regulations.

4.16.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.16.7.1 Short-term Impacts

The primary short-term impact to land use is related to access during construction. Property impacts would mainly be public, although some private lands could be impacted. To the extent possible, alternate access routes would be provided or projects would be timed to minimize access issues.

There would also be impacts related to in-water and near-water work. All work would comply with applicable permits and BMPs. This is discussed in more detail in Section 4.18, Shorelines.

4.16.7.2 Long-term Impacts

The primary long-term impact of the above described projects is increased water availability for domestic use. This could lead to land use changes related to increased domestic/residential use. Any land use conversion that may result from increased domestic supply would comply with all federal, state, and local land use regulations and zoning restrictions.

Some projects would require land acquisition or easements. Appropriate compensation would be required in accordance with applicable federal or state regulations.

4.17 Wilderness Area

This section describes the potential short- and long-term impacts that could affect the resources identified in Section 3.17, from construction and operation related to the No-action Alternative and Program Alternatives.

4.17.1 No-action Alternative

4.17.1.1 Short-term Impacts

Under the No-action Alternative, various agencies and other entities would continue to undertake individual actions to restore and enhance fish and aquatic resources in the Icicle Creek Watershed project area, but those actions would not be part of a coordinated program implemented with the support of the IWG. Actions implemented by individual agencies and entities could include construction of diversion improvements, irrigation system upgrades, LNFH improvements, and fish passage work.

IPID and USFWS would likely pursue some construction and maintenance activities at their dam sites in the ALWA. Especially those in need of reconstruction and repair. Potential short-term impacts affecting wilderness would be associated with projects that require construction. Construction can affect wilderness characteristics such as solitude in the short-term. As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

As discussed in Section 3.17, these construction activities are permissible in the ALWA per easements granted by the USFS to IPID.

4.17.1.2 Long-term Impacts

Long-term impacts under the No-action Alternative to the Wilderness Area are anticipated to be largely the same as current conditions. Under the No-action Alternative, seasonal maintenance and water release operations of the seven lakes located within the ALWA would continue. This includes use of helicopters to access dam sites, as studied in the USFS Environmental Assessment on IPID helicopter use (USFS, 1981), and allowed for in the land exchanges agreement. This requires multiple trips by IPID staff every year to both open impoundment release controls during the summer and close them in the fall, respectively. These activities impact the Wilderness Area's untrammeled state and the sense of solitude to wilderness users. However, it would not pose a significant change from current conditions.

4.17.2 Alternative 1

Implementation of Alternative 1 has the potential to result in different impacts on the Wilderness Area compared with the No-action Alternative. There is a higher likelihood that certain projects would be implemented and the scale of certain efforts would likely be greater. The following sections describe the short- and long-term impacts that would occur under Alternative 1.

4.17.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Construction activities associated with this project would involve replacing existing gates and installing solar panels, actuators, flow monitoring equipment, and other new equipment to improved management and release of stored water at the lakes in the Icicle Creek Subbasin.

The short-term impact to the Wilderness Area is primarily related to accessing the project sites, staging equipment, and providing for worker accommodations because these activities could temporarily disturb the wilderness characteristics of natural, solitude, undeveloped, and untrammeled experienced by users at these sites. Providing worker accommodations onsite (i.e., camping) would reduce the number of helicopter trips, minimizing impacts to wilderness experience of helicopters (USBR, 2018). As noted in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

To minimize impacts, construction work could occur after peak use, and construction could be phased so not all lakes are impacted at the same time. Additionally, a minimum tools analysis will occur for all work proposed within the ALWA.

Notices would be posted so wilderness users would be aware of potential impacts before planning a trip to the Wilderness Area.

As discussed in Section 3.17, these construction activities are permissible in the ALWA per easements granted by the USFS to IPID. The easement for Eightmile, Klonaqua, and Colchuck Lake provides the following:

> *"Excepting and reserving the right to overflow and inundate the bed and shore; water rights granted; perpetual easement across, through, along, and upon the property for maintenance, repair, operation, modification, upgrading, and replacement of all facilities presently located in and upon the property. IPID may exercise the rights by any means reasonable... including... motorized transport and equipment or aircraft. These rights include... regulating water level. Grantor will not without the prior written consent of the Forest Service, which consent*

shall not unreasonably be withheld, materially increase the size or scope of the facilities."

Colchuck also has an agricultural and Irrigation Livestock Watering System Easement because the lakes outlet and dam is located on land note subject to the IPID, USFS land exchange discussed in Section 3.17. Square Lake also operates under this type of permit. These permits authorize right-of-way and water conveyance systems and operation and maintenance of facilities with consultation and concurrence from USFS. Modernizing and automating releases from these lakes fall under the facility maintenance and would require USFS concurrence.

Upper and Lower Snow Lake are owned by USFWS. As ownership of the lakes, USFWS has the right to upgrade and maintain storage facilities on their property.

IPID Irrigation Efficiencies

The proposed IPID Irrigation Efficiencies improvements are downstream from the ALWA and do not present any short-term impacts to the Wilderness Area.

COIC Irrigation Efficiencies and Pump Exchange

The proposed COIC Irrigation Efficiencies and Pump Exchange improvements are downstream from the ALWA and do not present any short-term impacts to the Wilderness Area.

Domestic Conservation Efficiencies

The proposed Domestic Conservation Efficiencies improvements are downstream from the ALWA and do not present any short-term impacts to the Wilderness Area.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project would involve demolishing the existing dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures. Construction activities would occur along the lake shore. Short-term impacts to wilderness characteristics are expected as a result of construction. To minimize user impacts, construction work could occur after peak use and notices would be posted so wilderness users would be aware of potential impacts before planning a trip to the Wilderness Area. As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term wilderness impacts are not expected to be significant.

To minimize impacts, construction work could occur after peak use, and construction could be phased so not all lakes are impacted at the same time. Workers could camp to minimize helicopter trips. Additionally, a minimum tools analysis will occur for all work proposed within the ALWA. As discussed above, IPID reserved rights to maintenance, repair, operation, modification, upgrading, and replacement of all facilities at Eightmile

Lake. With prior written consent of the Forest Service, which consent shall not unreasonably be withheld, IPID can increase the size of Eightmile Lake.

Tribal Fishery Preservation and Enhancement

All proposed tribal fishery improvements are downstream from the Wilderness Area, and thus no short-term impacts are associated with these actions.

Habitat Protection and Enhancement

All proposed Habitat Protection and Enhancement Project construction activities are downstream from the Wilderness Area, and thus there are no potential impacts associated with these actions.

Instream Flow Rule Amendment

There are no proposed construction activities associated with this project and therefore no potential short-term impacts on the Wilderness character.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

There are no construction activities proposed under this project and therefore no potential short-term impacts on the Wilderness character.

Fish Passage Improvements

As all currently proposed Fish Passage Improvements are downstream from the Wilderness Area, there are no potential impacts associated with these actions.

Fish Screen Compliance

As all proposed Fish Screen Compliance improvements are downstream from the Wilderness Area, there are no potential impacts associated with these actions.

Water Markets

There are no construction activities proposed under the Water Markets Project and therefore no potential short-term impacts on the Wilderness character.

4.17.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from the lakes. This has several potential long-term impacts. Reservoir automation would significantly reduce seasonal reservoir maintenance and service visits, which are currently all done by hikes and helicopter visits to the lakes. Instead, stored water would be released via remote telemetry. Additionally, construction of the proposed facilities, such as antenna, solar panels, and equipment enclosures, could be designed to have an undeveloped, aesthetically appropriate look and feel so to appear unobtrusive on the natural wilderness character of the area.

As lake levels would be drawn down every year instead of rotating one or two lakes per year, stream and lake water levels would be changed in portions of the Wilderness Area.

As the resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system, downstream impacts are expected to beneficially increase flows in the Wilderness Areas in the summer months.

As it relates to wilderness character as described in the Wilderness Act, drawing down the lake levels from their current artificially impounded levels could have beneficial long-term impacts to the wilderness character by returning the lakes to their "natural," pre-1920s reservoir construction levels.

IPID Irrigation Efficiencies

The proposed IPID Irrigation Efficiencies improvements are downstream from the ALWA and do not present any long-term impacts to the wilderness character.

COIC Irrigation Efficiencies and Pump Exchange

The proposed COIC Irrigation Efficiencies and Pump Exchange improvements are downstream from the ALWA and do not present any long-term impacts to the wilderness character.

Eightmile Lake Storage Restoration

Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. However, a larger inundated area and bigger draw down would likely impact the wilderness experience of users. However, the inundation area was experienced for decades prior to the partial erosion on of the dam, including at the time of wilderness designation. Draw down could be managed to minimize these impacts during peak use.

Additionally, a larger dam would impact the wilderness characteristics that users experience (natural, undeveloped, untrammeled). As discussed in Section 4.11, Aesthetics, visual impacts of this project could be minimized by dam design that would incorporate architectural components to make the dam feel more natural and less modern.

Tribal Fishery Preservation and Enhancement

All proposed tribal fishery improvements are downstream from the Wilderness Area, thus there are no potential impacts associated with these actions.

Habitat Protection and Enhancement

The purpose of the Habitat Protection and Enhancement Project is to protect and enhance habitat within the Lower Icicle Creek corridor. There are also plans to obtain upland habitat for conservation purposes under this project. This would create additional public lands adjacent to the Wilderness Area, which would likely increase the feeling of a natural and undeveloped area to users.

Instream Flow Rule Amendment

There are no construction activities proposed under the Instream Flow Rule Amendment Project. Long term, this proposal would result in removal of water from Icicle Creek at

the City of Leavenworth's diversion. Because this diversion is downstream of the Wilderness Area, no potential long-term impacts are anticipated to the Wilderness Area.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

All proposed LNFH improvements are downstream from the Wilderness Area, thus there are no potential long-term impacts associated with these actions.

Fish Passage Improvements

All proposed Fish Passage Improvements are downstream from the Wilderness Area, thus there are no potential long-term impacts associated with these actions.

Fish Screen Compliance

All proposed Fish Screen Compliance improvements are downstream from the Wilderness Area, thus there are no potential long-term impacts associated with these actions.

Water Markets

All proposed Water Markets Project improvements are downstream from the Wilderness Area, thus there are no potential long-term impacts associated with these actions.

4.17.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would also be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project.

4.17.3.1 Short-term Impacts

IPID Dryden Pump Exchange

All proposed improvements are downstream from the Wilderness Area, thus there are no potential long-term impacts associated with these actions.

4.17.3.2 Long-term Impacts

IPID Dryden Pump Exchange

All proposed improvements are downstream from the Wilderness Area, thus there are no potential long-term impacts associated with these actions.

4.17.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange and the Legislative Change Creating OCPI Authority for Alternative 3 Projects would also be included while the Alpine Lakes Optimization, Modernization, and Automation and Eightmile Lake

Storage Restoration Projects would not. This section describes the specific short- and long-term impacts associated with the Legislative Change Creating OCPI Authority for Alternative 3 Project. The impacts of the IPID Dryden Pump Exchange Project are discussed in Section 4.17.3.

4.17.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

There are no construction activities proposed under this project and therefore no potential short-term impacts with the potential to affect the Wilderness Area.

4.17.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

This project relates to domestic water use in the Icicle Creek Subbasin and instream flows as measured at the Ecology gage on lower Icicle Creek, all of which are downstream of the Wilderness Area. There are no anticipated impacts to wilderness character from this project.

4.17.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1. The Eightmile Lake Storage Restoration project would be replaced with the Eightmile Lake Storage Enhancement Project, and the Upper Klonaqua and Upper and Lower Snow Lakes Storage Enhancement Projects would also be included. This section describes the specific short- and long-term impacts associated with these projects.

4.17.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

This project would involve demolishing the existing dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures that would allow for an increase in the accessible storage at Eightmile Lake by 1,000 acre-feet.

The short-term impacts to the Wilderness Area are primarily related to accessing the project sites, staging equipment, and providing for worker accommodations. These impacts would temporarily disturb the wilderness characteristics of solitude, natural, undeveloped, and untrammeled. As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

To minimize user impacts, construction work could occur after peak use, and notices would be posted so wilderness users would be aware of potential impacts before planning a trip to

the Wilderness Area. Workers could camp to minimize helicopter trips. Additionally, a minimum tools analysis will occur for all work proposed within the ALWA.

As discussed above, IPID reserved rights to maintenance, repair, operation, modification, upgrading, and replacement of all facilities at Eightmile Lake. With prior written consent of the Forest Service, which consent shall not unreasonably be withheld, IPID can increase the size of Eightmile Lake.

Upper Klonaqua Lake Storage Enhancement

Short-term impacts on the Wilderness Area from this project would primarily be associated with construction activities required to provide a low-level outlet from Upper Klonaqua Lake to Lower Klonaqua Lake using one of the three conceptual connection options discussed in Chapter 2. The construction activity would be similar in nature to that described for the Eightmile Lake Storage Enhancement Project in 4.17.5.1 above, as would the short-term impacts. As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term recreational impacts are not expected to be significant.

To minimize user impacts, construction work could occur after peak use, and notices would be posted so wilderness users would be aware of potential impacts before planning a trip to the Wilderness Area. Workers could camp to minimize helicopter trips. Additionally, a minimum tools analysis will occur for all work proposed within the ALWA.

As discussed in Section 3.17, IPID reserved several right at Upper and Lower Klonaqua Lakes, including the right to increase the size and scope of the facilities with USFS written consent and the right to regulate water levels.

Upper and Lower Snow Lakes Storage Enhancement

Short-term impacts on wilderness from this project would be primarily related to construction activities and are similar in type and mechanism to those discussed in Sections 4.17.5.1, Short-term Impacts, Eightmile Lake Storage Enhancement, and 4.17.5.1, Short-term Impacts, Upper Klonaqua Lake Storage Enhancement. As notes in Sections 4.11, Aesthetics, and 4.14, Noise, while construction activities would result in short-term visual changes and increased noise, the extent of these changes would be similar to operational and maintenance activities that currently occur, temporary, and relatively minimal. Therefore, short-term wilderness impacts are not expected to be significant.

To minimize user impacts, construction work could occur after peak use, and notices would be posted so wilderness users would be aware of potential impacts before planning a trip to the Wilderness Area. Workers could camp to minimize helicopter trips. Additionally, a minimum tools analysis will occur for all work proposed within the ALWA.

As discussed in Section 3.17, USFWS owns easement to the Upper and Lower Snow Lake beds, and land adjacent to these lakes. Because USFWS owns these lands, this project would have to undergo a NEPA review.

4.17.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

The greatest potential for impacts on the Wilderness Area over the long term would occur as a result of increased inundated areas and larger draw downs. These changes would impact the wilderness characteristics of natural, undeveloped, and untrammeled. Additionally, a larger dam could also impact these wilderness characteristics. Wilderness impacts and whether the action is permissible under the Wilderness Act and IPID easements would be addressed during project level environmental review.

As discussed in Section 4.11, Aesthetics, to minimize these impacts, dam design could incorporate architectural components to make the dam feel more natural and less modern. Additionally, draw down could be managed to minimize these impacts during peak use.

Upper Klonaqua Lake Storage Enhancement

Under the Upper Klonaqua Lake Storage Enhancement Project, the high water mark would remain unchanged and the lake would still refill and outlet naturally through an existing channel to Lower Klonaqua Lake during most of the year. However, the new facilities would allow for the lake to be drawn down an additional 10 to 50 feet to allow for access to additional storage. The draw down would likely occur over a couple of months in the late summer. Modifications at Upper Klonaqua Lake would also result in the ability to release up to an additional 5 to 20 cfs from the lake.

Similar to the Eightmile Lake Storage Enhancement Project, these changes would impact the wilderness characteristics of natural, undeveloped, and untrammeled. With this project in the conceptual stage, exact impacts and mitigation measures are unclear. Wilderness impacts and whether the action is permissible under the Wilderness Act and IPID easements would be addressed during project level environmental review should this project proceed.

Upper and Lower Snow Lakes Storage Enhancement

Similar to the Eightmile Lake Storage Enhancement Project, wilderness character would be impacted by a larger dam, greater area of inundation, and larger draw downs.

To minimize these impacts, dam design would incorporate architectural components to make the dam feel more natural and less modern and draw down could be managed to minimize these impacts during peak use. Wilderness impacts and whether the action is permissible under the Wilderness Act and IPID easements would be addressed during project level environmental review should this project proceed.

4.17.6 Alternative 5

Alternative 5 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Irrigation Efficiencies project would be replaced by the IPID Full Piping and Pump Exchange project. This section describes the specific short- and long-term impacts associated with the IPID Full Piping and Pump Exchange Project.

4.17.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

All proposed improvements are downstream from the Wilderness Area, thus there are no potential long-term impacts associated with these actions.

4.17.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

All proposed improvements are downstream from the Wilderness Area, thus there are no potential long-term impacts associated with these actions.

4.17.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential wilderness character impacts identified above. Additional mitigation measures are also identified as appropriate.

4.17.7.1 Short-term Impacts

Short-term impacts related to temporary construction on the Wilderness Area's feeling of solitude, naturalness, undeveloped, and untrammeled that users experience. To minimize the impacts of construction on these wilderness characters, notice would be provided, construction activities would occur outside of peak use when possible, and construction activities at lake sites would be staggered to allow for unimpacted wilderness experiences at some of the lakes during construction activities.

4.17.7.2 Long-term Impacts

Long-term impacts on the wilderness character could result from the increased frequency, and for some projects, increased level of draw down associated with proposals at the Alpine Lakes. To help minimize these impacts, releases could be managed to occur only when critical low flows are occurring in lower Icicle Creek. As a result, draw down might not occur in wet years when there is sufficient stream flow. Additionally, for storage restoration and enhancement projects some draw down could be managed outside of peak visitation windows.

Additional impacts to wilderness character could result from installation of equipment to allow for remote operation of control gates. This would include antenna, solar panels, and equipment enclosures. To minimize the impacts of this equipment, they would be made to blend into the natural environment to allow for the feeling of an untrammeled wilderness.

For storage enhancement projects discussed in Alternative 4, larger dams would also impact the wilderness experience. To minimize this impact, dam design would incorporate architectural components to make the dam feel more natural and less modern. Increased areas of inundation pose a potential significant impact, which would be examined in more detail during project level environmental review.

4.18 Shorelines

This section describes the potential short- and long-term impacts that could affect the resources identified in Section 3.18, Shorelines, from construction and operation related to the No-action Alternative and Program Alternatives. Potential shoreline impacts affecting aquatic and terrestrial habitat are addressed in Section 4.7, Fish, and Section 4.9, Wildlife.

4.18.1 No-action Alternative

4.18.1.1 Short-term Impacts

Under the No-action Alternative, various entities and agencies would undertake individual actions that could result in short-term impacts on shorelines around the seven Alpine Lakes, Icicle and Peshastin Creeks, and the Wenatchee River. This is anticipated to entail construction of water diversion modifications, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure at the Alpine Lakes including the restoration of the Eightmile Lake Dam, and improvements to existing irrigation systems to support agricultural reliability. Potential short-term impacts affecting shorelines would be associated with projects that require construction. Construction could adversely affect shorelines in the short-term by resulting in ground disturbance that could increase shoreline erosion. An increase in the potential for shoreline erosion and flooding could also occur as the result of more permanent changes and are addressed under long-term impacts.

The agencies or entities implementing projects under the No-action Alternative would be required to comply with applicable local, state, and federal environmental review requirements and permits as described in Section 1.9, Related Permits, Actions, and Laws. Applicable permits would require appropriate mitigation measures to reduce

impacts on shorelines, such as revegetation of adversely affected areas and BMPs designed to reduce the potential for erosion (Section 4.18.7, Mitigation Measures). Therefore, short-term impacts under the No-action Alternative are not expected to be significant.

4.18.1.2 Long-term Impacts

Long-term impacts under the No-action Alternative are anticipated to be largely beneficial for shorelines because many projects would seek to restore riparian habitat and improve instream flows. However, because both instream flow and fish habitat enhancement projects would not generally be coordinated with other activities in the Icicle project area, these benefits are not anticipated to be as great as they would under the other Program Alternatives. Potential long-term benefits from such projects are also expected to be more localized, providing only minor overall benefits within the larger Icicle Creek Subbasin.

Depending on the extent of changes affecting the shoreline or the flow regime, there could also be some minor and localized increases in flooding and erosion potential over the long term, mainly along Icicle Creek but also at the Alpine Lakes. Changes to the shorelines or stream flows could result in increased potential for erosion of the streambank. Minor changes are anticipated at the Alpine Lakes compared to existing conditions because management of lake levels would remain similar to existing conditions. Although the frequency at which any given lake might be drawn down could increase, the timing and extent of draw down would generally be similar to existing conditions.

Any alterations of streambanks or the placement of new structures within the floodplain could also reduce the flood storage capacity of the adjacent floodplain; however, as noted previously, compliance with applicable regulations would require minimizing these risks. More specifically, work within shorelines of the state is regulated by the Shoreline Master Plan (SMP) and any development within the shoreline would require review by the local jurisdiction for consistency with SMP regulations and policies (Section 4.18.7, Mitigation Measures, for additional information).

4.18.2 Alternative 1

Implementation of Alternative 1 has the potential to result in greater impacts on shorelines compared with the No-action Alternative because there would be higher likelihood that certain projects would be implemented and the scale of certain efforts would likely be greater. The following sections describe the short- and long-term impacts that would occur under Alternative 1.

4.18.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Construction activities associated with this project would involve replacing existing gates and installing solar panels, actuators, flow monitoring equipment, and other new equipment. Most of the work would occur in upland areas. Some limited work would occur within the lake shorelines but within the dry when the lakes are drawn down at the end of the summer. There would be limited potential to affect flooding and erosion potential along the shorelines in the short term.

Accessing the project sites, staging equipment, and providing for worker accommodations could temporarily disturb shoreline vegetation mainly as the result of inadvertent trampling; however, no permanent changes or placement of additional structures are proposed.

As noted in Section 4.5, Water Quality, the potential for these activities to increase erosion would be low because work along the lake margins would occur after the lake was drawn down. In addition, this work would also likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would help to further address potential impacts on shorelines.

IPID Irrigation Efficiencies

Construction activities associated with this project include the conversion of IPID canals to pipelines and lining of irrigation canals with concrete. Short-term impacts on shorelines would be limited because most of the work would occur within areas that are already developed, such as within rights-of-way and existing irrigation canal easements, and would occur during the off-season when the irrigation canals are dry.

Compliance with applicable permits and approvals would include appropriate mitigation measures to reduce impacts on shorelines, such as implementing BMPs designed to reduce the potential for erosion (Section 4.18.7, Mitigation Measures). Therefore, short-term impacts on shorelines from construction work are expected to be less than significant.

COIC Irrigation Efficiencies and Pump Exchange

Construction activities associated with COIC Irrigation Efficiencies and Pump Exchange would be similar to those described above for IPID Irrigation Efficiencies with the exception of a new COIC pump station to be constructed along the shoreline of Icicle Creek or the Wenatchee River. Depending on the specific location and the extent of the disturbance, these activities could result in short-term shoreline impacts, including minor localized potential for increased flooding and erosion, mainly related to vegetation clearing for the new facilities.

This work would likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would help to further address potential impacts on shorelines. Compliance with applicable permits and approvals would include appropriate mitigation measures to reduce impacts on shorelines, such as implementing BMPs designed to reduce the potential for erosion (Section 4.18.7, Mitigation Measures). Therefore, short-term impacts on shorelines from construction work are expected to be less than significant.

Domestic Conservation Efficiencies

Construction activities proposed under the Domestic Conservation Efficiencies Project include pipeline replacement and meter installation. These activities are unlikely to adversely affect shorelines because the work would be done in areas that are already developed away from waterways.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project would involve demolishing the existing dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures. Construction activities would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down. As a result, the potential for increased erosion and flooding would be low.

This work would likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would require BMPs to ensure that potential impacts would be less than significant.

Tribal Fishery Preservation and Enhancement

The focus of this project is to ensure that there would be no adverse effects on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. The specifics of this project are not yet determined but would involve elements of restoration along the lower Icicle Creek that could result in localized shoreline disturbance, including vegetation removal and grading. At this stage, the primary options under consideration include the construction of facilities such as a plumbing to create a bubble curtain, a sprayer, or other minor modifications to the Hatchery Channel spillway at LNFH to promote favorable fishing conditions in the pool at the bottom of the spillway. Depending on the extent of the disturbance, there is the potential for some short-term increase in shoreline erosion and to a lesser extent flooding. However, as noted in Section 4.18.7, Mitigation Measures, work within the shoreline of Icicle Creek would require compliance with applicable local, state, and federal regulations, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would ensure that potential impacts would be less than significant.

Habitat Protection and Enhancement

The Habitat Protection and Enhancement Project could involve grading; planting and thinning vegetation; and hauling and placing logs, rock, soil, and other materials. These activities could increase the potential for shoreline erosion and flooding in the short-term. However, project activities with the potential to affect these resources would likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would help to further address potential impacts on shorelines. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce potential impacts on shorelines, such as requiring revegetation of adversely affected areas and BMPs designed to reduce the potential for erosion and minimize potential shoreline impacts (Section 4.18.7, Mitigation Measures).

Instream Flow Rule Amendment

There are no construction activities proposed under this project and therefore no potential short-term impacts on shorelines.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

This project includes various elements geared towards improving water quality and hatchery rearing conditions at the LNFH. In general, construction of these elements has the potential to affect shorelines, depending on the specific location and type of disturbance. Because this facility is owned by Reclamation and operated by the USFWS, an evaluation of the potential short-term impacts under NEPA would be completed once the full scope of the project is determined.

Similar to the construction activities described above, this work would also likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would help to ensure that potential impacts would be avoided, minimized, or compensated as noted in Section 4.18.7, Mitigation Measures.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek as well as instream modifications to the Boulder Field near RM 5.6. This work would result in disturbances along the streambank and within Icicle Creek that would be addressed in subsequent environmental review and permitting once project specifics are determined. This work would also likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would help to further address potential impacts on shorelines.

Fish Screen Compliance

The Fish Screen Compliance Project involves replacing fish screens at three different diversions on lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Under this project, screens and associated infrastructure would be improved to bring all three intakes up to compliance with state and federal laws. This work would result in disturbances along the streambank and within Icicle Creek that would be addressed once project specifics are determined. This work would also likely require multiple authorizations from local, state, and federal regulatory agencies, including a shoreline permit, HPA, and a CWA Section 404 Permit and Section 401 Water Quality Certification, which would help to further address potential impacts on shorelines.

Water Markets

There are no construction activities proposed under this project and therefore no potential short-term impacts on shorelines.

4.18.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Operation of the proposed facilities for this project would involve a more efficient and flexible system for releasing flows from the lakes. The greatest potential for long-term impacts on shorelines could occur as a result of disturbance during maintenance activities or from changes in operations with respect to how lake levels are managed. Because the facilities would be newer and largely operated remotely by IPID, any trips to and from the lakes, or activities needed to maintain the facilities, are expected to be less frequent and extensive than what would occur compared to existing conditions. In addition, there would be no new structures that would contribute to increased potential for flooding at the lakes.

However, the project would result in some changes in how lake levels are managed. Lake levels would be drawn down every year instead of rotating one or two lakes per year. Although the lakes would be drawn down more frequently, the high and low lake levels and the general pattern of releases would not change. As noted in Section 3.5, Water Quality, these changes are not expected to result in a significant increase in the potential for erosion that would adversely affect shorelines.

Likewise, the resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months.

IPID Irrigation Efficiencies

This project would not result in the construction of any new facilities and therefore would not result in long-term impacts on shorelines.

COIC Irrigation Efficiencies and Pump Exchange

Of the elements proposed as part of this project, the new COIC pump station and intake facilities would have the potential to change instream flow dynamics that could contribute to increased potential for shoreline erosion. In addition, placement of these facilities along the shoreline could contribute to increased flooding. As noted in Section 3.18, Shorelines, the 100-year floodplain includes a fairly narrow area that extends along Icicle Creek and the Wenatchee River. The floodplain extends further upland from the shoreline in broader valley areas near the Cities of Leavenworth and Wenatchee. The proposed intake and pump station structure would be constructed in and adjacent to the river or creek channel and 100-year floodplain.

Any adverse impacts would be likely minor because compliance with applicable local, state, and federal permits or approvals would require appropriate mitigation measures to reduce any potentially significant long-term impacts, such as ensuring that stream channel morphology and floodplain storage capacity were not adversely affected (Section 4.18.7, Mitigation Measures) and the flood levels were not impacted. In addition, relocation of the pump station farther downstream would result in increased flows between the point of the old diversion (RM 5.7) and the new location. This would represent a restoration of increased flows along this segment of the creek, which would be beneficial to shorelines.

Domestic Conservation Efficiencies

Increased conservation and re-use associated with the Domestic Conservation Efficiencies Project is expected to lead to decreased return flows, which could decrease flows in the Wenatchee River downstream of the Leavenworth Wastewater Treatment Plant; however, the long-term effects on stream flow and any associated impacts on shorelines are expected to be negligible.

Eightmile Lake Storage Restoration

Operation of the proposed facilities for the Eightmile Lake Storage Restoration Project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. The greatest potential for impacts on shorelines over the long term would occur as the result of increased shoreline disturbance during maintenance and any changes in operations with respect to how lake levels are managed.

Because the facilities would be newer and largely operated remotely by IPID, any trips to and from the lakes, or activities needed to maintain the facilities, are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative. However, restoration of the facilities and re-operation of the lake would result in the ability to maintain the lake at higher levels compared to existing conditions and the No-action Alternative due erosion of the dam over time.

Under existing conditions, the lake fills to a maximum elevation of approximately 4,667 feet because the embankment portion of the dam has deteriorated. After the dam is restored, the lake would be able to fill to the historical high level of 4,671 feet. Under this project, lake levels would be managed to rise beginning in the late fall and would continue

to approximately 4,666 feet, which would be the crest elevation of a notch in the proposed dam. The lake would remain at this height until stop logs are placed in the notch early in the summer. Placement of the stop logs would allow the lake level to continue to rise to the spillway elevation of 4,671 feet, equal to the historical full water surface elevation. The lake would stay at this level for less than a month in the early summer, after which time IPID would begin drawing down the lake by releasing water.

The project would also allow for the lake to be drawn down below the existing low lake levels to an elevation of 4,621 feet, which is approximately 22.4 feet below the existing low. These changes would restore the maximum storage available for release from the lake to 2,500 acre-feet, which is the maximum volume permitted for release by IPID's water right and would not result in shoreline impacts because lake levels would be within the range of previously inundated shorelines.

The additional height and draw down are not expected to result in significant increases in erosion because draw down of the lake would occur over a period of several months each year. Potential changes to shoreline vegetation are addressed in Section 4.8, Vegetation.

Likewise, the resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months. As noted in Section 4.7, Fish, during high-flow years, there could also be a potential for this project to result in a reduced contribution by the lakes to peak flows that might otherwise contribute to increased erosion and flooding.

Tribal Fishery Preservation and Enhancement

The purpose of this project is to protect and enhance the tribal fishery, which, depending on the specific actions, could result in long-term changes to shorelines that could increase the potential for erosion and flooding; however, these project elements are meant to preserve and enhance stream and riparian habitat, leading to a general improvement in ecosystem quality and functions. Additionally, work within the shoreline would require multiple authorizations from local, state, and federal regulatory agencies. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce any potentially significant long-term impacts affecting shorelines (Section 4.18.7, Mitigation Measures). These requirements would be developed once project-specific details were available.

Habitat Protection and Enhancement

The purpose of the Habitat Protection and Enhancement Project is to protect and enhance habitat within the lower Icicle Creek corridor, which could require work within the shoreline. Projects would likely include placement of large woody debris and placement of other materials to enhance habitat and reduce bank and shoreline downcutting and erosion. The purpose of this project is to preserve and enhance stream and riparian habitat and would require multiple authorizations from local, state, and federal regulatory agencies. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce any potentially significant long-term impacts (Section 4.18.6, Mitigation

Measures). These requirements would be developed once project-specific details were available.

Instream Flow Rule Amendment

Under the Instream Flow Rule Amendment Project, the Icicle Reserve, established under Chapter 137-545 WAC, would be increased by 0.4 cfs. Over the long term, this amendment would ultimately result in the removal of an additional 0.4 cfs from Icicle Creek only after habitat and flow restoration elements are implemented. Additional water withdrawals could result in reduced instream flows, which could adversely affect the shoreline primarily through impacts on riparian vegetation because there could be less water to support these areas. However, potential impacts on shorelines would be offset by the implementation of required instream flow and habitat restoration actions under this Program Alternative, as well as several other projects associated with Alternative 1.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

The potential long-term adverse impacts on shorelines would occur in areas where new facilities were constructed within the shoreline. Potential adverse impacts would likely be minor because work within the shoreline would require compliance with various local, state, and federal regulations, including NEPA, which would address the need for mitigation to reduce potential long-term impacts (Section 4.18.7, Mitigation Measures).

Fish Passage Improvements

Although the details of the Fish Passage Improvements Project are not yet known, it would involve modification potentially affecting the shoreline at three locations on lower Icicle Creek. Depending on the extent of alteration to the shoreline, there could be increased potential for flooding and erosion along the shoreline. Work within the shoreline would require multiple authorizations from local, state, and federal regulatory agencies. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce any potentially significant long-term impacts affecting shorelines (Section 4.18.7, Mitigation Measures). These requirements would be developed once project-specific details were available.

Fish Screen Compliance

Although the details of the Fish Screen Compliance Project are not yet known, it would involve modification of intake screen facilities potentially affecting the shoreline at three locations on lower Icicle Creek. Depending on the extent of alteration to the shoreline, there could be increased potential for flooding and erosion along the shoreline. Work within the shoreline would require multiple authorizations from local, state, and federal regulatory agencies. Applicable permits issued by these agencies would require appropriate mitigation measures to reduce any potentially significant long-term impacts affecting shorelines (Section 4.18.7, Mitigation Measures). These requirements would be developed once project-specific details were available.

Water Markets

Proposed Water Markets Project elements would result in changes in the water market with the intention of increasing flows in lower Icicle Creek. Any increases would be consistent with the natural flow regime within the system and is not expected to result in significant adverse impacts, although in peak years, increased flows within Icicle Creek could contribute to increased flooding risks.

4.18.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Impacts associated with other project elements are discussed in Alternative 1.

4.18.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction of a new pump station under this project would require work along the shorelines of the Wenatchee River. Such activities could result in many of the same construction-related short-term impacts described above, including the increased potential for erosion. As long as construction activities comply with required permit terms and conditions that would be required as discussed in Section 4.18.7, Mitigation Measures, potential impacts would not be significant. Specific mitigation measures would be developed as part of future project-level review and permitting.

4.18.3.2 Long-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project would result in new pump exchange and intake facilities constructed along the right bank of the Wenatchee River and, depending on the specific location, could potentially affect shorelines by increasing the potential for shoreline erosion and flooding over the long term.

Any adverse impacts would likely be minor because compliance with applicable local, state, and federal permits or approvals would require appropriate mitigation measures to reduce any potentially significant long-term impacts, such as ensuring that stream channel morphology and floodplain storage capacity are not adversely affected (Section 4.18.7, Mitigation Measures) and that no increase in flood elevations result from the proposed project.

4.18.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 would be included while the Eightmile Lake Storage Restoration Project would not. This section describes the specific short- and long-term impacts associated with the Legislative Change Creating OCPI Authority for Alternative 3 Project. Impacts associated with other projects are discussed in Alternative 1 and Alternative 2.

4.18.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

There are no construction activities proposed under this project and therefore no potential short-term impacts with the potential to affect shorelines.

4.18.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

If the proposed Legislative Change Creating OCPI Authority for Alternative 3 Project were enacted, there could be potential conflicts with instream flow allocations. Under the proposed changes, junior domestic water rights could be exercised even when the Instream Flow Rule is not met, resulting in potential adverse impacts on riparian vegetation as a result of low-flow conditions. Although these changes would be generally adverse for shorelines, they would not contribute to an increased potential for flooding or erosion.

4.18.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1. The Eightmile Lake Storage Restoration Project would be replaced with the Eightmile Lake Storage Enhancement project, and the Upper Klonaqua Lake and Upper and Lower Snow Lakes Storage Enhancement Projects would also be included. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.18.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would involve demolishing the existing dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures that would allow for an increase in the accessible storage at Eightmile Lake to 3,500 acre-feet. Construction activities would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down. As a result, the potential for increased erosion and flooding would be low.

In addition, as noted in Section 4.18.7, Mitigation Measures, work within and around the lakes would require compliance with applicable local, state, and federal regulations, which would require BMPs to ensure that potential impacts would be less than significant.

Upper Klonaqua Lake Storage Enhancement

Short-term impacts on shorelines from the Upper Klonaqua Lake Storage Enhancement Project would primarily be associated with construction activities required to provide a low-level outlet from Upper Klonaqua Lake to Lower Klonaqua Lake using one of the three conceptual connection options discussed in the project description in Section 2.8.3, Upper Klonaqua Lake Storage Enhancement. Construction activity would occur between the lakes and along the banks within the dry areas of the lake margins once the lakes had been drawn down.

In addition, as noted in Section 4.18.7, Mitigation Measures, work within and around the lakes would require compliance with applicable local, state, and federal regulations, which would require BMPs to ensure that potential impacts would be less than significant.

Upper and Lower Snow Lakes Storage Enhancement

Short-term impacts on shorelines from the Upper and Lower Snow Lakes Storage Enhancement Project would be primarily related to construction activities and are similar in type and mechanism to those discussed in Sections 4.8.5.1, Short-term Impacts, Eightmile Lake Storage Enhancement and Upper Klonaqua Lake Storage Enhancement. Construction activities would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down. As a result, the potential for increased erosion and flooding would be low.

In addition, as noted in Section 4.18.7, Mitigation Measures, work within and around the lakes would require compliance with applicable local, state, and federal regulations, which would require BMPs to ensure that potential impacts would be less than significant.

4.18.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Operation of the proposed facilities for the Eightmile Lake Storage Enhancement Project would involve a more efficient and flexible system for releasing flows from Eightmile Lake. The greatest potential for impacts on shorelines over the long term would occur as the result of permanent conversion of any sensitive areas, disturbance during maintenance, and any changes in operations with respect to how lake levels are managed.

Because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative. However, this project would result in the ability to maintain the lake at higher than historical levels compared to existing conditions and the No-action Alternative.

Under existing conditions, the maximum fill height of the lake is approximately 4,667 feet because the embankment portion of the dam has deteriorated. After the dam is restored, the lake would be able to fill to a new high water surface of 4,682 feet. Under this project, lake levels would be managed to rise beginning in the late fall and would continue to approximately 4,677 feet to the height of a notch in the proposed dam. The lake would remain at this height until stop logs are placed in the notch in the early summer. Placement of the stop logs would allow the lake level to continue to rise to the spillway elevation of 4,682 feet. The lake would stay at this level for less than a month in the early summer, after which time IPID would begin drawing down the lake by releasing water. These changes would increase the accessible storage to 3,500 acre-feet, which is 1,000 acre-feet more than currently permitted by IPID's water right.

Compared with existing conditions and the No-action Alternative, this means that an additional area of shoreline would be under water. Shoreline areas up to 4,671 feet have been historically inundated, but areas above 4,671 feet to 4,682 feet have not been inundated. The additional area would be under water for a little less than a month each summer. This change in lake levels could result in some changes to the vegetative community along the shoreline. The proposed project would inundate approximately 13.6 acres that are not currently inundated, which would not represent a substantial loss but rather a change in the mix of shoreline vegetation.

The project would also allow for the lake to be drawn down below existing lake levels to an elevation of 4,619 feet, which is approximately 24.4 feet lower than the existing low. This change would result in the exposure of slightly more lake bed, mainly in the later summer months and early fall up to the point when the water would no longer be drawn down, generally around the end of September. The additional draw down is not expected to adversely affect shorelines by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity

Likewise, the resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months.

Upper Klonaqua Lake Storage Enhancement

Under the Upper Klonaqua Lake Storage Enhancement Project, potential long-term impacts to shorelines would be similar to those described under the Eightmile Lake Storage Enhancement Project (Section 4.18.5.2, Long-term Impacts). Potential benefits would mainly occur in Icicle Creek and would include an increased ability to augment stream flow in the late summer or during drought years, with flow augmentation primarily benefitting the section of Icicle Creek between Upper Klonaqua Lake and the IPID diversion.

The frequency in fluctuations in lake levels in Upper Klonaqua Lake would increase compared to existing conditions and the No-action Alternative. Lake levels would also be drawn down further compared to existing conditions.

The new high lake level in Upper Klonaqua Lake would not change. The lake would still refill and outlet naturally through an existing channel to Lower Klonaqua Lake during most of the year. However, the new facilities would allow for the lake to be drawn down an additional 20 feet to allow for access to an additional 1,146 acre-feet of storage. The draw down would likely occur over a couple of months in the late summer. The additional draw down is not expected to adversely affect shorelines by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

Modifications at Upper Klonaqua Lake would also result in the ability to release up to an additional 5 to 20 cfs from the lake. Increased flows would be released from the dam into a downstream tributary, which flows into Icicle Creek. Increased flows would occur from the point of release at Klonaqua Dam down to the IPID diversion at RM 5.7.

The resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months.

Upper and Lower Snow Lakes Storage Enhancement

Potential long-term impacts to shorelines under the Upper and Lower Snow Lakes Storage Enhancement Project would be similar to those described under the Eightmile Lake Storage Enhancement Project (Section 4.8.5.2, Long-term Impacts). Potential benefits would mainly occur in Icicle Creek and would include an increased ability to augment stream flow in the late summer or during drought years, with flow augmentation primarily benefitting the section of Icicle Creek between lower Snow Lake and the IPID diversion.

The proposed enhancement project would increase the high-water storage levels in both Upper and Lower Snow Lakes by 5 feet compared with existing high levels. This change would result in the inundation of some upland vegetation that has grown along the shoreline areas between the current and proposed high lake levels, most likely occurring in the fall through the early summer when releases would be likely to begin. This could result in some changes to the vegetative community along the shoreline.

The project would also allow for the Lower Snow Lake to be drawn down 3 feet below the current lake level, which would result in the exposure of slightly more lake bed. The additional draw down is not expected to adversely affect the shorelines by comparison, particularly because draw down of the lake would occur over a period of a couple of months and would not result in substantial increases in turbidity.

The resulting downstream changes in flows in Icicle Creek would be within the natural variation already occurring within the system. In most years, the main change would be a beneficial increase in flows during the summer months.

4.18.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange project would be included.

4.18.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange Project

Construction of three new pump stations under this project would require work along the shorelines of the Wenatchee River. Removal of existing diversion facilities would also require work along Icicle and Peshastin Creeks. Ground disturbance would occur along the entire existing IPID delivery system as the canal system is replaced with a pressurized pipeline. Such activities could result in many of the same construction-related short-term impacts described above, including the increased potential for erosion. As long as construction activities comply with required permit terms and conditions that would be required as discussed in Section 4.18.7, Mitigation Measures, potential impacts would not be significant. Specific mitigation measures would be developed as part of future project-level review and permitting. Therefore, short-term impacts on shorelines from construction work are expected to be less than significant.

4.18.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange Project

The IPID Full Piping and Pump Exchange Project would result in new pump stations and intake facilities at three locations on the Wenatchee River. Depending on the specific location, these new facilities could potentially affect shorelines by increasing the potential for shoreline erosion and flooding over the long term.

Any adverse impacts would likely be minor because compliance with applicable local, state, and federal permits or approvals would require appropriate mitigation measures to reduce any potentially significant long-term impacts, such as ensuring that stream channel morphology and floodplain storage capacity are not adversely affected (Section 4.18.7 Mitigation Measures) and that no increase in flood elevations result from the proposed project.

As noted in Section 3.18, Shorelines, the 100-year floodplain includes a fairly narrow area that extends along Icicle Creek and the Wenatchee River. The floodplain extends further upland from the shoreline in broader valley areas near the Cities of Leavenworth and Wenatchee. The proposed intake and pump station structures would be constructed in and adjacent to the river or creek channel and 100-year floodplain.

4.18.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.18.7.1 Short-term Impacts

Short-term impacts on shorelines related to increasing the potential for shoreline erosion would be mitigated by complying with the terms and conditions of local, state, and federal regulations and project-specific permits and approvals, including local building, grading, and stormwater construction permits; state stormwater permits; Shoreline Management Act shoreline permits; HPAs; and CWA Section 404 permits and their associated Section 401 Water Quality Certifications, among others. Common permit conditions are likely to include conducting work in a manner to minimize potential disturbance of sensitive shoreline vegetation communities, minimizing soil disturbance, and implementing BMPs to control and minimize erosion.

Specific mitigation measures would be developed as part of future project-level review and permitting. In addition to those measures identified in Sections 4.5.7, Water Quality, and Section 4.8.7, Vegetation, implementation of the following measures would ensure impacts would be less than significant.

- Where project elements may be permanently located in or substantially alter the floodplain, conduct a study to assess the potential for the project activities to adversely affect floodplain storage capacity and flood levels.
- Where project elements may be permanently located in the stream channel, ensure that the project is designed in a manner that does not result in long-term changes in sediment transport of the affected water way.

4.18.7.2 Long-term Impacts

Long-term impacts on shorelines would be mitigated by complying with the terms and conditions of local, state, and federal regulations and project-specific permits and approvals, as described above.

4.19 Utilities

The primary utility types to be impacted by the alternatives discussed in this document are related to municipal water service and irrigation districts. Short-term impacts would be reductions or disturbances in service related to project construction. Impacts are considered minor if the impact is short or can be scheduled to minimize impacts. Long-term impacts are related to increased demand on a utility. Impacts are considered minor if the increases would not affect regional supplies.

In addition to water utilities, potential impacts on power utilities are discussed.

4.19.1 No-action Alternative

4.19.1.1 Short-term Impacts

Under the No-action Alternative, various agencies and other entities would continue to undertake individual actions to restore and enhance fish and aquatic resources in the Icicle Creek Watershed project area, but those actions would not be part of a coordinated program implemented with the support of the IWG. Actions implemented by individual agencies and entities could include construction of diversion improvements, irrigation system upgrades, LNFH improvements, and fish passage work.

Implementing projects under the No-action Alternative could result in some construction impacts to water service. However, coordination and timing should limit any such impacts. No other construction related impacts to utilities are anticipated.

4.19.1.2 Long-term Impacts

Long-term impacts on utilities from implementing the No-action Alterative would relate to increased power consumption.

Increased power use would likely be associated with any project that increases pressurized water pumping versus historical gravity flow, such as the COIC Irrigation Efficiencies and Pump Exchange, IPID Dryden or Full Pump Exchange project, and the groundwater augmentation portion of the LNFH improvements. These increases in power use would not affect regional power supplies.

4.19.2 Alternative 1

Under Alternative 1, short-term effects to utilities include potential impacts to water service by the City of Leavenworth and irrigation districts. Preventative steps such as construction on Alpine Lakes projects occurring during normal or high water years and coordinating construction projects with water purveyors would minimize potential effects. Long-term impacts to utilities include increased water service and power consumption. Increased power consumption is not expected to affect regional power supplies and is considered insignificant.

4.19.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Construction for this project would require the Alpine Lakes to be drawn down prior to construction. To avoid service disruptions to IPID, which relies on the water stored in these lakes to provide irrigation water to their district in drought years, construction would have to be scheduled for a normal or above average water year.

IPID Irrigation Efficiencies

Under the IPID Irrigation Efficiencies Project, construction activities would likely include piping or lining canals and on-farm irrigation efficiency upgrades. These construction activities would occur outside the irrigation season, and water service disruptions would be unlikely. There are no anticipated impacts on other utility types.

COIC Irrigation Efficiencies and Pump Exchange

The COIC Irrigation Efficiencies and Pump Exchange Project would include a point of diversion change and pressurized piping of the current canal and lateral system. Construction activities would occur outside the irrigation season, and there are no anticipated water service disruptions. No other service disruptions are anticipated under this project.

Domestic Conservation Efficiencies

Construction activities under the Domestic Conservation Efficiencies Project would include replacing mainlines and installing new meters. Other aspects of this project are more administrative in nature. Some service disruption could occur as a result of mainline replacements. However, this would be of short duration and would be coordinated with water users to minimize the impact.

Eightmile Lake Storage Restoration

Construction of the Eightmile Lake Storage Restoration Project would require Eightmile Lake to be drawn down. To avoid service disruptions to IPID, which relies on the water stored in this lake to provide irrigation water to their district in drought years, construction would have to be scheduled for a normal or above average water year.

Tribal Fishery Preservation and Enhancement

Any construction activities associated with this project are not expected to have impacts on utility service.

Habitat Protection and Enhancement

Any construction activities associated with this project are not expected to have impacts on utility service.

Instream Flow Rule Amendment

This is an administrative action with no construction component. No short-term impacts to utilities are anticipated.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

One aspect of the LNFH Conservation and Water Quality Improvements Project involves rehabilitating the LNFH intake structure. If COIC is still sharing a point of diversion with LFNH when construction occurs, it could impact COIC delivery. To minimize any impacts, construction activities would be coordinated with COIC if they are still sharing a

point of diversion at the time of construction. No other short-term utility impacts are anticipated.

Fish Passage Improvements

Construction activities related to fish passage are generally not expected to impact water service delivery or any other utility. However, construction activities at the Boulder Field have the potential to impact both the City of Leavenworth and IPID's diversion given their proximity to the Boulder Field. Construction activities related to passage at the Boulder Field would need to be coordinated with both entities to minimize any impacts and disruption to their service.

Fish Screen Compliance

Fish Screen installation would have to be coordinated with the City of Leavenworth, IPID, LNFH, and COIC to ensure no impact on water service. No other short-term utility impacts are anticipated.

Water Markets

This is an administrative action with no construction component. No short-term impacts to utilities are anticipated.

4.19.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

The Alpine Lakes Optimization, Modernization, and Automation Project would provide water for instream flow benefit when the district generally does not need to use the water stored in the Alpine Lakes (non-drought years). Because the water would still be available to IPID when they need it, there are no anticipated long-term effects to water service.

Power for automation would be provided by a small solar panel. There are no anticipated impacts to electrical utilities.

IPID Irrigation Efficiencies

Lining and piping portions of the IPID canal is not anticipated to have any impacts to water delivery by the district.

Because the system would continue to be gravity fed, there are no anticipated impacts to electrical utilities.

COIC Irrigation Efficiencies and Pump Exchange

Piping the COIC canal and laterals and changing the point of diversion is not anticipated to impact water delivery by the district.

Using a pump station on the Wenatchee River or Icicle Creek would lead to increased power consumption. However, this increase in electrical use is expected to be relatively small and would not affect regional power supplies.

Water service is not expected to be significantly impacted by this project.

Domestic Conservation Efficiencies

Under the Domestic Conservation Efficiencies Project, water made available through domestic conservation efforts would go to new domestic users. This would allow increased water service in the City of Leavenworth and potentially for other small water purveyors that provide water to rural domestic water users.

Impacts on electrical use are expected to be neutral.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project would make additional water available to the City of Leavenworth and rural domestic water users. This would allow increased water service in the City of Leavenworth and potentially for other small water purveyors that provide water to rural domestic water users.

If the City of Leavenworth takes any additional water from their Icicle Creek diversion, the impact on electrical use is expected to be minimal. However, if the City of Leavenworth takes any additional water made available from this project from their Wenatchee River well field then power consumption would increase. This increased power demand would likely be provided by Chelan PUD and would not affect regional power supplies.

Tribal Fishery Preservation and Enhancement

This project is not expected to have long-term impacts on water service or power utilities.

Habitat Protection and Enhancement

This project is not expected to have long-term impacts on water service or power utilities.

Instream Flow Rule Amendment

The Instream Flow Rule Amendment Project would provide additional water for rural domestic use within the Icicle Creek Subbasin. This would allow increased water service from small water purveyors that provide water to rural domestic water users. Additionally, it would make more water available for small domestic groundwater users.

Power consumption would likely increase because of increased groundwater use. However, this increased electrical use is expected to be relatively small and would not affect regional power supplies.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

The LNFH Conservation and Water Quality Improvements Project is not anticipated to have long-term impacts on water service within the Icicle project area.

It is currently unknown what impact this project would have on power consumption, although with increased reliance on groundwater sources and the use of circular tanks, power use would likely increase. However, this increase in electrical use is expected to be

relatively small and may be partially offset by reduction in the use of chillers for egg temperature control. Impacts would be less than significant and would not affect regional power supplies.

Fish Passage Improvements

Fish passage projects are not anticipated to have any impact on water service or electrical utilities.

Fish Screen Compliance

The Fish Screen Compliance Project is not anticipated to have any impact on water service or electrical utilities.

Water Markets

The Water Markets Project is not anticipated to have any impact on water service or electrical utilities.

4.19.3 Alternative 2

Alternative 2 contains many of the same project elements as Alternative 1, with the addition of the IPID Dryden Pump Exchange Project and the removal of the Alpine Lakes Optimization, Modernization, and Automation Project. This section describes the short- and long-term impacts of the IPID Dryden Pump Exchange Project. All other project impacts are described under Alternative 1.

4.19.3.1 Short-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project proposes to pump water from the Wenatchee River rather than from Icicle Creek. Construction activities are not expected to impact utility service or have any other short-term impacts to utilities.

4.19.3.2 Long-term Impacts

IPID Dryden Pump Exchange

IPID's point of diversion on Icicle Creek is gravity fed and requires no electricity to operate. Using a pump station on the Wenatchee River to reduce use on Icicle Creek would lead to increased power consumption. However, this increase in electrical use is expected to not affect regional power supplies.

Water service is not expected to be significantly impacted by this project.

4.19.4 Alternative 3

Alternative 3 contains many of the same project elements as Alternative 2, with the addition of the Legislative Change Creating OCPI Authority for Alternative 3 Project and the removal of the Eightmile Lake Storage Restoration Project. This section describes the short- and long-term impacts of the Legislative Change Creating OCPI Authority for

Alternative 3 Project. All other project impacts are described under Alternative 1 and Alternative 2.

4.19.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

The Legislative Change to OCPI Project is an administrative action without a construction component. There are no anticipated short-term impacts to utilities resulting from this project.

4.19.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

Under this project, domestic water use could increase. This would allow increased water service from the City of Leavenworth and small water purveyors that provide water to rural domestic water users.

Power consumption would likely increase because of increased pumping associated with increased water use. However, this increased electrical use is expected to be relatively small and would not affect regional power supplies.

4.19.5 Alternative 4

Alternative 4 contains many of the same project elements as Alternative 1, except that the Eightmile Lake Storage Restoration Project would replace the Eightmile Lake Storage Enhancement Project, and the Upper Klonaqua Lake and Upper and Lower Snow Lakes Storage Enhancement Projects would be added. This section describes the short- and long-term impacts of those additional projects. All other project impacts are described under Alternative 1.

4.19.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

Construction of the Eightmile Lake Storage Enhancement Project would require Eightmile Lake to be drawn down. To avoid service disruptions to IPID, which relies on the water stored in this lake to provide irrigation water to their district in drought years, construction would have to be scheduled for a normal or above average water year.

Upper Klonaqua Lake Storage Enhancement

Construction of the Upper Klonaqua Lake Storage Enhancement Project would involve construction at Upper Klonaqua Lake, which is currently not managed for IPID water delivery. There are no expected short-term impacts to water service or other utility use.

Upper and Lower Snow Lakes Storage Enhancement

Construction of Upper and Lower Snow Lakes Storage Enhancement Project would require Upper Snow and Lower Snow Lakes to be drawn down. IPID relies on water stored in these lakes to provide irrigation water during drought years only. USFWS relies

on storage to sustain water supply to the hatchery every year, but the need is greater during dry years. To avoid service disruptions to IPID and the USFWS, construction would have to be scheduled for a normal or above average water year.

4.19.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would make additional water available to the City of Leavenworth and rural domestic water users. The impacts to utilities are similar to the Eightmile Lake Storage Restoration Project (4.19.2.2, Long-term Impacts). This project would allow increased water service in the City of Leavenworth and potentially for other small water purveyors that provide water to rural domestic water users.

If the City of Leavenworth takes any additional water from their Icicle Creek diversion, the impact on electrical use is expected to be minimal. However, if the City of Leavenworth takes any additional water made available from this project from their Wenatchee River well field, the anticipated increase in power demand is not expected to not affect regional power supplies.

Upper Klonaqua Lake Storage Enhancement

The Upper Klonaqua Lake Storage Enhancement Project would primarily benefit instream flows. Some water might be made available to the City of Leavenworth and rural domestic water users. This would allow increased water service in the City of Leavenworth and potentially for other small water purveyors that provide water to rural domestic water users.

If the City of Leavenworth takes any additional water from their Icicle Creek diversion, the impact on electrical use is expected to be minimal. However, if the City of Leavenworth takes any additional water made available from this project from their Wenatchee River well field, increase in power demand is expected. This increased demand would not affect regional power supplies.

Upper and Lower Snow Lakes Storage Enhancement

The Upper and Lower Snow Lakes Storage Enhancement Project would primarily benefit instream flows. Some water might be made available to the City of Leavenworth and rural domestic water users. This would allow increased water service in the City of Leavenworth and potentially for other small water purveyors that provide water to rural domestic water users.

If the City of Leavenworth takes any additional water from their Icicle Creek diversion, the impact on electrical use is expected to be minimal. However, if the City of Leavenworth takes any additional water made available from this project from their Wenatchee River well field, increase in power demand is expected. This increased demand would not affect regional power supplies.

4.19.6 Alternative 5

Alternative 5 contains many of the same project elements as Alternative 1, with the addition of the IPID Full Piping and Pump Exchange Project and the removal of the IPID Irrigation Efficiencies Project. This section describes the short- and long-term impacts of the IPID Dryden Pump Exchange Project. All other project impacts are described under Alternative 1.

4.19.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

The IPID Full Piping and Pump Exchange Project proposes to pipe the entire IPID system and pump water from the Wenatchee River rather than from Icicle and Peshastin Creek. Construction activities are not expected to impact water or utility service or have any other short-term impacts to utilities.

4.19.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

IPID's point of diversion on Icicle Creek is gravity fed and requires no electricity to operate. Using pump stations on the Wenatchee River to replace use from Icicle Creek would lead to increased power consumption, likely provided by Chelan PUD. At this point in project planning, the exact impacts have not been fully analyzed, however power consumption is not anticipated to affect regional power supplies and is therefore not viewed as a significant effect.

Water service is not expected to be significantly impacted by this project.

4.19.7 Mitigation Measures

This section discusses mitigation measures to address impacts identified and discussed above.

4.19.7.1 Short-term Impacts

The primary short-term impact identified above is potential disruptions of water service by the City of Leavenworth or irrigation districts. Coordinating the timing of construction work should mitigate many of these potential impacts.

4.19.7.2 Long-term Impacts

Long-term impacts identified in this section include improved water service and increased power consumption. The increased power consumption is not anticipated to affect regional power supplies and is therefore not viewed as a significant effect. Improved water service is also not considered a significant effect.

4.20 Transportation

This section discusses the short- and long-term impacts of the alternatives on transportation. Anticipated short-term impacts are related to construction activities and include the movement of heavy equipment to and from the project sites as well as commutes by workers during construction. Long-term impacts relate primarily to maintenance trips from project operation. Many of the project elements are located at already existing infrastructure. For already existing infrastructure in the ALWA, the number of maintenance trips is expected to decline. For new infrastructure, such as the IPID pump station, maintenance trips would increase.

4.20.1 No-action Alternative

4.20.1.1 Short-term Impacts

Under the No-action Alternative, various agencies and other entities would continue to undertake individual actions to restore and enhance fish and aquatic resources in the Icicle Creek Watershed project area, but those actions would not be part of a coordinated program implemented with the support of the IWG. Actions implemented by individual agencies and entities could include construction of diversion improvements, irrigation system upgrades, LNFH improvements, and fish passage work.

The No-Action Alternative would likely result in construction activities in lower Icicle Creek and near the confluence of Icicle Creek and the Wenatchee River. Transporting equipment to project sites would likely impact traffic flow on Icicle Road and Highway 2. Additionally, commutes from construction workers would increase traffic on these roads. No roadways would be closed and standard safety procedures would be followed for transport of heavy equipment to the project sites.

4.20.1.2 Long-term Impacts

Transportation is expected to be relatively unchanged under the No-action Alternative. IPID would continue flying or hiking into their lake sites several times per season for maintenance and inspection activities, and points of diversions and water conveyance structures on lower Icicle Creek would undergo a similar level of maintenance and inspection as they currently do. There would likely be no new projects implemented that would require additional trips for monitoring or maintenance.

4.20.2 Alternative 1

Under Alternative 1, short-term impacts to transportation include increased traffic or traffic slowdowns resulting from the transportation of heavy equipment and workers to construction sites, and increased air support and foot traffic to construction sites within the ALWA. Long-term impacts to transportation are considered insignificant. They include a potential slight increase in maintenance trips to some project sites and decreased maintenance trips to the Alpine Lakes.

4.20.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Construction of the Alpine Lakes Optimization, Modernization, and Automation Project would require the use of hand and power tools, which would either be packed in via trails or flown in by helicopter. Workers would have to either hike in or be flown in as well. This would create a temporary increase in foot and air traffic to the Alpine Lakes sites. The USFS Environmental Assessment found the use of helicopter transport to support IPID maintenance activities to be acceptable (USFS, 1981). However, this increase could disrupt wilderness use as discussed in Section 4.17, Wilderness. To minimize impacts to wilderness uses of increased air and foot traffic, construction activities could occur in fall after the peak backpacking season, and construction notices would be posted so users would be aware of potential impacts.

IPID Irrigation Efficiencies

Under the IPID Irrigation Efficiencies Project, construction activities, such as canal lining and piping, would impact transportation by increasing traffic from construction worker commuter trips and slowing traffic from heavy equipment transport. No roadway closures are anticipated and standard safety procedures would be followed for transport of heavy equipment.

COIC Irrigation Efficiencies and Pump Exchange

Under the COIC Irrigation Efficiencies and Pump Exchange and Pump Exchange Project, construction activities, such as system piping and building a pump station, would impact transportation by increasing traffic from construction worker commuter trips and slowing traffic from heavy equipment transport. Road access may temporarily be limited to single lane closures and would include consultation with local public utilities and transportation authorities in accordance with state and local laws.

Domestic Conservation Efficiencies

Construction activities, such as mainline replacement and meter installation, would impact transportation by increasing traffic from construction worker commuter trips and slowing traffic from heavy equipment transport. Standard safety procedures would be followed for transport of heavy equipment. Road access may temporarily be limited and would include consultation with local public utilities and transportation authorities in accordance with state and local laws.

Eightmile Lake Storage Restoration

Construction of the Eightmile Lake Storage Restoration Project would require the use of hand and power tools, which would either be packed in via trails or flown in by helicopter, and the use of heavy equipment, which would likely have to be flown in or walked up National Forest Road 7601 and overland adjacent to the Eightmile Lake Trail. Workers would likely have to hike in to the site or be flown in by helicopter, with support equipment being flown or packed in. This would create a temporary increase in foot and

air traffic to the lake site. The USFS Environmental Assessment found the use of helicopter transport to support IPID maintenance activities to be acceptable (USFS, 1981). However, this increase could disrupt wilderness use as discussed in Section 4.17, Wilderness. To minimize impacts to wilderness uses, construction activities may occur in fall after the peak backpacking season, and construction notices would be posted so users would be aware of potential impacts.

Tribal Fishery Preservation and Enhancement

Some minor construction activities could be associated with this project. Any transportation of heavy equipment or increased construction worker commuter traffic could increase or slow traffic. No roadway closures are anticipated and standard safety procedures would be followed for transport of heavy equipment.

Habitat Protection and Enhancement

Construction activities associated with the Habitat Protection and Enhancement Project would include grading, vegetation planting and removal, and placement of logs and rocks in riparian areas. Impacts to transportation would include increased traffic from construction worker commuter trips and slowed traffic from heavy equipment transport. No roadway closures are anticipated and standard safety procedures would be followed for transport of heavy equipment.

Instream Flow Rule Amendment

The Instream Flow Rule Amendment Project is an administrative action with no construction component. No short-term impacts to transportation are anticipated.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

Construction activities associated with the LNFH Conservation and Water Quality Improvements Project would include well drilling, installing circular tanks, installation of a pump at the hatchery outfall, and rehabilitating the intake structure. Impacts to transportation would include increased traffic from construction worker commuter trips and slowed traffic from heavy equipment transport. No roadway closures are anticipated and standard safety procedures would be followed for transport of heavy equipment.

Fish Passage Improvements

Construction activities associated with the Fish Passage Improvements Project include modifying or removing passage barriers. Impacts to transportation would include increased traffic from construction worker commuter trips and slowed traffic from heavy equipment transport. No roadway closures are anticipated and standard safety procedures would be followed for transport of heavy equipment.

Fish Screen Compliance

Construction activities associated with the Fish Screen Compliance Project involve replacing/installing fish screens at major diversions. Impacts to transportation would include increased traffic from construction worker commuter trips and slowed traffic

from heavy equipment transport. No roadway closures are anticipated and standard safety procedures would be followed for transport of heavy equipment.

Water Markets

The Water Markets Project has no construction component and therefore no short-term impacts to transportation are anticipated.

4.20.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

The Alpine Lakes Optimization, Modernization, and Automation Project would result in fewer operational trips to the lake sites. Releases from the lakes would be automated, and trips to adjust gates throughout the season would not be required. There would still be occasional maintenance and inspection trips to the lake sites to ensure equipment and dams are in good repair.

IPID Irrigation Efficiencies

There are no significant long-term impacts to transportation associated with the IPID Irrigation Efficiencies Project. Routine inspection and maintenance trips would be required but would not be more frequent than current trips required to maintain the existing infrastructure.

COID Irrigation Efficiencies

There are no significant long-term impacts to transportation associated with the COIC Irrigation Efficiencies and Pump Exchange and Pump Exchange Project. Routine inspection and maintenance trips would be required but would not be more frequent than current trips required to maintain the existing infrastructure.

Domestic Conservation Efficiencies

There are no significant long-term impacts to transportation associated with the Domestic Conservation Efficiencies Project. Routine inspection and maintenance already occur on this infrastructure.

Eightmile Lake Storage Restoration

There are no significant long-term impacts to transportation associated with the Eightmile Lake Storage Restoration Project. Routine inspection and maintenance already occur on this infrastructure.

Tribal Fishery Preservation and Enhancement

This project is not expected to impact the use of transportation infrastructure in the long-term.

Habitat Protection and Enhancement

Under the Habitat Protection and Enhancement Project, some routine maintenance or inspection of plantings, logjams, and other improvements could be required. However, this is not expected to significantly impact traffic or transportation.

Instream Flow Rule Amendment

Amendment of the Instream Flow Rule is not expected to increase the use of transportation infrastructure.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

There are no significant long-term impacts to transportation associated with the LNFH Conservation and Water Quantity Improvements Project. Routine inspection and maintenance already occur on LNFH's operational infrastructure.

Fish Passage Improvements

Under the Fish Passage Improvements Project, some routine maintenance or inspection of infrastructure may be required. However, this is not expected to significantly impact traffic or transportation.

Fish Screen Compliance

There are no significant long-term impacts to transportation associated with the Fish Screen Compliance Project. Routine inspection and maintenance already occur at the major diverters points of diversion.

Water Markets

The implementation of the Icicle Water Market Project is not expected to increase the use of transportation infrastructure in the long term.

4.20.3 Alternative 2

Alternative 2 contains many of the same project elements as Alternative 1, with the addition of the IPID Dryden Pump Exchange Project and the removal of the Alpine Lakes Optimization, Modernization, and Automation Project. This section describes the short- and long-term impacts of the IPID Dryden Pump Exchange Project. All other project impacts are described under Alternative 1.

4.20.3.1 Short-term Impacts

IPID Dryden Pump Exchange

Construction activities, such as canal piping and building a pump station, would impact transportation by increasing traffic from construction worker commuter trips and slowing traffic from heavy equipment transport. Standard safety procedures would be followed for transport of heavy equipment. Road access may temporarily be limited and would include consultation with local public utilities and transportation authorities in accordance with state and local laws.

4.20.3.2 Long-term Impacts

IPID Dryden Pump Exchange

Under the IPID Dryden Pump Exchange Project, some routine maintenance or inspection of infrastructure could be required. However, this is not expected to significantly impact traffic or transportation.

4.20.4 Alternative 3

Alternative 3 contains many of the same project elements as Alternative 2, with the addition of the Legislative Change Creating OCPI Authority for Alternative 3 Project and the removal of the Eightmile Lake Storage Restoration Project. This section describes the short- and long-term impacts of the Legislative Change Creating OCPI Authority for Alternative 3. All other project impacts are described under Alternative 1 and Alternative 2.

4.20.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

The Legislative Change Creating OCPI Authority for Alternative 3 Project is an administrative action without a construction component. There are no anticipated short-term impacts to transportation resulting from this project.

4.20.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

It is not anticipated that long-term impacts to transportation would result from the Legislative Change Creating OCPI Authority for Alternative 3.

4.20.5 Alternative 4

Alternative 4 contains many of the same project elements as Alternative 1, except for the removal of the Eightmile Lake Storage Restoration Project and the addition of the Eightmile Lake Storage Enhancement Project, Upper Klonaqua Lake Storage Enchantment Project, and Upper and Lower Snow Lakes Storage Enhancement Project. This section describes the short- and long-term impacts of those additional projects. All other project impacts are described under Alternative 1.

4.20.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

Construction of the Eightmile Lake Storage Enhancement Project would require the use of hand and power tools, which would either be packed in via trails or flown in by helicopter, and the use of heavy equipment, which would likely have to be flown in via helicopter or be walked up National Forest Road 7601 and overland adjacent to the Eightmile Lake Trail. Workers would likely have to hike in to the site, with support equipment being flown or packed in. This would create a temporary increase in foot and air traffic to the lake site. The USFS Environmental Assessment found the use of

helicopter transport to support IPID maintenance activities to be acceptable (USFS, 1981). However, this increase could disrupt wilderness use as discussed in Section 4.17, Wilderness. To minimize impacts to wilderness uses construction activities could occur in fall after the peak backpacking season, and notices would be posted so users would be aware of potential impacts.

Upper Klonaqua Lake Storage Enhancement

Construction of the Upper Klonaqua Lake Storage Enhancement Project would require the use of hand and power tools, which would either be packed in via trails or flown in by helicopter, and potentially the use of heavy equipment, which would likely be walked up National Forest Road 7600 and trails. Workers would have to hike in or fly into the site, with support equipment being flown or packed in. This would create a temporary increase in foot and air traffic to the lake site. The USFS Environmental Assessment found the use of helicopter transport to support IPID maintenance activities to be acceptable (USFS, 1981). However, this increase could disrupt wilderness use as discussed in Section 4.17, Wilderness. To minimize impacts to wilderness uses, construction activities could occur in fall after the peak backpacking season, and notices would be posted so users would be aware of potential impacts.

Upper and Lower Snow Lakes Storage Enhancement

Construction of the Upper and Lower Snow Lakes Storage Enhancement Project would require the use of hand and power tools, which would either be packed in via trails or flown in by helicopter, and potentially the use of heavy equipment, which would likely be walked up Icicle Road and the Snow Lakes Trail. Workers would likely have to hike in to the site, with support equipment being flown or packed in. This would create a temporary increase in foot and air traffic to the lakes site. The USFS Environmental Assessment found the use of helicopter transport to support IPID maintenance activities to be acceptable (USFS, 1981). However, this increase could disrupt wilderness use as discussed in Section 4.17, Wilderness. To minimize impacts to wilderness uses, construction activities could occur in fall after the peak backpacking season, and notices would be posted so users would be aware of potential impacts.

4.20.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

There are no significant long-term impacts to transportation associated with the Eightmile Lake Storage Enhancement Project. Routine inspection and maintenance already occur on this infrastructure.

Upper Klonaqua Lake Storage Enhancement

The Upper Klonaqua Lake Storage Enhancement Project would require maintenance and inspection trips to Upper Klonaqua Lake, which do not currently occur. These trips could be coordinated with inspection and maintenance trips to lower Klonaqua Lake that currently occur.

Upper and Lower Snow Lakes Storage Enhancement

There are no significant long-term impacts to transportation associated with the Upper and Lower Snow Lakes Storage Enhancement Project. Routine inspection and maintenance already occur on this infrastructure.

4.20.6 Alternative 5

Alternative 5 contains many of the same project elements as Alternative 1, with the addition of the IPID Full Piping and Pump Exchange Project would replace the IPID Irrigation Efficiencies Project. This section describes the short- and long-term impacts of the IPID Full Piping and Pump Exchange Project. All other project impacts are described under Alternative 1.

4.20.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

Construction activities, such as canal piping and building a pump station, would impact transportation by increasing traffic from construction worker commuter trips and slowing traffic from heavy equipment transport. Standard safety procedures would be followed for transport of heavy equipment. Road access may temporarily be limited and would include consultation with local public utilities and transportation authorities in accordance with state and local laws.

4.20.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

Under the IPID Full Piping and Pump Exchange Project, some routine maintenance or inspection of infrastructure could be required. However, this is not expected to significantly impact traffic or transportation.

4.20.7 Mitigation Measures

This section describes mitigation measures to reduce short-term and long-term impacts identified throughout Section 4.20.

4.20.7.1 Short-term Impacts

Mitigation measures to reduce construction-related impacts on transportation would include using flaggers and signage and providing detour routes where possible and appropriate. Private access to properties would be maintained during construction activities. Advanced notice would be provided to wilderness users to minimize impacts of transportation on those users.

4.20.7.2 Long-term Impacts

For most of the alternatives, there would be no significant long-term impacts on transportation and no mitigation would be necessary. The Upper Klonaqua Lake Storage Enhancement Project under Alternative 4 would require inspection and maintenance trips in the Wilderness Area that do not currently occur. The impact of these inspection and maintenance trips would be reduced by coordinating them with trips that already occur to Lower Klonaqua Lake.

4.21 Cultural Resources (Archaeological, Ethnographic, and Historic Sites of Significance)

This section describes the potential short- and long-term impacts that could affect the resources identified in Section 3.21, Cultural Resources, from construction and operation related to the No-action Alternative and Program Alternatives.

4.21.1 No-action Alternative

4.21.1.1 Short-term Impacts

Under the No-action Alternative, various entities and agencies would undertake individual actions that could result in short-term impacts on cultural resources in the Icicle Creek Watershed project area. This is anticipated to entail construction of water diversion modifications, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure at the Alpine Lakes including the restoration of the Eightmile Lake Dam, and improvements to existing irrigation systems to support agricultural reliability. Short-term impacts would generally be associated with projects that require construction. Although impacts would occur as the result of construction, they would not be permanent. Cultural resources would be adversely affected if any of these activities disturbed or damaged archaeological sites, historic structures, or other important cultural properties.

Ground-disturbing activities can potentially damage archaeological resources that may be otherwise hidden below ground. Construction activities can alter or damage historic structures, such as buildings, to an extent that the culturally important features are compromised. Cultural properties may also include areas where activities have occurred or are occurring that contribute to the cultural identity of a group of people or that are a significant part of a unique historic event. Depending on the nature and extent of the construction activities, it is also possible to disrupt or damage the important features of cultural properties. Sites that are sacred to Indian tribes are addressed in Section 4.22, Indian Sacred Sites.

Although projects have the potential to affect cultural resources, various local, state, and federal laws and regulations protect sensitive cultural resources as described in Section 1.9, Related Permits, Actions, and Laws. Prior to construction, federal agencies taking actions on the projects would be required to ensure compliance with these regulations. Projects involving state capital funding would be required to comply with Governor's Executive Order 05-05, which requires consultation with DAHP, Bureau of Indian Affairs, and potentially affected Indian tribes as part of the decision to provide funds.

Compliance could result in the development of mitigation measures to reduce cultural resources impacts, such as conducting site-specific surveys and evaluations, minimizing ground-disturbing activities, stopping work if previously unknown cultural resources are uncovered, and compensating for any impacts that cannot be avoided (Section 4.21.7, Mitigation Measures). Therefore, short-term impacts under the No-action Alternative are not expected to be significant.

4.21.1.2 Long-term Impacts

As discussed above, any impacts with the potential to result in lasting damage to cultural resources would be addressed prior to construction. For the most part, the No-action Alternative is not expected to result in any additional changes that would adversely affect cultural resources. Operational and maintenance activities, particularly those that would result in any ground disturbance or additional modifications to sensitive resources could have a limited potential to result in cultural resources impacts. However, this chance would be low given that the activities would be affecting areas already evaluated as described above. Potential long-term impacts on sites sacred to Indian tribes are addressed in Section 4.22, Indian Sacred Sites.

4.21.2 Alternative 1

Implementation of Alternative 1 has the potential to result in both increased adverse and beneficial impacts to cultural resources compared with the No-action Alternative because there would be greater likelihood that multiple projects would be implemented and the scale of certain efforts would likely be greater. The following sections describe the short- and long-term impacts that would occur under Alternative 1.

4.21.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Under the Alpine Lakes Optimization, Modernization, and Automation Project, most of the work would occur in upland areas. Some limited work would occur within the lake shorelines but within the dry when the lakes are drawn down at the end of the summer. As discussed in Section 3.21, Cultural Resources, pedestrian surveys at Eightmile, Square, Klonaqua, and Colchuck Lakes revealed no archaeological sites along the passable section of the shoreline. The remainder of the area is too steep to traverse and unlikely to contain archaeological materials.

The majority of workers and equipment could be flown in, but IPID could also walk in some equipment via the Eightmile Lake Trail. No cultural resources were observed along the existing width of the trail that would be affected by this activity.

As discussed in Section 3.21, Cultural Resources, four of the five dams where construction activities are proposed are considered potentially eligible for listing in the NRHP. Eligibility is recommended because the facilities are associated with historically significant and controversial water management infrastructure in Chelan County. The facilities are unique in style and influenced by the extremely difficult terrain and constraints of mid-century construction methods, and they have the potential to yield data about early twentieth century engineering and construction.

Proposed construction activities at these lakes include mounting actuators on headgates where possible to remotely control operation. At some of the lakes, this could involve renovating or replacing some of the surrounding infrastructure, such as gates or pipes leading to and from the headgate, headwall, or housing. Electronic equipment would be powered by solar panel-charged batteries. These activities would occur at Eightmile, Square, Colchuck, Klonaqua, and Upper Snow/Nada Lakes.

If these activities altered any of the existing features such that the criteria listed above were no longer met, there would be a potential for a significant impact on these resources. More specifically, significant impacts could occur if any of the visible, historic components, such as the masonry dams, concrete headwalls, or headgate cranks, were removed or altered. These impacts could potentially be avoided, minimized, or mitigated by installing replacement structures that are consistent with historic components and by installing equipment on historic components. Replacing in the same location infrastructure that is not visible and is of unknown age, such as pipes running from headgates to release channels, would not significantly alter the structures and would therefore avoid potentially significant adverse impacts.

Impacts could also occur if equipment were placed on historic components in a manner that diminishes their integrity. These impacts could potentially be avoided, minimized, or mitigated by implementing mitigation measures. These could include placing removable equipment that does not damage the structures, provided the equipment is not visible (for example, inside an existing vault) or is designed to blend in with the existing structure, or placing equipment in the vicinity but not on the structures (for example, a solar panel in a nearby tree).

Activities at these lakes would require an inadvertent discovery plan and compliance with various local, state, and federal regulations that address in part the protection of cultural resources as described in Section 4.21.6, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

IPID Irrigation Efficiencies

Construction activities associated with this project include the conversion of irrigation canals to pipelines and lining of irrigation canals with concrete. Work within already disturbed areas, such as existing irrigation canals, is not likely to encounter archaeological resources.

These activities would require compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.6, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

COIC Irrigation Efficiencies and Pump Exchange

Construction activities associated with the COIC Efficiencies Project would result in short-term impacts similar to those described above with the exception of a new COIC pump station to be constructed along the shoreline of Icicle Creek or the Wenatchee River. Based on the analysis summarized in Section 3.21, Cultural Resources, there is a moderate to high potential for construction of the COIC pump station to encounter cultural resources along Icicle Creek or the Wenatchee River.

These activities would require an inadvertent discovery plan (IDP) and compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.6, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Domestic Conservation Efficiencies

Certain components of the Domestic Conservation Efficiencies Project, such as evaluating conservation-oriented rate structures and expanding conservation education, xeriscape, and rebate programs, would not result in any construction activities. Other activities, such as replacing leaky water mains and residential meters, could result in some minor construction activities, including the potential for ground disturbance. However, any ground work would occur in areas that were previously disturbed during construction of the initial plumbing and pipework. Therefore, the potential for any impacts on cultural resources would be low.

Eightmile Lake Storage Restoration

The Eightmile Lake Storage Restoration Project involves demolishing the existing dam, installing a new low-level outlet pipeline, and constructing new impoundment and water control structures to restore the maximum water storage level in the lake to an elevation of 4,671 feet and restore the accessible storage in the lake to the volume permitted by

IPID's water right (2,500 acre-feet). While most construction equipment (potentially including a small tracked excavator) and materials would likely be flown into the project site via helicopter, IPID is considering the option of walking in a larger tracked excavator or a spider excavator.

As noted previously, the water release system at Eightmile Lake is recommended for listing in the NRHP based on the criteria listed in Section 4.21.2.1, Short-term Impacts, Alpine Lakes Optimization, Modernization, and Automation. No cultural resources were observed along the margins of the lake or within the existing width of the trail to the project site.

Construction activity would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down. Construction would involve making improvements to and/or replacing failing infrastructure, including replacing the low-level outlet pipeline and possibly extending it further downstream, replacing the damaged headgate, and replacing the rock masonry, concrete, and embankment dam structure with a new concrete and embankment dam structure.

If improvements and additions are constructed in materials that are similar to the historically used materials, the potential impacts on cultural resources would likely be low. Because the project would completely replace much of the water release system, the potential impacts would likely be significant.

These activities would require an inadvertent discovery plan and compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Tribal Fishery Preservation and Enhancement

The focus of this project is to ensure that there would be no adverse effects on tribal fishing as a result of implementing other projects as part of the overall Icicle Strategy. The specifics of this project are not yet determined but would involve elements of restoration along the lower Icicle Creek that could result in localized construction-related ground disturbance. At this stage, the primary options under consideration include the construction of facilities such as plumbing needed to create a bubble curtain, a sprayer, or other modifications near the spillway in front of the LNFH to promote favorable fishing conditions.

Depending on the location and extent of any necessary ground disturbance, there is a potential for impacts on any previously undiscovered cultural resources. Generally speaking, any activities that occur within the water have a low potential to affect cultural

resources. However, any ground disturbance in upland areas would have a higher chance of encountering archaeological sites.

These activities would require compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Habitat Protection and Enhancement

The Habitat Protection and Enhancement Project could involve grading; planting and thinning vegetation; and hauling and placing logs, rock, soil, and other materials in or adjacent to lower Icicle Creek. Depending on the location and extent of any necessary ground disturbance, there is a potential for impacts on any previously undiscovered cultural resources. Generally speaking, any activities that occur within the water have a low potential to affect cultural resources. However, any ground disturbance in upland areas would have a higher chance of encountering archaeological sites.

These activities would require compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Instream Flow Rule Amendment

Cultural resources impacts are not anticipated to occur under the Instream Flow Rule Amendment project because it would not involve any construction work.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

As noted in Section 3.21, Cultural Resources, the LNFH is listed in the NRHP. Previous studies at the LNFH have indicated that it is located in an area that was previously an active part of the Icicle Creek channel but has now been filled and armored. Therefore, there is a low potential for archaeological resources to occur at this location.

The focus of this project is to implement improvements for water quality and water use efficiency. Some ground disturbance would occur as well as modifications to the facility.

Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential short-term impacts under NEPA would be completed once the full scope of the project is determined. If deemed necessary, compliance with these regulations could

result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of the existing LNFH instream structures in Icicle Creek as well as instream modifications to the Boulder Field near RM 5.6. This work would result in disturbances along the streambank and within Icicle Creek that would be addressed in subsequent environmental review and permitting once project specifics are determined.

Depending on the location and extent of any necessary ground disturbance, there is a potential for impacts on any previously undiscovered cultural resources. Generally speaking, any activities that occur within the water have a low potential to affect cultural resources. However, any ground disturbance in upland areas would have a higher chance of encountering archaeological sites.

These activities would require an inadvertent discovery plan and compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Fish Screen Compliance

This project involves replacing fish screens at three different diversions on lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Some ground-disturbing activities would likely be required.

Depending on the location and extent of any necessary ground disturbance, there is a potential for impacts on any previously undiscovered cultural resources. Generally speaking, any activities that occur within the water have a low potential to affect cultural resources. However, any ground disturbance in upland areas would have a higher chance of encountering archaeological sites.

These activities would require an inadvertent discovery plan and compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Water Markets

Cultural resources impacts are not anticipated to occur under the Water Markets Project because it would not involve any construction work.

4.21.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Similar to existing conditions and the No-action Alternative, some level of ongoing operations and maintenance activities would occur under this project; however, because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lakes would result in changes in how frequently the lakes are drawn down but would not result in any changes in the high or low levels. As noted in Section 3.18, Shorelines, increased frequency of withdrawals are not anticipated to result in increased erosion that could inadvertently expose buried cultural resources.

As noted above, this project would require compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

IPID Irrigation Efficiencies

As noted above, the IPID Irrigation Efficiencies Project would not involve ground disturbance in areas that are not already developed with existing irrigation facilities. Operation and maintenance activities of these facilities would have limited potential to result in long-term impacts on cultural resources.

COIC Irrigation Efficiencies and Pump Exchange

In general, the long-term impacts associated with the COIC Irrigation Efficiencies and Pump Exchange Project would be similar to those described for the IPID Irrigation Efficiencies Project with the exception of those related to the COIC pump station and intake facilities. These facilities would result in ground disturbance along lower Icicle Creek or the Wenatchee River and depending on the specific location could adversely affect cultural resources that may be present at the selected site. The potential for long-term impacts affecting cultural resources would be addressed prior to construction as described in greater detail in Section 4.21.7, Mitigation Measures.

Domestic Conservation Efficiencies

The Domestic Conservation Efficiencies Project involves evaluating conservation-oriented rate structures and expanding conservation education, xeriscape, and rebate programs, which would not affect cultural resources. After completing any elements involving construction, such as fixing leaky water mains and replacing residential meters, operation and maintenance activities affecting these facilities are expected to be less than what would occur with existing conditions and the No-action Alternative. As noted in 4.21.2.1, Short-term Impacts, any ongoing work in these areas would have a very low potential for encountering cultural resources.

Eightmile Lake Storage Restoration

Similar to existing conditions and the No-action Alternative, some level of ongoing operations and maintenance activities would occur under the Eightmile Lake Storage Restoration Project; however, because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lake would allow the lake to rise to approximately 4 feet higher than the current high level to match the historical high water surface elevation. The lake would typically be full, to the new high water surface elevation, for less than a month in early summer. It would also allow for the lake to be drawn down to approximately 22.4 feet below the existing low. As noted in Section 3.18, Shorelines, these changes are not anticipated to result in increased erosion and therefore would not be expected to inadvertently expose buried cultural resources.

As noted above, this project would require compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Tribal Fishery Preservation and Enhancement

As noted in 4.21.2.1, Short-term Impacts, the specifics of this project are not yet determined, but could involve some minor new facilities along Icicle Creek, near the LNFH. It is not anticipated that operation and maintenance activities would result in any new or ongoing impacts on cultural resources; however, as noted above, this project would require compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination

with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Habitat Protection and Enhancement

As noted in 4.21.2.1, Short-term Impacts, the specifics of this project are not yet determined, but would include restoration and enhancement activities that are not likely to include new facilities that would require any ongoing operation or maintenance activities. As noted above, this project would require compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Instream Flow Rule Amendment

The Instream Flow Rule Amendment Project involves an administrative change to the instream flow rule to allow for additional water withdrawals to occur in the Icicle Creek Subbasin if certain conditions are met and would not result in any long-term changes that would affect cultural resources.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

As noted in 4.21.2.1, Short-term Impacts, the specifics of this project are not yet determined, but would involve some modifications to the LNFH. Operation and maintenance activities would occur within the facilities and would be likely to affect cultural resources over the long term; however, as noted above, because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential impacts under NEPA would be completed once the full scope of the project is determined. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with Reclamation, USFWS, DAHP, and other affected parties if applicable. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek, as well as instream modifications to the Boulder Field near RM 5.6. After completing any elements involving construction, operation and maintenance activities would occur within areas already developed and would have limited potential to result in impacts on cultural resources.

Fish Screen Compliance

The Fish Screen Compliance Project involves replacing fish screens at three different diversions on lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID.

After completing any elements involving construction, operation and maintenance activities would occur within areas already developed and would have limited potential to result in impacts on cultural resources. Additionally, these activities are expected to be less than what currently occurs or would occur under the No-action Alternative and therefore would not result in long-term impacts on cultural resources.

Water Markets

The Water Markets Project involves the creation of a market system with the intention of increasing water availability within the Icicle Creek Subbasin and would not result in any long-term changes that would affect cultural resources.

4.21.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Impacts associated with other project elements proposed under Alternative 2 are discussed under Alternative 1.

4.21.3.1 Short-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project would involve constructing a new pump station and intake facilities on the bank of the Wenatchee River near the town of Dryden to deliver water to the IPID canals and possibly a new re-regulation pond. Based on the analysis summarized in Section 3.21, Cultural Resources, there is a moderate to high potential for construction of the IPID pump exchange facilities to encounter cultural resources, depending on the site that is selected.

These activities would require an inadvertent discovery plan and compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

4.21.3.2 Long-term Impacts

IPID Dryden Pump Exchange

As noted above, the IPID Dryden Pump Exchange Project would construct an IPID pump station on the Wenatchee River and possibly a re-regulation pond. Operation and maintenance activities of these facilities would take place within developed areas and would have limited potential to result in long-term impacts on cultural resources.

4.21.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 Project would be included while the Eightmile Lake Storage Restoration Project would not. This section describes the specific short- and long-term impacts associated with the Legislative Change Creating OCPI Authority for Alternative 3 Project. Impacts associated with other projects proposed under this alternative are discussed in Alternative 1 and Alternative 2.

4.21.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

There are no construction activities proposed under this project and therefore no potential short-term impacts on cultural resources are expected.

4.21.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

If the proposed Legislative Change Creating OCPI Authority Project for Alternative 3 Project were enacted, there could be potential conflicts with instream flow allocations; however, these changes would not have the potential to affect cultural resources.

4.21.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1 with the exception that the Eightmile Lake Storage Enhancement Project would replace the Eightmile Lake Storage Restoration Project, and the Upper Klonaqua Lake and Upper and Lower Snow Lakes Storage Enhancement Projects would be included. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.21.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

The Eightmile Lake Storage Enhancement Project would involve demolishing the existing dam, installing new piping, and constructing new impoundment and water control structures that would allow for an increase in the accessible storage at Eightmile Lake to 3,500 acre-feet. The spillway elevation would be raised to allow for storage at a higher level (4,682 feet) than current or historical water storage levels and the project would allow for additional draw down of the lake.

As noted previously, the water release system at Eightmile Lake is recommended for listing in the NRHP based on the criteria listing in Section 4.21.2.1, Short-term Impacts, Alpine Lakes Optimization, Modernization, and Automation. No cultural resources were

observed along the margins of the lake or within the existing width of the trail to the project site.

Construction activity would occur along the banks and within the dry areas of the lake margins once the lake has been drawn down. Construction would involve making improvements to and/or replacing failing infrastructure, including replacing the low-level outlet pipeline and possibly extending it further downstream, replacing the damaged headgate, and replacing the rock masonry, concrete, and embankment dam structure with a new concrete and embankment dam structure. Because the project would completely replace much of the water release system, the potential impacts would likely be significant.

These activities would require an inadvertent discovery plan and compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.6, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Upper Klonaqua Lake Storage Enhancement

The Upper Klonaqua Lake Storage Enhancement Project would likely include ground disturbance in an area that has not been surveyed for archaeological resources at Upper Klonaqua Lake. Depending on the location and extent of any necessary ground disturbance, there is a low to moderate potential to encounter any previously undiscovered cultural resources.

As noted previously, the water release system at Klonaqua Lake is recommended for listing in the NRHP based on the criteria listing in Section 4.21.2.1, Short-term Impacts, Alpine Lakes Optimization, Modernization, and Automation; however, there is no irrigation infrastructure at the Upper Lake where construction activities are proposed and therefore no potential for construction to result in adverse impacts on this resource.

In addition, these activities would require an inadvertent discovery plan and compliance with various local, state, and federal regulations that address in part the protection of cultural resources as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Upper and Lower Snow Lakes Storage Enhancement

This project would likely include modification of existing dam structures at Upper and Lower Snow Lakes. The structures have not been recorded, and it is not known whether they would contribute to either the LNFH or the potential Alpine Lakes Irrigation

Historic District. If they do, then project activities have the potential to result in a significant adverse effect on this resource.

The area has also not been surveyed for other archaeological resources. Depending on the location and extent of any necessary ground disturbance, there is a low to moderate potential to encounter any previously undiscovered cultural resources.

This project would require an inadvertent discovery plan and compliance with various local, state, and federal regulations, including NEPA, which would address the protection of cultural resources as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

4.21.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Similar to existing conditions and the No-action Alternative, some level of ongoing activities would occur for operations and maintenance under the Eightmile Lake Storage Enhancement Project; however, because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lake would allow the lake to rise to approximately 15 feet higher than the current high and 11 feet higher than the historical high water level. The lake would operate full to the new high water level for less than a month in early summer. It would also allow for the lake to be drawn down to approximately 24.4 feet below the existing low. As noted in Section 3.18, Shorelines, these changes are not anticipated to result in increased erosion and therefore would not be expected to inadvertently expose buried cultural resources.

As noted above, this project would require compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Upper Klonaqua Lake Storage Enhancement

Compared to existing conditions and the No-action Alternative, some level of ongoing activities would occur for operations and maintenance under the Upper Klonaqua Lake Storage Enhancement Project; however, these activities would focus on maintaining and

operating the new facilities and are not expected to result in any substantial changes to the structures or ground disturbance.

Re-operation of the lake would allow Upper Klonaqua Lake to be lowered approximately 20 feet, which would likely occur for 1 to 2 months in the late summer. There would be no changes at Lower Klonaqua Lake. As noted in Section 3.18, Shorelines, these changes are not anticipated to result in increased erosion and therefore would not be expected to inadvertently expose buried cultural resources.

In addition, this project would require compliance with various local, state, and federal regulations that address the protection of cultural resources as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

Upper and Lower Snow Lakes Storage Enhancement

Similar to existing conditions and the No-action Alternative, some level of ongoing activities would occur for operations and maintenance under the Upper and Lower Snow Lakes Storage Enhancement Project; however, because the facilities would be newer and operated remotely by USFWS, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lakes would allow both lakes to rise to approximately 5 feet higher than the current high level and 3 feet lower than the current low level. As noted in Section 3.18, Shorelines, these changes are not anticipated to result in increased erosion and therefore would not be expected to inadvertently expose buried cultural resources.

In addition, this project would require compliance with various local, state, and federal regulations, including NEPA, which address the protection of cultural resources as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

4.21.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange project would be included.

4.21.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

The IPID Full Piping and Pump Exchange project would involve fully replacing the IPID canal systems with a pressurized pump delivery system and constructing three intake and pump station facilities on the Wenatchee River. Existing surface water diversion facilities on Icicle and Peshastin Creeks could be removed. Based on the analysis summarized in Section 3.21, Cultural Resources, there is a moderate to high potential for construction of the IPID pump station facilities to encounter cultural resources within the IPID service area, especially along the Wenatchee River or lower Icicle Creek.

These activities would require an inadvertent discovery plan and compliance with various local, state, and federal regulations that address in part the protection of cultural resources, as described in Section 4.21.7, Mitigation Measures. If deemed necessary, compliance with these regulations could result in the development of mitigation measures to reduce cultural resources impacts in coordination with DAHP. With implementation of appropriate mitigation, this project is not anticipated to result in any significant impacts on cultural resources.

IPID Full Piping and Pump Exchange Project

As noted above, the IPID Full Piping and Pump Exchange project would construct three pump stations on the Wenatchee River, as well as fully replace the existing IPID canal system with a pressurized pipeline. Operation and maintenance activities of the pump facilities would take place within developed areas and would have limited potential to result in long-term impacts on cultural resources.

4.21.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.21.7.1 Short-Term Impacts

The Icicle Strategy would be required to comply with the Guiding Principles, which includes ensuring the suite of selected projects does not result in significant adverse impacts on tribal resources. In addition, federal actions and projects receiving state capital funds require coordination with potentially affected Indian tribes.

Continued coordination is ongoing and the potential for cultural resources to be affected would be addressed during project-level review. In the event of potential short-term impacts, the following types of mitigation measures may be implemented.

- Conduct tribal outreach to identify potentially affected cultural and tribal resources and avoid potential access conflicts or permanent changes adversely affecting these resources to the extent feasible.

- Limit the timing of construction activities with the potential to disturb use of affected cultural and tribal resources.
- Document the historic infrastructure before it is altered or removed.
- Compensate for potential disturbance to affected cultural and tribal resources as appropriate.

4.21.7.2 Long-term Impacts

As discussed above, any impacts with the potential to result in lasting damage to cultural resources would be addressed prior to construction.

4.22 Indian Sacred Sites

This section describes the potential short- and long-term impacts that could affect the resources identified in Section 3.22, Indian Sacred Sites, from construction and operation related to the No-action Alternative and Program Alternatives.

4.22.1 No-action Alternative

4.22.1.1 Short-term Impacts

Under the No-action Alternative, various entities and agencies would undertake individual actions that have the potential to affect sacred sites that may be present in the Icicle Creek Watershed project area. The No-action Alternative would include construction of water diversion modifications, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure at the Alpine Lakes including the restoration of the Eightmile Lake Dam, and improvements to existing irrigation systems to support agricultural reliability.

Construction activities can disturb sacred sites by resulting in increased noise, dust, or activity that conflicts with the use of the sacred site. Construction could also result in physical changes that can disrupt or conflict with the sacred or ceremonial use. The extent of the impact would depend on the specific uses at the site and the nature and extent of the construction activity.

Prior to construction, project proponents would be required to ensure compliance with regulations related to sacred sites as described in Section 1.9, Related Permits, Actions, and Laws. Compliance could result in the development of mitigation measures to reduce impacts, such as minimizing disruptive activities, implementing timing restrictions on the activities, and compensating for any impacts that cannot be avoided (Section 4.22.7, Mitigation Measures).

4.22.1.2 Long-term Impacts

Any impacts with the potential to result in lasting damage to sacred sites would be addressed prior to construction. For the most part, the No-action Alternative is not expected to result in any additional changes that would adversely affect sacred sites over the long term. Operational and maintenance activities, particularly those that would result in any ground disturbance or additional modifications to sensitive resources could have a limited potential to result in impacts. The potential would be low given that the activities would be affecting areas already evaluated as described above.

4.22.2 Alternative 1

Implementation of Alternative 1 has the potential to result in both increased adverse and beneficial impacts on sacred sites compared with the No-action Alternative because there would be greater likelihood that multiple projects would be implemented and the scale of certain efforts would likely be greater. Compliance with the Guiding Principles addresses tribal resources in general by improving instream flows, improving the sustainability of LNFH, protecting tribal and non-tribal harvest, and enhancing Icicle Creek riparian habitat. In addition, federal actions and projects receiving state capital funds require coordination with potentially affected Indian tribes. The following sections describe the short- and long-term impacts that would occur under Alternative 1.

4.22.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

As noted in Section 3.21, Cultural Resources, historically, there has been relatively limited study of the project site for cultural activities related to sacred sites because of its remoteness. As noted in Section 3.22, Indian Sacred Sites, no sacred sites have been formally identified with the Alpine Lakes Optimization, Modernization, and Automation Project sites.

Most of the work would occur in upland areas. Some limited work would occur within the lake shorelines but within the dry when the lakes are drawn down at the end of the summer. This work is expected to have a low potential to result in short-term impacts of any sacred sites. Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

IPID Irrigation Efficiencies

Construction activities associated with this project include the conversion of irrigation canals to pipelines and lining of irrigation canals with concrete. This work would occur within already developed areas and has a low likelihood of disturbing sacred sites. Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review.

Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

COIC Irrigation Efficiencies and Pump Exchange

Construction activities associated with COIC Efficiencies would be similar to those described for the IPID Irrigation Efficiencies project with the exception of a new COIC pump station to be constructed along the shoreline of Icicle Creek or the Wenatchee River. Depending on the specific location and the presence of any sacred sites, there is a potential for this project to result in short-term impacts. Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Domestic Conservation Efficiencies

Certain components of the Domestic Conservation Efficiencies Project, such as evaluating conservation-oriented rate structures and expanding conservation education, xeriscape, and rebate programs, would not result in any construction activities. Other activities, such as replacing leaky water mains and residential meters, could result in some minor construction activities, including the potential for ground disturbance. However, any ground work would occur in areas that were previously disturbed during construction of the initial plumbing and pipework. Therefore, the potential for any impacts on sacred sites would be very low.

Eightmile Lake Storage Restoration

As noted in Section 3.21, Cultural Resources, historically, there has been relatively limited study of the Eightmile Lake Storage Restoration Project site for cultural activities related to sacred sites because of its remoteness. As noted in Section 3.22, Indian Sacred Sites, no sacred sites have been formally identified within the project site.

Construction activities for this project would be largely limited to the dry lake margins and existing structures and is expected to have a low potential to result in short-term impacts of any sacred sites. Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Tribal Fishery Preservation and Enhancement

The specifics of this project are not yet determined but could involve some minor new facilities along Icicle Creek near the LNFH. Depending on the specifics of this project, there is a potential that construction activity could affect Indian sacred sites in the short term.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Habitat Protection and Enhancement

The specifics of the Habitat Protection and Enhancement Project are not yet determined, but would likely involve some construction activity, including grading; planting and thinning vegetation; and hauling and placing logs, rock, soil, and other materials in or adjacent to lower Icicle Creek. Depending on the specifics of this project, there is a potential that construction activity could affect Indian sacred sites in the short term.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Instream Flow Rule Amendment

The Instream Flow Rule Amendment Project would not involve any construction activities, physical changes, or disturbance in the short term and would therefore not result in any short-term impacts on Indian sacred sites.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

The focus of this project is to implement improvements for water quality and water use efficiency. Some ground disturbance would occur as well as modifications to the facility. Most activity is anticipated to occur within the boundaries of the hatchery; however, there would be some construction activities along lower Icicle Creek.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential short-term impacts under NEPA would be completed once the full scope of the project is determined. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek as well as instream modifications to the Boulder Field near RM 5.6. This work would result in disturbances along the streambank and within Icicle Creek.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review.

Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Fish Screen Compliance

The Fish Screen Compliance Project involves replacing fish screens at three different diversions on Lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Some ground-disturbing activities would likely be required.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Water Markets

The Water Markets Project would not involve any construction activities, physical changes, or disturbance in the short-term and would therefore not result in any short-term impacts on sacred sites.

4.22.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Similar to existing conditions and the No-action Alternative, some level of ongoing operations and maintenance activities would occur under the Alpine Lakes Optimization, Modernization, and Automation Project; however, because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lakes would result in changes in how frequently the lakes are drawn down but would not result in any changes in the high or low levels. As noted in Section 3.18, Shorelines, increased frequency of withdrawals are not anticipated to result in increased erosion that would significantly alter the shoreline.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

IPID Irrigation Efficiencies

As noted above, the IPID Irrigation Efficiencies Project would not involve ground disturbance in areas that are not already developed with existing irrigation facilities. Operation and maintenance activities of these facilities would have limited potential to result in long-term impacts adversely affecting Indian sacred sites.

COIC Irrigation Efficiencies and Pump Exchange

In general, the long-term impacts associated with the COIC Irrigation Efficiencies and Pump Exchange Project would be similar to those described for the IPID Irrigation Efficiencies Project with the exception of those related to the COIC pump station and intake facilities. These facilities would result in new facilities along lower Icicle Creek or the Wenatchee River and depending on the specific location could adversely affect sacred sites that may be present at the selected site. Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Domestic Conservation Efficiencies

The Domestic Conservation Efficiencies Project involves evaluating conservation-oriented rate structures and expanding conservation education, xeriscape, and rebate programs, which would have a very low potential to affect sacred sites. After completing any elements involving construction, such as fixing leaky water mains and replacing residential meters, operation and maintenance activities affecting these facilities are expected to be less than what would occur with existing conditions and the No-action Alternative.

Eightmile Lake Storage Restoration

Similar to existing conditions and the No-action Alternative, some level of ongoing operations and maintenance activities would occur under the Eightmile Lake Storage Restoration Project; however, because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lake would allow the lake to rise to approximately 4 feet higher than the current high level, which would occur for less than a month in early summer. It would also allow for the lake to be drawn down to approximately 22.4 feet below the existing low. As noted in Section 3.18, Shorelines, increased frequency of withdrawals are not anticipated to result in increased erosion and therefore would not be expected to inadvertently expose buried cultural resources.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Tribal Fishery Preservation and Enhancement

As noted above, the specifics of the Tribal Fishery Preservation and Enhancement Project are not yet determined but could involve some minor new facilities along Icicle Creek

near the LNFH. It is not anticipated that operation and maintenance activities would result in any new or ongoing impacts on Indian sacred sites.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Habitat Protection and Enhancement

The specifics of the Habitat Protection and Enhancement Project are not yet determined but would include restoration and enhancement activities that are not likely to include new facilities that would require any ongoing operation or maintenance activities. There would be limited potential for long-term impacts affecting Indian sacred sites.

Instream Flow Rule Amendment

The Instream Flow Rule Amendment Project involves an administrative change to the Instream Flow Rule to allow for additional water withdrawals to occur on Icicle Creek if certain conditions are met.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

As noted above, the specifics of this project are not yet determined, but would involve some modifications to the LNFH. Operation and maintenance activities would occur within the facilities and would not be likely to affect sacred sites over the long term.

Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential impacts under NEPA would be completed once the full scope of the project is determined. Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Fish Passage Improvements

As noted above, the specifics of the Fish Passage Improvements Project are not yet determined but could involve some minor new facilities along Icicle Creek near the LNFH. It is not anticipated that operation and maintenance activities would result in any new or ongoing impacts on sacred sites. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Fish Screen Compliance

As noted above, the specifics of the Fish Screen Compliance Project are not yet determined but would involve replacing fish screens along Icicle Creek. It is not anticipated that operation and maintenance activities would result in any new or ongoing impacts on sacred sites. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Water Markets

The Water Markets Project is expected to result in beneficial impacts for increased water availability within the Icicle Creek Subbasin and is not expected to adversely affect Indian sacred sites.

4.22.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. Compliance with the Guiding Principles addresses tribal resources in general by improving instream flows, improving the sustainability of LNFH, protecting tribal and non-tribal harvest, and enhancing Icicle Creek riparian habitat. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Impacts of other projects proposed under Alternative 2 are discussed under Alternative 1.

4.22.3.1 Short-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project involves construction of a new IPID pump station and intake facilities on the Wenatchee River. Depending on the specific location in relation to any sacred sites, there is a potential that construction activity could affect that sacred site in the short term. Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

4.22.3.2 Long-term Impacts

IPID Dryden Pump Exchange

As noted above, the IPID Dryden Pump Exchange Project would construct an IPID pump station on the Wenatchee River and possibly a re-regulation pond. Operation and maintenance activities of these facilities would take place within developed areas and would have limited potential to result in long-term impacts on Indian sacred sites.

4.22.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 Project needed to allow for permitting additional domestic supplies would be included while the Eightmile Lake Storage Restoration Project would not. Compliance with the Guiding Principles addresses tribal resources in general by improving instream flows, improving the sustainability of LNFH, protecting tribal and non-tribal harvest, and enhancing Icicle Creek riparian habitat. This section describes the specific short- and long-term impacts associated with the Legislative Change Creating OCPI Authority for Alternative 3 Project. Impacts of other projects proposed under this Alternative are discussed under Alternative 1 and Alternative 2.

4.22.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

There are no construction activities proposed under this project and therefore no potential short-term impacts on Indian sacred sites.

4.22.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

If the proposed Legislative Change Creating OCPI Authority for Alternative 3 Project were enacted, there could be potential conflicts with instream flow allocations. Under the proposed changes, junior domestic water rights could be exercised even when the Instream Flow Rule is not met.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

4.22.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1 with the exception that the Eightmile Lake Storage Enhancement project would replace the Eightmile Lake Storage Restoration project, and the Upper Klonaqua Lake and Upper and Lower Snow Lakes Storage Enhancement Projects would be included. Compliance with the Guiding Principles addresses tribal resources in general by improving instream flows, improving the sustainability of LNFH, protecting tribal and non-tribal harvest, and enhancing Icicle Creek riparian habitat. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.22.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

As noted in Section 3.21, Cultural Resources, historically, there has been relatively limited study of the project site for cultural activities related to sacred sites because of its remoteness. As noted in Section 3.22, Indian Sacred Sites, no sacred sites have been formally identified with the Eightmile Lake Storage Enhancement Project site.

Construction activities for this project would be largely limited to the dry lake margins and existing structures and is expected to have a low potential to result in short-term impacts of any sacred sites. Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.6, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Upper Klonaqua Lake Storage Enhancement

As noted in Section 3.21, Cultural Resources, historically, there has been relatively limited study of the project site for cultural activities related to sacred sites because of its remoteness. As noted in Section 3.22, Indian Sacred Sites, no sacred sites have been formally identified with the Upper Klonaqua Lake Storage Enhancement Project site.

Construction activities for this project would be largely limited to the dry lake margins and existing structures and is expected to have a low potential to result in short-term impacts of any sacred sites. Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Upper and Lower Snow Lakes Storage Enhancement

As noted in Section 3.21, Cultural Resources, historically, there has been relatively limited study of the project site for cultural activities related to sacred sites because of its remoteness. As noted in Section 3.22, Indian Sacred Sites, no sacred sites have been formally identified with the Upper and Lower Snow Lakes Storage Enhancement Project site.

Construction activities for this project would be largely limited to the dry lake margins and existing structures and is expected to have a low potential to result in short-term impacts of any sacred sites. Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

4.22.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Similar to existing conditions and the No-action Alternative, some level of ongoing activities would occur for operations and maintenance under the Eightmile Lake Storage Enhancement Project; however, because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lake would allow the lake to rise to approximately 15 feet higher than the current high level and 11 feet higher than the historical high water levels. The lake would operate full to the new high water level for less than a month in early summer. It would also allow for the lake to be drawn down to approximately 24.4 feet below the existing low. As noted in Section 3.18, Shorelines, increased frequency of withdrawals are not anticipated to result in increased erosion and therefore would not be expected to inadvertently expose buried cultural resources.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Upper Klonaqua Lake Storage Enhancement

Compared to existing conditions and the No-action Alternative, some level of ongoing activities would occur for operations and maintenance under the Upper Klonaqua Lake Storage Enhancement Project; however, these activities would focus on maintaining and operating the new facilities and are not expected to result in any substantial changes to the structures or ground disturbance.

Re-operation of the lake would allow Upper Klonaqua Lake to be lowered approximately 20 feet, which would likely occur for 1 to 2 months in the late summer. There would be no changes at Lower Klonaqua Lake. As noted in Section 3.18, Shorelines, these changes are not anticipated to result in increased erosion and therefore would not be expected to inadvertently expose buried cultural resources.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

Upper and Lower Snow Lakes Storage Enhancement

Similar to existing conditions and the No-action Alternative, some level of ongoing activities would occur for operations and maintenance under the Upper and Lower Snow Lakes Storage Enhancement; however, because the facilities would be newer and

operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lakes would allow both lakes to rise to approximately 5 feet higher than the current high level and 3 feet lower than the current low. As noted in Section 3.18, Shorelines, these changes are not anticipated to result in increased erosion and therefore would not be expected to inadvertently expose buried cultural resources.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review, which would include NEPA. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

4.22.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange project would be included.

4.22.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange Project

The IPID Full Piping and Pump Exchange project involves construction of three new pump stations and intake facilities on the Wenatchee River, and fully replacing the existing IPID canal delivery system with a pressurized pipeline. Depending on the specific location in relation to any sacred sites, there is a potential that construction or ground disturbing activity could affect that sacred site in the short term. Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

4.22.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange Project

As noted above, the Full Project would construct three new pump stations on the Wenatchee River and replace the existing canal delivery system. Operation and maintenance activities of the pump stations would take place within developed areas and would have limited potential to result in long-term impacts on Indian sacred sites.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for sacred sites to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.22.7, Mitigation Measures, would ensure any potential impacts on Indian sacred sites are addressed.

4.22.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.22.7.1 Short-Term Impacts

As noted in Section 1.2, The Icicle Strategy Guiding Principles, the Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring the suite of selected projects does not result in significant adverse impacts on tribal harvest, among other things. In addition, federal actions and projects receiving state capital funds require coordination with potentially affected Indian tribes.

Continued coordination is ongoing and the potential for Indian sacred sites to be affected would be addressed during project-level review. In the event of potential short-term impacts, the following types of mitigation measures could be implemented.

- Conduct tribal outreach to identify potentially affected cultural and tribal resources, including sacred sites, and avoid potential access conflicts or permanent changes adversely affecting sacred sites to the extent feasible.
- Limit the timing of construction activities with the potential to disturb use of affected cultural and tribal resources, including sacred sites.
- Compensate for potential disturbance to affected cultural and tribal resources, including sacred sites as appropriate.

4.22.7.2 Long-term Impacts

As discussed above, any impacts with the potential to result in lasting damage to sacred sites would be addressed prior to construction.

4.23 Indian Trust Assets and Fishing Harvest

This section describes the potential short- and long-term impacts that could affect the resources identified in Section 3.23, Indian Trust Assets and Fishing Harvest, from construction and operation related to the No-action Alternative and Program Alternatives. Potential impacts on water quality are addressed in Section 4.5, Water Quality. Potential impacts on fish and special-status species are addressed in Sections 4.7, Fish, and 4.10, Threatened and Endangered Species, respectively. Any impacts to land-based ITAs such as reservation lands or Native Allotments would require review by the Bureau of Indian Affairs (BIA). Impacts to resource-based ITAs such as treaty-protected fisheries rights would require negotiation between the Indian tribe and the State of Washington. Projects involving state capital funding would also be required to comply with Governor's

Executive Order 05-05, which requires consultation with potentially affected Indian tribes as part of the decision to provide funds.

4.23.1 No-action Alternative

4.23.1.1 Short-term Impacts

Under the No-action Alternative, various entities and agencies would undertake individual actions that have the potential to affect ITAs that may be present in the Icicle Creek Watershed project area. The No-action Alternative would include construction of water diversion modifications, general habitat enhancement projects, LNFH improvements, required fish screening upgrades, modernization of infrastructure at the Alpine Lakes including the restoration of the Eightmile Lake Dam, and improvements to existing irrigation systems to support agricultural reliability.

Construction activities can disturb ITAs by blocking access to the resource, including any Usual & Accustomed fishing areas, such as occur near the LNFH plunge pool, or by resulting in other environmental impacts that can degrade the ITAs, such as water quality impacts adversely affecting fish. Water quality impacts are addressed in Section 4.5, Water Quality.

Prior to construction, federal agencies taking action on the projects would be required to ensure compliance with the regulations specific to the protection of ITAs described in Section 1.9, Related Permits, Actions, and Laws. Any impacts to land-based ITAs such as reservation lands or Native Allotments would require review by the Bureau of Indian Affairs (BIA). Impacts to resource-based ITAs such as treaty-protected fisheries rights would require negotiation between the Indian tribe and the State of Washington. Projects involving state capital funding would also be required to comply with Governor's Executive Order 05-05, which requires consultation with potentially affected Indian tribes as part of the decision to provide funds.

Compliance could result in the development of mitigation measures to reduce impacts, such as minimizing disruptive activities, implementing timing restrictions on construction activities, and compensating for any impacts that cannot be avoided (see Section 4.23.7, Mitigation Measures).

4.23.1.2 Long-term Impacts

Any impacts with the potential to result in lasting damage to ITAs would be addressed prior to construction through the compliance processes described above. For the most part, the No-action Alternative is not expected to result in any additional changes that would adversely affect ITAs over the long term because most of the affected facilities already exist, would not be located in areas where ITAs exist, or would have already been evaluated prior to construction as described above. Potential long-term impacts on sites sacred to Indian tribes are addressed in Section 4.22, Indian Sacred Sites.

4.23.2 Alternative 1

Implementation of Alternative 1 has the potential to result in an increase in impacts on tribal resources compared with the No-action Alternative because there would be greater likelihood that multiple projects would be implemented and the scale of certain efforts would likely be greater. Compliance with the Guiding Principles addresses tribal resources in general by improving instream flows, improving the sustainability of LNFH, protecting tribal and non-tribal harvest, and enhancing Icicle Creek riparian habitat. The following sections describe the short- and long-term impacts that would occur under Alternative 1.

4.23.2.1 Short-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

As noted in Section 3.23, Indian Trust Assets and Fishing Harvest, no ITAs have been formally identified within the Alpine Lakes Optimization, Modernization, and Automation Project sites and no tribal fish harvest is known to occur at the project site. However, coordination with the Confederated Tribes and Bands of the Yakama Indian Nation (YN) and Confederated Tribes of the Coleville Reservation (CTCR) is ongoing with the intention of minimizing the potential for impacts on any ITAs.

Most of the work would occur in upland areas. Some limited work would occur within the lake shorelines but within the dry when the lakes are drawn down at the end of the summer. This work is expected to have a low potential to result in short-term impacts on any ITAs. The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review.

IPID Irrigation Efficiencies

Construction activities associated with the IPID Irrigation Efficiencies Project include the conversion of irrigation canals to pipelines and lining of irrigation canals with concrete. This work would occur within already developed areas and has a low likelihood of disturbing ITAs, including tribal fish harvest. The Icicle Creek Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

COIC Irrigation Efficiencies and Pump Exchange

Construction activities associated with the COIC Irrigation Efficiencies and Pump Exchange Project would be similar to those described above with the exception of a new COIC pump station to be constructed along the shoreline of Icicle Creek or the Wenatchee River. Depending on the specific location of the pump station, there is a potential for

construction activities to disturb ITAs, including tribal fish harvest, in the short term. Potential impacts on fish in general are addressed in Section 4.7, Fish.

The Icicle Creek Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Domestic Conservation Efficiencies

Certain components of the Domestic Conservation Efficiencies Project, such as evaluating conservation-oriented rate structures and expanding conservation education, xeriscape, and rebate programs, would not result in any construction activities. Other activities, such as replacing leaky water mains and residential meters, could result in some minor construction activities, including the potential for ground disturbance. However, any groundwork would occur in areas that were previously disturbed during construction of the initial plumbing and pipework. Therefore, the potential for any impacts on ITAs would be low.

Eightmile Lake Storage Restoration

As noted in Section 3.23, Indian Trust Assets and Fishing Harvest, no ITAs have been formally identified with the Eightmile Lake Storage Restoration Project site and no tribal fish harvest occurs at the project site. However, coordination with the YN and CTCR is ongoing with the intention of minimizing the potential for impacts on any ITAs.

Construction activities for this project would be largely limited to the dry lake margins and existing structures and is expected to have a low potential to result in short-term impacts of any ITAs.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Tribal Fishery Preservation and Enhancement

The specifics of the Tribal Fishery Preservation and Enhancement Project are not yet determined but could involve some minor new facilities along Icicle Creek near the LNFH. Depending on the specifics of this project, there is a potential that construction activity could affect ITAs, including potential disruption of fishing activities, in the short term. The potential impacts on fish in general are addressed in Section 4.7, Fish. The overall project is intended to preserve ITAs in accordance with the Guiding Principles.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued

coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Habitat Protection and Enhancement

The specifics of the Habitat Protection and Enhancement Project are not yet determined, but would likely involve some construction activity, including grading; planting and thinning vegetation; hauling and placing logs, rock, soil, and other materials; and some in-water work on lower Icicle Creek. Depending on the specifics of this project, there is a potential that construction activity could affect ITAs, including potential disruption of fishing activities, in the short term. The potential impacts on fish in general are addressed in Section 4.7, Fish.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Instream Flow Rule Amendment

The Instream Flow Rule Amendment Project would not involve any construction activities or physical changes or disturbance in the short-term and would therefore not result in any short-term impacts on ITAs.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

The focus of this project is to implement improvements for water quality and water use efficiency at the LNFH. Some ground disturbance would occur as well as modifications to the facility. Most activity is anticipated to occur within the boundaries of the hatchery; however, there would be some construction activities along lower Icicle Creek. Depending on the specifics of this project, there is a potential for construction activity to affect ITAs, including disruption of fishing activities, in the short term. The potential impacts on fish in general are described in Section 4.7, Fish.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review. Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential short-term impacts under NEPA would be completed once the full scope of the project is determined, which could include the development of mitigation measures, such as are listed in Section 4.23.6, Mitigation Measures.

Fish Passage Improvements

The Fish Passage Improvements Project would potentially involve modification of existing LNFH instream structures in Icicle Creek as well as instream modifications to the Boulder Field near RM 5.6. This work would result in disturbances along the streambank and within Icicle Creek. Depending on the specifics of this project, there is a potential for construction activity to affect ITAs, including disruption of fishing activities, in the short term. The potential impacts on fish in general are described in Section 4.7, Fish.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Fish Screen Compliance

The Fish Screen Compliance Project involves replacing fish screens at three different diversions on Lower Icicle Creek: LNFH/COIC, the City of Leavenworth, and IPID. Some ground-disturbing activities would likely be required. Depending on the specifics of this project, there is a potential for construction activity to affect ITAs, including disruption of fishing activities, in the short term. The potential impacts on fish in general are described in Section 4.7, Fish.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Water Markets

The Water Markets Project would not involve any construction activities, physical changes, or disturbance in the short term and would therefore not result in any short-term impacts on ITAs.

4.23.2.2 Long-term Impacts

Alpine Lakes Optimization, Modernization, and Automation

Similar to existing conditions and the No-action Alternative, some level of ongoing operations and maintenance activities would occur under the Alpine Lakes Optimization, Modernization, and Automation Project; however, because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lakes would result in changes in how frequently the lakes are drawn down but would not result in any changes in the high or low levels. As noted in Sections

3.11, Aesthetics, and 3.18, Shorelines, increased frequency of withdrawals are not anticipated to result in substantial visual changes or increased erosion that would significantly alter the shoreline. Therefore, the potential for long-term impacts affecting any ITAs that might occur within this area is low.

As noted in Section 4.7, Fish, there is a potential for impacts on fish as the result of increased flows in lower Icicle Creek. These impacts could include some localized changes in habitat, increased competition between fish for any limiting resources, and some genetic mixing within otherwise distinct populations of the same species; however, the overall impacts are anticipated to be beneficial for fish and for related fisheries, including those supporting tribal harvest.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation and monitoring measures, such as are listed in Section 4.23.7, Mitigation Measures.

IPID Irrigation Efficiencies

As noted in Section 4.23.2.1, Short-term Impacts, the IPID Irrigation Efficiencies Project would not result in the development of new facilities. Operation and maintenance activities of existing facilities would have limited potential to result in long-term impacts adversely affecting ITAs or fish harvest.

As discussed in greater detail in Section 4.7, Fish, this project would result in changes to instream flows that have a potential to alter the distribution of fish within lower Icicle Creek. These changes may affect tribal fishing. As part of the overall Icicle Strategy, efforts to characterize the impacts of the managed flows on fish species are ongoing. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs and tribal fishing to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.23.7, Mitigation Measures, would ensure any potential impacts are addressed.

COIC Irrigation Efficiencies and Pump Exchange

In general, the long-term impacts associated with the COIC Irrigation Efficiencies and Pump Exchange Project would be similar to those described for the IPID Irrigation Efficiencies Project with the exception of those related to the COIC pump station and intake facilities. These facilities would result in new facilities along lower Icicle Creek or the Wenatchee River, and depending on the specific location could adversely affect ITAs and tribal fishing. Continued coordination with potentially affected Indian tribes is ongoing and the potential for these resources to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.23.7, Mitigation Measures, would ensure any potential impacts are adequately addressed.

Domestic Conservation Efficiencies

The Domestic Conservation Efficiencies Project involves evaluating conservation-oriented rate structures and expanding conservation education, xeriscape, and rebate programs, which are not expected to affect ITAs. After completing any elements involving construction, such as fixing leaky water mains and replacing residential meters, operation and maintenance activities affecting these facilities are expected to be less than what would occur with existing conditions and the No-action Alternative.

Eightmile Lake Storage Restoration

Similar to existing conditions and the No-action Alternative, some level of ongoing operations and maintenance activities would occur under the Eightmile Lake Storage Restoration Project; however, because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lake would allow the lake to rise to approximately 4 feet higher than the current high level, which would occur for less than a month in early summer. It would also allow for the lake to be drawn down to approximately 22.4 feet below the existing low. As noted in Sections 3.11, Aesthetics, and 3.18, Shorelines, increased frequency of withdrawals are not anticipated to result in substantial visual changes or increased erosion that would significantly alter the shoreline. Therefore, the potential for long-term impacts affecting any ITAs that might occur within this area is low.

As noted in Section 4.7, Fish, there is a potential for impacts on fish as the result of flow changes in lower Icicle Creek. These impacts could include some localized changes in habitat, increased competition between fish for any limiting resources, and some genetic mixing within otherwise distinct populations of the same species; however, the overall impacts are anticipated to be beneficial for fish and for related fisheries, including those supporting tribal harvest. The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.6, Mitigation Measures.

Tribal Fishery Preservation and Enhancement

As noted above, the specifics of the Tribal Fishery Preservation and Enhancement Project are not yet determined but could involve some minor new facilities along Icicle Creek near the LNFH. It is not anticipated that operation and maintenance activities would result in any new or ongoing impacts on ITAs.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs

to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Habitat Protection and Enhancement

The specifics of the Habitat Protection and Enhancement Project are not yet determined but would include restoration and enhancement activities that are not likely to include new facilities that would require any ongoing operation or maintenance activities. There would be limited potential for long-term impacts affecting ITAs.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Instream Flow Rule Amendment

This project involves an administrative change to the Instream Flow Rule to allow for additional water withdrawals to occur on Icicle Creek if certain conditions are met.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Leavenworth National Fish Hatchery Conservation and Water Quality Improvements

As noted above, the specifics of this project are not yet determined, but would involve some modifications to the LNFH. Operation and maintenance activities would occur within the facilities and would not be likely to affect ITAs over the long term.

Because this facility is owned by Reclamation and operated by USFWS, an evaluation of the potential impacts under NEPA would be completed once the full scope of the project is determined. The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Fish Passage Improvements

As noted above, the specifics of the Fish Passage Improvements Project are not yet determined but could involve some minor new facilities along Icicle Creek near the LNFH. It is not anticipated that operation and maintenance activities would result in any new or ongoing impacts on ITAs. The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Fish Screen Compliance

As noted in 4.23.2.1, Short-term Impacts, the specifics of the Fish Screen Compliance Project are not yet determined but would involve replacing fish screens along Icicle Creek. It is not anticipated that operation and maintenance activities would result in any new or ongoing impacts on ITAs. The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Water Markets

The Water Markets Project is expected to result in beneficial impacts for increased water availability within the Icicle Creek Subbasin and is not expected to adversely affect ITAs.

4.23.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project. Impacts of other projects are discussed in Alternative 1.

4.23.3.1 Short-term Impacts

IPID Dryden Pump Exchange

The IPID Dryden Pump Exchange Project involves construction of a new IPID pump station and intake facilities on the Wenatchee River. Depending on the specifics of this project, there is a potential that construction activity could affect ITAs, including fishing harvest, in the short term.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued

coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

4.23.3.2 Long-term Impacts

IPID Dryden Pump Exchange

As noted above, the IPID Dryden Pump Exchange Project would construct an IPID pump station on the Wenatchee River and possibly a re-regulation pond. Operation and maintenance activities of these facilities would take place within developed areas and would have limited potential to result in long-term impacts on ITAs.

4.23.4 Alternative 3

Alternative 3 would result in the implementation of many of the same projects included in Alternative 2 with the exception that the Legislative Change Creating OCPI Authority for Alternative 3 Project would be included while the Eightmile Lake Storage Restoration Project would not. This section describes the specific short- and long-term impacts associated with the Legislative Change Creating OCPI Authority for Alternative 3 Project.

4.23.4.1 Short-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

There are no construction activities proposed under this project and therefore no potential short-term impacts on ITAs.

4.23.4.2 Long-term Impacts

Legislative Change Creating OCPI Authority for Alternative 3

If the proposed Legislative Change Creating OCPI Authority for Alternative 3 Project were enacted, there could be potential conflicts with instream flow allocations. Under the proposed changes, junior domestic water rights could be exercised even when the Instream Flow Rule is not met.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

4.23.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1 with the exception that the Eightmile Lake Storage Enhancement Project would replace the Eightmile Lake Storage Restoration Project, and the Upper Klonaqua Lake and Upper and Lower Snow Lakes Storage Enhancement Projects would be

included. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.23.5.1 Short-term Impacts

Eightmile Lake Storage Enhancement

As noted in Section 3.23, Indian Trust Assets and Fishing Harvest, no ITAs have been formally identified with the Eightmile Lake Storage Enhancement Project site and no tribal fish harvest occurs at the project site. However, coordination with the YN and CTCR is ongoing with the intention of minimizing the potential for impacts on any ITAs.

Construction activities for this project would be largely limited to the dry lake margins and existing structures and is expected to have a low potential to result in short-term impacts of any ITAs.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Upper Klonaqua Lake Storage Enhancement

As noted in Section 3.23, Indian Trust Assets and Fishing Harvest, no ITAs have been formally identified with the Upper Klonaqua Lake Storage Enhancement Project site and no tribal fish harvest occurs at the project site. However, coordination with the YN and CTCR is ongoing with the intention of minimizing the potential for impacts on any ITAs.

Construction activities for this project would be largely limited to the dry lake margins and existing structures and is expected to have a low potential to result in short-term impacts of any ITAs.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Upper and Lower Snow Lakes Storage Enhancement

As noted in Section 3.23, Indian Trust Assets and Fishing Harvest, no ITAs have been formally identified with the Upper and Lower Snow Lakes Storage Enhancement Project site and no tribal fish harvest occurs at the project site. However, coordination with the YN and CTCR is ongoing with the intention of minimizing the potential for impacts on any ITAs.

Construction activities for this project would be largely limited to the dry lake margins and existing structures and is expected to have a low potential to result in short-term impacts of any ITAs.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

4.23.5.2 Long-term Impacts

Eightmile Lake Storage Enhancement

Similar to existing conditions and the No-action Alternative, some level of ongoing operations and maintenance activities would occur under the Eightmile Lake Storage Enhancement project; however, because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lake would allow the lake to rise to approximately 15 feet higher than the current high level and 11 feet higher than the historical high water level. The lake would operate full to the new high water level for less than a month in early summer. It would also allow for the lake to be drawn down to approximately 24.4 feet below the existing low.

As noted in Sections 3.11, Aesthetics, and 3.18, Shorelines, increased frequency of releases are not anticipated to result in substantial visual changes or increased erosion that would significantly alter the shoreline. Therefore, the potential for long-term impacts affecting any ITAs that might occur within this area is low.

As noted in Section 4.7, Fish, there is a potential for impacts on fish as the result of flow changes in lower Icicle Creek. These impacts could include some localized changes in habitat, increased competition between fish for any limiting resources, and some genetic mixing within otherwise distinct populations of the same species; however, the overall impacts are anticipated to be beneficial for fish and for related fisheries, including those supporting tribal harvest. The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation and monitoring measures, such as are listed in Section 4.23.7, Mitigation Measures.

Upper Klonaqua Lake Storage Enhancement

Compared to existing conditions and the No-action Alternative, some level of ongoing activities would occur for operations and maintenance under the Upper Klonaqua Lake Storage Enhancement Project; however, these activities would focus on maintaining and operating the new facilities and are not expected to result in any substantial changes to the structures or ground disturbance.

Re-operation of the lake would allow Upper Klonaqua Lake to be lowered approximately 20 feet, which would likely occur for 1 to 2 months in the late summer. There would be no changes at Lower Klonaqua Lake. As noted in Sections 3.11, Aesthetics, and 3.18, Shorelines, increased frequency of withdrawals are not anticipated to result in substantial visual changes or increased erosion that would significantly alter the shoreline. Therefore, the potential for long-term impacts affecting any ITAs that might occur within this area is low.

As noted in Section 4.7, Fish, there is a potential for impacts on fish as the result of flow changes in lower Icicle Creek. These impacts could include some localized changes in habitat, increased competition between fish for any limiting resources, and some genetic mixing within otherwise distinct populations of the same species; however, the overall impacts are anticipated to be beneficial for fish and for related fisheries, including those supporting tribal harvest. The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

Upper and Lower Snow Lakes Storage Enhancement

Similar to existing conditions and the No-action Alternative, some level of ongoing activities would occur for operations and maintenance under the Upper and Lower Snow Lakes Storage Enhancement Project; however, because the facilities would be newer and operated remotely by IPID, any trips to and from the lakes or activities needed to maintain the facilities are expected to be less frequent and extensive than what would occur compared to existing conditions and the No-action Alternative.

Re-operation of the lakes would allow both lakes to rise to approximately 5 feet higher than the current high level and 3 feet lower than the current low. As noted in Sections 3.11, Aesthetics, and 3.18, Shorelines, increased frequency of withdrawals are not anticipated to result in substantial visual changes or increased erosion that would significantly alter the shoreline. Therefore, the potential for long-term impacts affecting any ITAs that might occur within this area is low.

As noted in Section 4.7, Fish, there is a potential for impacts on fish as the result of flow changes in lower Icicle Creek. These impacts could include some localized changes in habitat, increased competition between fish for any limiting resources, and some genetic

mixing within otherwise distinct populations of the same species; however, the overall impacts are anticipated to be beneficial for fish and for related fisheries, including those supporting tribal harvest. The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures.

4.23.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange project would be included.

4.23.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

The IPID Full Piping and Pump Exchange project involves construction of new pump stations and intake facilities on the Wenatchee River. This project would also fully replace the IPID canal systems with a pressurized pipeline delivery system. Depending on the specifics of this project, there is a potential that construction activity could affect ITAs, mainly fishing harvest, in the short term.

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on tribal harvest. Continued coordination with potentially affected Indian tribes is ongoing and the potential for ITAs to be affected would be addressed during project-level review, which could include the development of mitigation measures, such as are listed in Section 4.23.7, Mitigation Measures. Potential impacts on fish in general are addressed in Section 4.7, Fish.

4.23.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

As noted above, the IPID Full Piping and Pump Exchange Project would construct three new pump stations on the Wenatchee River and replace the entire existing IPID canal delivery system with a pressurized pipeline. Operation and maintenance activities of the pump stations would take place within developed areas and would have limited potential to result in long-term impacts on ITAs.

Continued coordination with potentially affected Indian tribes is ongoing and the potential for these resources to be affected would be addressed during project-level review. Compliance with the regulations as discussed in Section 4.23.7, Mitigation Measures, would ensure any potential impacts are adequately addressed.

4.23.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.23.7.1 Short-Term Impacts

The Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring the suite of selected projects does not result in significant adverse impacts on tribal harvest. In addition, federal actions and projects receiving state capital funds require coordination with potentially affected Indian tribes.

Continued coordination is ongoing and the potential for ITAs to be affected would be addressed during project-level review. In the event of potential short-term impacts, the following types of mitigation measures could be implemented.

- Conduct tribal outreach to identify potentially affected cultural and tribal resources, including ITAs, and avoid potential access conflicts or permanent changes adversely affecting ITAs to the extent feasible.
- Limit the timing of construction activities with the potential to disturb use of affected cultural and tribal resources, including ITAs.
- Compensate for potential disturbance to affected cultural and tribal resources, including ITAs as appropriate.

4.23.7.2 Long-term Impacts

As discussed above, any impacts with the potential to result in lasting conflicts or damage to ITAs would be addressed prior to construction.

- Adaptive monitoring of the Tribal Harvest as project implementation occurs.

4.24 Socioeconomics

This section describes the potential short- and long-term impacts that could affect the resources identified in Section 3.24, Socioeconomics, from construction and operation related to the No-action Alternative and Program Alternatives.

Although a cost-benefit analysis is not required by the State Environmental Policy Act, one may be completed to aid in the consideration of environmentally different Program Alternatives and has, therefore, been completed to provide additional decision-making information. To this end, Ecology's Office of Economic and Regulatory Research completed an analysis of anticipated costs and benefits, using the Washington State OFM 2007 Input/Output Model for the No-Action Alternative and Alternatives 1 through 4.

The analysis need not be displayed in monetary terms when there are important qualitative considerations (WAC 197-11-726). Although the OFM modeling did not include Alternative 5, the discussion of costs and benefits presented below does address the relative socioeconomic impacts of Alternative 5 in qualitative terms.

Results from the Office of Financial Management (OFM) 2007 Input/Output Model are presented in Table 4-5. Inputs to the model, such as construction costs, are preliminary estimates to be refined as the project elements are more fully developed and designed. For this reason, the model results are most useful for comparing the costs and benefits of the Program Alternatives rather than providing an absolute value of costs or benefits. The output categories include the total number of jobs created, the corresponding labor income, and the related long-term economic impact of the increase in spending and jobs. Outputs also include the number of additional households that would be served by increased domestic water supply afforded under each Program Alternative, the associated increase in land value as the result of development, and the corresponding increases in property tax revenue that would be generated as the result of the additional households. These results are more fully described in the sections that follow for each Program Alternative.

Table 4-5
OFM 2007 Input/Output Model Results for Costs and Benefits Associated with Program Alternatives

	Construction Costs[1]	Job Creation	Labor Income	Long-term Economic Impact	Additional Households Served by Increased Domestic Water Supply	Increase in Land Value Associated with Additional Households	Increase in Property Tax Revenue Associated with Additional Households
Alternative 1	$43.7 M	514	$29.2 M	$100.4 M	10,076	$1,312.6 M	$1.6 M
Alternative 2	$49.0 M	576	$32.7 M	$112.5 M	10,076	$1,312.6 M	$1.6 M
Alternative 3	$47.8 M	562	$32.0 M	$109.9 M	5,709	$743.7 M	$0.9 M
Alternative 4	$45.2 M*	531	$30.2 M	$103.8 M	12,473	$1,624.8 M	$2.0 M
Alternative 5[2]	$43.7 M +	514 +	$29.2 M +	$100.4 M +	10,076	$1,312.6 M	$1.6 M

Source: Washington State Department of Ecology
[1] OFM model input based on assumed costs of construction. Not a model output. Construction costs were estimated based on previous studies and do not include additional contingencies added for Wilderness-related construction described in Table 4-9, which provides a more conservative estimate of construction benefits.
[2]The costs and benefits of Alternative 5 are unknown at this point but are expected to be great than Alternative 1. This is because Alternative 5 includes the same projects as Alternative 1, but IPID Irrigation Efficiency project is replaced by the IPID Full Piping and Pump Exchange project. Construction costs and instream flow benefits will be greater for the IPID Fulling Piping and Pump Exchange project.
*Construction costs unavailable for Upper Klonaqua Lake Storage Enhancement Project because it is currently in the conceptual stage.
M = million
OFM = Washington State Office of Financial Management

In addition to the OFM analysis, biologists with Ecology analyzed the anticipated net increases in wild steelhead (*Oncorhynchus mykiss*) and hatchery fish for the Icicle Creek Reach 2. The number of returning fish was based on several factors, including the anticipated instream flow increases described in Sections 2.5, 2.6, 2.7, and 2.8, and the expected escapement and stock size. The analysis further assumes that the fish would return to their natal streams over a period of 20 years. A per-fish value of $7,200 was assigned, based on Layton et al.'s research *Valuing Programs to Improve Multi-Species Fisheries* (Layton et al., 1999). As with the results from the OFM 2007 Input/Output Model, the findings presented in Table 4-6 are most useful when considered as the basis for a relative comparison. Additional increases in fish populations beyond those presented in Table 4-6 are anticipated to occur within the Wenatchee River.

Table 4-6
Assumed Fish Increases for Each Program Alternative

	Wild Steelhead	Hatchery Fish	Total Value of Fish Increases
Alternative 1	50	28	$561,600
Alternative 2	54	31	$612,000
Alternative 3	49	28	$554,400
Alternative 4	51	29	$576,000
Alternative 5	69	39	$777,600

4.24.1 No-action Alternative

Under the No-action Alternative, projects could be developed and executed on their own that would lead to some job creation, labor income, long-term economic impacts, increased housing and growth, changes in land values, and additional property tax revenue. However, there would be no coordinated and integrated effort to ensure that the projects move forward in a well-planned manner. Because implementation of individual projects would be more localized, the socioeconomic benefits are expected to be lower compared to the other Program Alternatives.

4.24.2 Alternative 1

Relative to the other Program Alternatives, Alternative 1 would result in the lowest construction costs, job creation, labor income, and long-term economic impact. Job creation and the long-term economic impact reflect the cycles of spending and earning in the economy as the initial construction investment works its way through the economy. Essentially, construction spending provides a jump-start to broader economic growth.

As increased water becomes available for future land development and growth, additional housing is expected to be developed. Alternative 1 ranks in the middle regarding the

number of households likely to increase as a result and in the middle with respect to the expected increase in land value and property tax revenue associated with development.

Based on the amount of water made available that would benefit fish, Alternative 1 would result in the second lowest increase in fish.

4.24.3 Alternative 2

Alternative 2 is assumed to have the highest construction costs, and, therefore, is expected to result in the highest job creation, labor income, and long-term economic impact compared to the other Program Alternatives. These results could change once construction costs for Upper Klonaqua Lake Storage Enhancement can be estimated for Alternatives 4 and 5. Construction costs for that project were not available at the time of this analysis.

Alternative 2 provides for the same increase as Alternative 1 in the number of households likely to be supported by the increase in domestic water supply, and by extension, the same increase in land value and property tax revenue. Both are in the middle range compared to the other Program Alternatives.

The anticipated fish increases are greater than Alternatives 1, 3, and 4, but less than Alternative 5.

4.24.4 Alternative 3

Construction costs, job creation, labor income, and long-term economic impact with Alternative 3 are higher than Alternatives 1 and 4, but less than Alternative 2[1] and most likely Alternative 5. The increase in households related to increased domestic water supply and associated increases in land value and property tax revenue are approximately half of what is anticipated with Alternatives 1 and 2. This decline in the number of additional households by comparison is likely due to the fact that Alternative 3 would require adoption of a legislative change to allow for some additional water to be withdrawn to support future growth, meaning water available for future development would be more limited. Because less water is available to meet domestic needs, there would be less growth in the number of households expected under Alternative 3.

The increases in the number of and overall value of fish would be lowest.

4.24.5 Alternative 4

Alternative 4 is assumed to have greater construction costs, and therefore, higher job creation, labor income, and long-term economic impact than Alternative 1, but less than

[1] As noted previously, costs associated with Alternative 3 may be less than Alternative 4 after incorporation of construction costs for the Upper Klonaqua Lake Storage Enhancement Project, which were not available at the time of this analysis.

Alternatives 2, 3, and 5 although it is possible that construction costs and job creation associated with Alternative 4 could be close to the highest overall after incorporation of construction costs for the Upper Klonaqua Lake Storage Enhancement Project; however, this information was not available at the time of this analysis. In terms of the domestic water supply, Alternative 4 provides for the greatest increase in households served and the associated increases in land value and property tax overall. It also provides for the third greatest increase in the number and value of fish just below Alternatives 2 and 5.

4.24.6 Alternative 5

Although this information was not available at the time this EIS was published, Alternative 5 is expected to have the highest construction costs of all the Program Alternatives because the cost of the IPID Full Piping and Pump Exchange Project alone is $72.5 to $83.7 million. The higher the costs of construction, the greater the job creation, labor income, and long-term economic impact. Alternative 5 is also expected to result in the greatest increase in fish for the Icicle Reach 2 of all the Program Alternatives.

4.25 Environmental Justice

This section considers the potential to disproportionately affect minority and low-income populations, as described in Section 3.25, Environmental Justice, from construction and operation related to the No-action Alternative and Program Alternatives.

Environmental justice impacts occur when significant environmental impacts disproportionately affect minority or low-income populations. To determine the potential for environmental justice impacts, this analysis first assesses the presence of populations or important resources to these populations within the Icicle Creek Watershed project area.

As noted in Section 3.25, Environmental Justice, U.S. Census Bureau data do not indicate the presence of minority or low-income populations in a substantially greater proportion compared to Chelan County or the State of Washington. However, as discussed in Sections 3.21, Cultural Resources; 3.22, Indian Sacred Sites; and 3.23, Indian Trust Assets and Fishing Harvest, there are important cultural and tribal resources that are especially important resources to the Confederated Tribes and Bands of the Yakama Nation and Confederated Tribes of the Colville Reservation. These Indian tribes are both members of the IWG and preliminary information has been gathered during initial project planning and early coordination with these Indian tribes. Ongoing coordination through the IWG and subsequent project-level permitting and review, including formal environmental justice assessments for any federal actions, would occur through program implementation. Accordingly, the analysis in this section focuses on the potential for the

Icicle Strategy to result in significant impacts on cultural and tribal resources as discussed in greater detail below.

4.25.1 No-action Alternative

4.25.1.1 Short-term Impacts

In the short term, environmental justice impacts would occur if construction significantly disturbed cultural or tribal resources. Depending on the extent of ground disturbance, construction activities could damage any archaeological resources or sacred sites that may be present. Construction can also disturb or conflict with ceremonial uses, ITAs, and use of any Usual & Accustomed Areas, including tribal fishing harvest.

Under the No-action Alternative, the greatest potential for environmental justice impacts would be related to projects involving work in areas with high archaeological potential as noted in Section 3.21, Cultural Resources, or within or near waterways in areas that could directly or indirectly conflict with tribal fishing as noted in Section 3.23, Indian Trust Assets and Fishing Harvest.

As noted previously, prior to construction, federal agencies taking action on the projects would be required to ensure compliance with the regulations specific to the protection of ITAs described in Section 1.9, Related Permits, Actions, and Laws. Any impacts to land-based ITAs such as reservation lands or Native Allotments would require review by the BIA. Impacts to resource-based ITAs such as treaty-protected fisheries rights would require negotiation between the Indian tribe and the State of Washington. Projects involving state capital funding would also be required to comply with Governor's Executive Order 05-05, which requires consultation with potentially affected Indian tribes as part of the decision to provide funds.

Compliance could result in the development of mitigation measures to reduce impacts, such as minimizing disruptive activities, implementing timing restrictions on construction activities, and compensating for any impacts that cannot be avoided (Section 4.25.7, Mitigation Measures).

4.25.1.2 Long-term Impacts

The greatest potential for environmental justice impacts would occur for any projects resulting in long-term operations and maintenance activities that could conflict with tribal uses, including sacred or ceremonial sites, ITAs, or tribal fishing harvest. These impacts would be primarily related to any new or upgraded facilities, affecting flow changes, or long-term access to fishing areas. Under the No-action Alternative, the projects likely to be implemented are expected to improve aquatic habitat, which would benefit tribal fishing; however, work at the LNFH or any new facilities along Icicle Creek could result in potential long-term conflicts with tribal fishing. As noted previously, compliance with applicable local, state, and federal regulations would require addressing potential impacts on these resources (Section 4.25.7, Mitigation Measures).

4.25.2 Alternative 1

Implementation of Alternative 1 has the potential to result in greater impacts on cultural and tribal resources, and, therefore, environmental justice impacts, compared with the No-action Alternative, because there would be higher likelihood that certain projects would be implemented and the scale of certain efforts would likely be greater. Compliance with the Guiding Principles addresses tribal resources in general by improving instream flows, improving the sustainability of LNFH, protecting tribal and non-tribal harvest, and enhancing Icicle Creek riparian habitat. The following sections describe the short- and long-term impacts that would occur under Alternative 1.

4.25.2.1 Short-term Impacts

Implementation of Alternative 1 would result in an increase in the potential for short-term impacts on cultural and tribal resources compared to the No-action Alternative. Under Alternative 1, there is a moderate to low potential for significant short-term impacts on cultural and tribal resources at Eightmile Lake (primarily associated with changes to the dam structure), at the LNFH, and at other locations, not yet determined, along the lower Icicle Creek. Depending on the specific location for the COIC pump station, potential impacts could also occur along the Wenatchee River.

Depending on the specific location and extent of the activities, construction disturbance in these areas could adversely affect any sacred or ceremonial sites or ITAs if the activities altered important features of these resources or directly disturbed their use. Construction activities within or along the shoreline of Icicle Creek could also alter the quality of fishing habitat, directly harm or disturb fish, or block access to fishing areas.

As noted in Section 1.2, The Icicle Strategy Guiding Principles, the Icicle Strategy would be required to comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on cultural and tribal resources. Continued coordination with potentially affected Indian tribes is ongoing and the potential for tribal resources to be affected would be addressed during project-level review. With implementation of mitigation as described in Section 4.25.7, Mitigation Measures, the potential for significant environmental justice impacts in the short term would be low.

4.25.2.2 Long-term Impacts

Because potential impacts resulting in the direct damage or disturbance of cultural or tribal resources, including sacred sites, ceremonial uses, or ITAs, would largely be addressed during project-level permitting prior to construction, the greatest potential for long-term environmental justice impacts would occur as the result of operation and maintenance activities, including long-term flow changes affecting Icicle Creek, that could adversely affect tribal fishing.

As noted in Section 4.7, Fish, implementation of the projects being considered under Alternative 1 would generally result in beneficial impacts on fish and by extension, tribal fishing; however, there is the potential for some of the projects to result in localized

impacts on tribal fishing over the long term. Specifically, operation and maintenance activities at LNFH and the management of releases from the Alpine Lakes by IPID and USFWS could result in changes to aquatic habitat and fishing conditions within lower Icicle Creek over time.

In recognition of these potential impacts, the Icicle Strategy would comply with the Guiding Principles, which include ensuring there are no significant adverse impacts on cultural and tribal resources. Additionally, implementation of Alternative 1 includes the Tribal Fishery Preservation and Enhancement Project to ensure that any long-term impacts on tribal fishing are appropriately mitigated. Continued coordination with potentially affected Indian tribes is ongoing and the potential for tribal resources to be affected would be addressed during project-level review. With implementation of mitigation as described in Section 4.25.7, Mitigation Measures, the potential for significant environmental justice impacts in the long term would be low.

4.25.3 Alternative 2

Alternative 2 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project would be included while the Alpine Lakes Optimization, Modernization, and Automation Project would not. Compliance with the Guiding Principles addresses tribal resources in general by improving instream flows, improving the sustainability of LNFH, protecting tribal and non-tribal harvest, and enhancing Icicle Creek riparian habitat. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project and describes the primary differences in impacts from not implementing the Alpine Lakes Optimization, Modernization, and Automation Project compared to Alternative 1 and the No-action Alternative.

4.25.3.1 Short-term Impacts

The potential impacts on cultural and tribal resources would be similar to those described under Alternative 1 with the exception that there would be no modernization of facilities at Colchuck, Upper Klonaqua, Square, Nada, and Upper and Lower Snow Lakes. Therefore, the relatively low potential to adversely affect cultural or tribal resources at these lakes would not occur. By comparison, Alternative 2 would result in a slightly increased potential for disturbing archaeological resources and possibly tribal fishing along the Wenatchee River. The overall likelihood is considered to be moderate and the degree of the impact would depend on the specific location of the IPID Dryden pump exchange.

Similar to Alternative 1, Alternative 2 would require complying with the Guiding Principles, which include ensuring there are no significant adverse impacts on cultural and tribal resources. Continued coordination with potentially affected Indian tribes would continue and the potential for tribal resources to be affected would be addressed during project-level review. With implementation of mitigation as described in Section 4.25.7,

Mitigation Measures, the potential for significant environmental justice impacts in the short term would be low.

4.25.3.2 Long-term Impacts

Over the long term, the potential for impacts on cultural or tribal resources would be similar to Alternative 1. Under Alternative 2, the majority of the projects are the same with the exception that there would be an additional new facility, the IPID Dryden Pump Exchange Project, constructed on the Wenatchee River. This would result in a slightly increased potential for long-term impacts on tribal fishing compared to Alternative 1, depending on the specific location of the facilities.

Similar to Alternative 1, Alternative 2 would require complying with the Guiding Principles, which include ensuring there are no significant adverse impacts on cultural and tribal resources. Additionally, implementation of Alternative 1 includes the Tribal Fishery Preservation and Enhancement Project to ensure that any long-term impacts on tribal fishing are appropriately mitigated. Continued coordination with potentially affected Indian tribes would continue and the potential for tribal resources to be affected would be addressed during project-level review. With implementation of mitigation as described in Section 4.25.7, Mitigation Measures, the potential for significant environmental justice impacts in the long term would be low.

4.25.4 Alternative 3

Alternative 3 would result in implementation of many of the same projects included in Alternative 1 with the exception that the IPID Dryden Pump Exchange Project and the Legislative Change Creating OCPI Authority for Alternative 3 Project would also be included, while the Alpine Lakes Optimization, Modernization, and Automation and Eightmile Lake Storage Restoration Projects would not. Compliance with the Guiding Principles addresses tribal resources in general by improving instream flows, improving the sustainability of LNFH, protecting tribal and non-tribal harvest, and enhancing Icicle Creek riparian habitat. This section describes the specific short- and long-term impacts associated with the IPID Dryden Pump Exchange Project and the Legislative Change Creating OCPI Authority for Alternative 3 Project and describes the primary differences in impacts from not implementing the Alpine Lakes Optimization, Modernization, and Automation or Eightmile Lake Storage Restoration Projects compared to Alternative 1 and the No-action Alternative.

4.25.4.1 Short-term Impacts

The potential impacts on cultural and tribal resources at the Alpine Lakes would be lower compared with Alternative 1 because there would no activities proposed at any of the lakes under Alternative 3. Potential impacts along Icicle Creek and the Wenatchee River corridors would generally be the same as Alternative 2 except for a slight potential increase to result in impacts related to construction of the IPID Dryden Pump Exchange Project.

Alternative 3 would also be implemented in compliance with the Guiding Principles, which include ensuring there are no significant adverse impacts on cultural and tribal resources. Continued coordination with potentially affected Indian tribes would continue and the potential for tribal resources to be affected would be addressed during project-level review. With implementation of mitigation as described in Section 4.25.7, Mitigation Measures, the potential for significant environmental justice impacts in the short term would be low.

4.25.4.2 Long-term Impacts

Over the long term, the potential for impacts on cultural or tribal resources would be slightly greater compared to Alternative 1. This is because Alternative 3 would require implementing the Legislative Change Creating OCPI Authority for Alternative 3 Project to ensure there was adequate future water for municipal users over the long term. If implemented, this change could result in the withdrawal of additional water from Icicle Creek that could potentially conflict with minimum instream flows, resulting in adverse impacts on aquatic habitat in general, including possible adverse impacts on tribal fishing.

Alternative 3 would also be implemented in compliance with the Guiding Principles, which include ensuring there are no significant adverse impacts on cultural and tribal resources. Additionally, implementation of Alternative 1 includes the Tribal Fishery Preservation and Enhancement Project to ensure that any long-term impacts on tribal fishing are appropriately mitigated. Continued coordination with potentially affected Indian tribes would continue and the potential for tribal resources to be affected would be addressed during project-level review. With implementation of mitigation as described in Section 4.25.7, Mitigation Measures, the potential for significant environmental justice impacts in the long term would be low.

4.25.5 Alternative 4

Alternative 4 would result in implementation of many of the same projects included in Alternative 1. The Eightmile Lake Storage Restoration Project would be replaced with the Eightmile Lake Storage Enhancement Project, and the Upper Klonaqua Lake and Upper and Lower Snow Lakes Storage Enhancement Projects would be included. Compliance with the Guiding Principles addresses tribal resources in general by improving instream flows, improving the sustainability of LNFH, protecting tribal and non-tribal harvest, and enhancing Icicle Creek riparian habitat. This section describes the specific short- and long-term impacts associated with these projects compared to Alternative 1 and the No-action Alternative.

4.25.5.1 Short-term Impacts

The potential for short-term impacts on cultural and tribal resources at the Alpine Lakes would be greater under Alternative 4 compared to Alternative 1. This is because there would be more extensive construction disturbance at Eightmile, Upper Klonaqua, and

Upper and Lower Snow Lakes under this Program Alternative. The potential for disturbance of cultural or tribal resources along Icicle Creek or the Wenatchee River would be the same as Alternative 1.

Alternative 4 would also be implemented in compliance with the Guiding Principles, which include ensuring there are no significant adverse impacts on cultural and tribal resources. Continued coordination with potentially affected Indian tribes would continue and the potential for tribal resources to be affected would be addressed during project-level review. With implementation of mitigation as described in Section 4.25.7, Mitigation Measures, the potential for significant environmental justice impacts in the short term would be low.

4.25.5.2 Long-term Impacts

Over the long term, the potential for impacts on cultural or tribal resources would be similar to Alternative 1. Alternative 4 would also be implemented in compliance with the Guiding Principles, which include ensuring there are no significant adverse impacts on cultural and tribal resources. Additionally, implementation of Alternative 1 includes the Tribal Fishery Preservation and Enhancement Project to ensure that any long-term impacts on tribal fishing are appropriately mitigated. Continued coordination with potentially affected Indian tribes would continue and the potential for tribal resources to be affected would be addressed during project-level review. With implementation of mitigation as described in Section 4.25.7, Mitigation Measures, the potential for significant environmental justice impacts in the long-term would be low.

4.25.6 Alternative 5

Alternative 5 would result in implementation of the same projects as Alternative 1 except instead of the IPID Irrigation Efficiencies, the IPID Full Piping and Pump Exchange project would be included.

4.25.6.1 Short-term Impacts

IPID Full Piping and Pump Exchange

The potential impacts on cultural and tribal resources would be greater compared to those under Alternative 1. This is because Alternative 5 would result in an increased potential for disturbing archaeological resources related to full piping of the IPID conveyance system and at three pump station locations along the Wenatchee River.

Alternative 5 would require compliance with the Guiding Principles, which include ensuring there are no significant adverse impacts on cultural and tribal resources. Continued coordination with potentially affected Indian tribes would continue and the potential for tribal resources to be affected would be addressed during project-level review. With implementation of mitigation as described in Section 4.25.7, Mitigation Measures, the potential for significant environmental justice impacts in the short term would be low.

4.25.6.2 Long-term Impacts

IPID Full Piping and Pump Exchange

Over the long term, the potential for impacts on cultural or tribal resources would be similar to Alternative 1. Under Alternative 5, the majority of the projects are the same with the exception that there would be three pump stations constructed on the Wenatchee River and the existing IPID canal delivery system would be fully replaced with a pressurized pipeline. This would result in a slightly increased potential for long-term impacts on tribal fishing compared to Alternative 1, depending on the specific location of the pump stations.

Alternative 5 would require compliance with the Guiding Principles, which include ensuring there are no significant adverse impacts on cultural and tribal resources. Additionally, implementation of Alternative 1 includes the Tribal Fishery Preservation and Enhancement Project to ensure that any long-term impacts on tribal fishing are appropriately mitigated. Continued coordination with potentially affected Indian tribes would continue and the potential for tribal resources to be affected would be addressed during project-level review. With implementation of mitigation as described in Section 4.25.7, Mitigation Measures, the potential for significant environmental justice impacts in the long term would be low.

4.25.7 Mitigation Measures

This section describes required permits and approvals that would help to mitigate the potential environmental impacts identified above. Additional mitigation measures are also identified as appropriate.

4.25.7.1 Short-term Impacts

Short-term impacts on cultural and tribal resources would be mitigated by meeting the goals of the Guiding Principles, continuing coordination with potentially affected Indian tribes, and complying with the terms and conditions of local, state, and federal regulations and obtaining required project-specific permits and approvals. Common mitigation measures that would protect these resources from short-term impacts are addressed in the following sections:

- Section 4.5, Water Quality
- Section 4.7, Fish
- Section 4.8, Vegetation
- Section 4.9, Wildlife
- Section 4.10, Threatened and Endangered Species
- Section 4.21, Cultural Resources
- Section 4.22, Indian Sacred Sites
- Section 4.23, Indian Trust Assets and Fishing Harvest

4.25.7.2 Long-term Impacts

Potential impacts associated with the potential for lasting conflicts or damage to cultural or tribal resources would be addressed prior to construction as noted above. In addition, evaluation and monitoring of the potential impacts to fish and fish habitat related to the management of instream flows would be ongoing. For an additional discussion of how the Icicle Strategy proposes to evaluate these issues over time, see Section 4.7.7, Mitigation Measures in Section 4.7, Fish.

4.26 Summary of Impacts and Benefits of the Icicle Strategy by Alternative

4.26.1 Short-Term

Construction activities required for many of the project elements comprising the Program Alternatives would cause short-term impacts. These impacts include erosion and sedimentation, construction dewatering, vegetation removal, construction emissions and dust, noise, aesthetic impacts for equipment and stock piles, and traffic delays. Construction may also temporarily block access to areas near construction sites, resulting in temporary disruption to activities in those areas, such as fishing or recreational use. Additionally, other impacts such as increased noise and dust or aesthetic changes might create a disturbance for recreationalists and wilderness users. Noise and vibrations could also temporary disturb fish and wildlife species. Cultural resources could also be disturbed during construction and access to Usual & Accustomed Fishing sites could be temporary restricted, especially for any construction near the plunge pool in front of the LNFH. These access impacts would be temporary and could be minimized by scheduling construction after the fishing season. Table 4-7 provides short-term impacts of implementation for the five Program Alternatives and the No-Action Alternative.

Implementation of the various projects under the Program Alternatives would be phased overtime depending on the design process, environmental review, and available funding. Because of this, construction impacts for various projects under an alternative are not likely to occur at the same time, minimizing the cumulative impact at any given time. Additionally, some project may be phased specifically to reduce recreational, Indian Trust Assets, and Wilderness user impacts.

Many of the projects proposed under the Program Alternatives could advance under the No-action Alternative. Ongoing projects would likely include work at LNFH to implement water re-use, water quality improvements, and groundwater augmentation. Additionally, Fish Screening Compliance, COIC Irrigation Efficiencies and Pump Exchange, and some fish passage would likely continue. The construction level, short-term impacts for these project elements would be the same under the Program

Alternatives and the No-action Alternative. But because fewer projects would likely be implemented, overall construction-related impacts would be lowest under the No-action Alternative compared with other alternatives. IPID and USFWS would likely maintain and upgrade their storage and hatchery facilities under the No-action Alternative, and construction level impacts could be similar to those discussed in the Program Alternatives.

The short-term impacts identified for Alternatives 1, 2, 3, and 5 are similar because they contain many of the same projects. The most significant difference is there would be fewer construction-related impacts in the ALWA under Alternative 2, 3, and 5 and more along the Wenatchee River corridor. This could lead to increased impacts to fish and shorelines with the construction of a Wenatchee River pump stations under Alternative 2, 3, and 5, but fewer impacts to other threatened and endangered species and wilderness users. Alternative 3 would have no construction-related short-term impacts in the ALWA as part of the Icicle Strategy above the No-action Alternative, with less resiliency to climate change.

Alternative 4 would have the greatest construction impacts because it is made up of the most projects. In addition to the short-term impacts identified for Alternative 1 in common with Alternative 4, there would be additional impacts from building two additional storage enhancement projects, and expending storage at Eightmile Lake. In addition to Alternative 4 having more projects, the scale of the storage projects is relatively larger than the scale of other water development projects proposed in Alternative 1.

Table 4-7
Summary of Short-Term Impacts

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Earth	Construction-related erosion and sedimentation from ongoing projects.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1, greater in Wenatchee corridor
Surface Water Resources	Use of cofferdams and dewatering during construction of on-going project.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1 greater in Wenatchee corridor
Groundwater Resources	Dewatering impacts during construction of ongoing projects.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1 greater in Wenatchee corridor
Water Quality	Construction of ongoing projects could result in temporary water quality impacts. Impacts include risk of erosion and contamination from construction activities.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1 greater in Wenatchee corridor
Water Use	Potential construction related impacts to surface water diversions. Work would be coordinated to minimize impacts.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1 greater in Wenatchee corridor

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Fish	Temporary habitat disturbance, construction-related impacts.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1, greater in Wenatchee corridor
Vegetation	Some vegetation removal from construction of ongoing projects.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1, greater in Wenatchee corridor
Wildlife	Temporary disruption of habitat during construction of ongoing projects.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1, greater in Wenatchee corridor
Threatened and Endangered Species	Temporary disruption of habitat during construction from noise and disturbance. Construction would generally occur outside breeding season, reducing impacts.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1, greater in Wenatchee corridor
Aesthetics	Construction activities and equipment of ongoing projects would generally create impacts on visual settings.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1, greater in Wenatchee corridor
Air Quality	Construction related emissions from ongoing projects including transportation and use of heavy equipment.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1, greater in Wenatchee corridor

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Climate Change	Minor amounts of greenhouse gas emissions related to construction of ongoing projects.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1
Noise	Increased noise from construction of ongoing projects.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1
Recreation	Access restriction, nuisance noise, and aesthetics impacts during construction of ongoing projects.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1
Land Use	Temporary access restrictions during construction of ongoing projects. Private owner access would be maintained.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1
Wilderness Area	Ongoing projects would likely be outside ALWA. No wilderness impacts are anticipated.	Temporary impacts to wilderness character related to construction activities include noise, construction equipment transport and staging, and presence and housing of construction workers.	Less than Alternative 1	Projects would likely be outside ALWA. No wilderness impacts are anticipated.	Greater than Alternative 1	Less than Alternative 1

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Shorelines	Increased potential for shoreline erosion related to ground disturbing activities.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1
Utilities	Potential temporary disruption in water service related to instream construction activities near diversions.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1
Transportation	Traffic delays associated with equipment transport and construction of ongoing projects. Least number of helicopter trips during construction.	Similar but greater impacts compared to No-action. Several helicopter trips for transporting construction equipment.	Similar to Alternative 1 Less than Alternative 1.	Less than Alternative 1 Similar to the No-action Alternative.	Greater than Alternative 1 More than Alterative 1.	Greater than Alternative 1 Similar to Alternative 1.
Cultural Resources	Ground disturbing activities and construction work on culturally significant structures could result in impacts. Compliance with regulations and coordination with affected tribes would ensure any potential issues and mitigation measures would be addressed prior to construction.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Indian Sacred Sites	Ground disturbing activities would have the potential to impact sacred sites. Ongoing coordination with potentially affected tribes and compliance with regulations would ensure any potential issues would be addressed prior to construction.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1
Indian Trust Assets and Fishing Harvest	Potential to temporarily block access to Usual & Accustomed fishing areas.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1
Socioeconomics	Increased construction jobs from ongoing projects. Impacts would be smallest of all alternatives because fewer projects would be constructed.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1

4.26.2 Long-Term

Implementation of the Icicle Strategy would provide benefit to Icicle Creek Subbasin by meeting the Guiding Principles. The Guiding Principles, which are discussed in detail in Section 1.2, The Icicle Strategy Guiding Principles, of this document, include improved instream flows, improved sustainability of LNFH, protection of the tribal and non-tribal fish harvest, improved domestic supply, improved agricultural reliability, enhancement of Icicle Creek habitat, and compliance with state and federal laws and Wilderness Acts. All Program Alternatives would meet the Guiding Principles and provide these benefits; although there are important differences, which are summarized below. Additionally, all the Program Alternatives would increase resiliency to stream impacts resulting from climate change. Table 4-8 provides an overview of long-term impacts for each Program Alternative and the No-action Alternative.

The No-action Alternative would not meet the goals and provide the benefits prescribed in the Guiding Principles, although some instream flow, LNFH, fish passage, and screening improvements would be made. Under the No-action Alternative, ongoing projects could increase streamflow by approximately 32 cfs, with localized benefit in water quality, fish habitat, and improved riparian vegetation. Impacts of the No-action Alternative would include decreased ability to respond to climate change and conflict between water users would not be resolved. Under the No-action Alternative, IPID would still manage, operate, and repair their dam sites, so long-term impacts identified by these activities would still likely occur under the No-action Alternative.

Alternative 1 would provide 88 cfs of instream flow benefit and meet all the Guiding Principles. Additionally, Alternative 1 would allow flexibility in flow management and allow the instream flow goal of 100 cfs to be met in 2080 under low, medium, and high climate change scenarios. Additionally, under Alternative 1 there would be net-benefit water quality improvements, increased available water for out-of-stream users, improved habitat benefit for fish and wildlife, and improved water-based recreational opportunities. Impacts of Alternative 1 would include noise disturbance resulting from the operation of a pump station, and aesthetic impacts resulting from increased draw down at Eightmile Lake and installation of modernized equipment in the ALWA, which could be minimized by construction design.

Alternative 2 would provide 83 cfs of instream flow benefit and meet all the Guiding Principles. Additionally, Alternative 2 would allow the instream flow goal of 100 cfs to be met in 2080 under low and medium climate change scenarios, but not under a high climate change scenario. Many of the net benefits to water quality, water use, habitat, and recreation that would exist under Alternative 1 would also exist under Alternative 2 because of the commonality of projects. Additionally, Alternative 2 would have many of the same impacts as Alternative 1. The impact of Alternative 2 compared to Alternative 1 is reduced flexibility in flow management that would result from not implementing the

Alpine Lake Optimization, Modernization, and Automation Project, and greater long-term reliance on power supplies over gravity diversions.

Alternative 3 would provide 70 cfs of instream flow benefit and meet all the Guiding Principles. Many of the net benefits to water quality, water use, habitat, and recreation that would exist under Alternative 1 would also exist under Alternative 3 because many projects are common to both alternatives. In addition, many of the impacts under Alternative 1 would also occur under Alternative 3. The primary impacts of Alternative 3 compared to Alternative 1 would be less resiliency to climate change and no flexibility in flow management, and greater long-term reliance on power supplies over gravity diversions. Alternative 3 would have less long-term recreation, aesthetics, and Wilderness impacts because Alpine Lake Automation would not be constructed as part of the Icicle Strategy.

Alternative 4 would provide 131 cfs of instream flow benefit and meet all the Guiding Principles. Alternative 1 would allow flexibility in flow management and allow the instream flow goal of 100 cfs to be met in 2080 under low, medium, and high climate change scenarios. As with other alternatives, there would also be net benefits to water quantity, water use, and water-based recreation. Alternative 4 would have the greatest impact on wilderness character and recreation in the Wilderness Area. This is because more infrastructure would be built or expanded in the Wilderness Area. Additionally, this would have an increased impact on shoreline vegetation and habitat.

Alternative 5 would provide 195 cfs of instream flow benefit and meet all the Guiding Principles. Additionally, Alternative 5 would allow the instream flow goal of 100 cfs to be met in 2080 under low, medium, and high climate change scenarios. Many of the net benefits to water quality, water use, habitat, and recreation that would exist under Alternative 1 would also exist under Alternative 5 because of the commonality of projects. Additionally, Alternative 5 would have many of the same impacts as Alternative 1, but have greater long-term reliance on power supplies over gravity diversions.

Table 4-8
Summary of Long-Term Impacts

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Earth	Some potential for erosion, and sediment transport resulting from long-term operation of ongoing projects. These impacts are expected to be minor.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1
Surface Water Resources	Ongoing projects would likely increase stream flow by 20 to 30 cfs. Benefits would be localized.	Similar but greater impacts compared to No-action. Would increase instream flow by 88 cfs. Increases expected when flow is naturally at its lowest. Flexibility in flow management to respond to low-flow conditions.	Similar to Alternative 1. Would increase instream flow by 83 cfs. Increases expected when flow is naturally at its lowest.	Less than Alternative 1. Would increase instream flow by 70 cfs. Benefits would not be as adaptable to low flows.	Greater than Alternative 1. Would increase instream flow by 131 cfs. Increases expected when flow naturally at its lowest. Flexibility in flow management to respond to low-flow conditions.	Greater than Alternative 1. Would increase stream flow by 195 cfs. Increases expected when flow is naturally at its lowest.
Groundwater Resources	Groundwater recharge near Icicle Creek is expected to decrease compared to other alternatives. Groundwater recharge could increase in some areas compared with other alternatives because some conservation projects (piping canals or fix leaky pipes) would not be implemented.	Increased groundwater use; increased groundwater recharge near Icicle Creek; reduced groundwater recharge resulting from conservation projects.	Similar to Alternative 1	Similar to Alternative 1	Greater than Alternative 1	Similar to Alternative 1

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Water Quality	Localized benefits from ongoing water quantity and quality improvements. Expected benefits include increased dissolved oxygen and cooler temperatures.	Similar but greater impacts compared to No-action.	Similar to Alternative 1	Similar to Alternative 1	Greater than Alternative 1	Similar to Alternative 1
Water Use	Water use would be relatively unchanged. Localized instream flow benefit from ongoing conservation projects. No water made available for projected domestic growth.	Increased water available for instream and out-of-stream uses. Water available to meet projected domestic growth.	Similar to Alternative 1	Similar to Alternative 1	Greater than Alternative 1	Similar to Alternative 1
Fish	Ongoing projects could provide localized habitat and flow improvements. However, critical low-flow periods would likely persist in some reaches, which would continue to impact habitat availability and passage.	Increased stream flow, passage improvements, and habitat improvements. Flow releases from Alpine Lakes would be managed to provide greatest fisheries benefit and minimize any impacts.	Similar to Alternative 1	Greater than Alternative 1. Less instream flow benefit, OCPI needed, and benefits would not be as adaptable to low flows.	Greater than Alternative 1	Greater benefits than Alternative 1 through increased instream flow

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Vegetation	Localized benefits to riparian vegetation from ongoing projects.	Improvements to riparian habitat resulting from increased flows and riparian habitat restoration efforts. Relatively small negative impacts from increased Eightmile Lake level; however, this is within historical range. Installation of pump station may also have small impacts.	Similar to Alternative 1	Less benefit to riparian vegetation in Icicle Creek than Alternative 1. Impacts associated with Eightmile Lake may not occur under this alternative.	Greater than Alternative 1	Greater benefits than Alternative 1 through increased instream flow improving vegetation
Wildlife	Largely beneficial for wildlife dependent on Icicle Creek because ongoing projects would seek to improve instream flows during low-flow season. Benefit is more limited than under other alternatives. Impacts are less than significant.	Similar but greater benefits compared to No-action. Greater impacts, although impacts are anticipated to be less than significant.	Similar to Alternative 1	Less benefit than Alternative 1. Impacts to wildlife greater than Alternative 1.	Greater benefits and impacts than Alternative 1	Similar to Alternative 1

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Threatened and Endangered Species	Ongoing projects would provide localized habitat and flow improvements.	Similar but greater impacts compared to No-Action. Overall positive impacts from habitat improvements. Minor changes in shoreline associated with Eightmile project and new pump station not anticipated to impact threatened and endangered species.	Similar to Alternative 1	Less habitat improvement than Alternative 1, which is less beneficial to aquatic threatened and endangered species. Less terrestrial habitat impacts Alternative 1.	Greater instream habitat improvement than Alternative 1. Greater terrestrial habitat impacts than Alternative 1.	Similar to Alternative 1
Aesthetics	Anticipated to be largely beneficial for aesthetics because the projects likely to be implemented are expected to improve habitat and upgrade aging and degraded infrastructure.	Similar but greater impacts compared to No-Action. Potential visual impacts from pump station project, which would be mitigated. Less than significant impacts of increased lake bed exposure.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater than Alternative 1
Air Quality	No significant long - term impacts identified	No significant long - term impacts identified	No significant long - term impacts identified. Greater impacts than Alternative 1 due to increased power reliance.	No significant long - term impacts identified. Greater impacts than Alternative 1 due to increased power reliance.	No significant long - term impacts identified. Similar to Alternative 1.	No significant long - term impacts identified. Greater impacts than Alternative 1 due to increased power reliance.

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Climate Change	Water supply shortages and critically low stream flow conditions would likely become worse. Limited ability to respond to climate change-induced impacts.	Increased instream flow and water supplies. Ability to adaptively manage flow to respond to impacts of climate change. Meets 100cfs streamflow goals in 2080 under low, medium, and high climate change scenarios.	Greater impacts than Alternative 1 due to increased power reliance.	Greater impacts than Alternative 1 due to increased power reliance.	Similar to than Alternative 1	Greater impacts than Alternative 1 due to increased power reliance.
Noise	Increased noise related to pump station operation. Construction measures would ensure compliance with Chapter 137-60 WAC.	Similar but greater impacts compared to No-action.	Greater than Alternative 1	Greater than Alternative 1	Greater than Alternative 1	Greater than Alternative 1
Recreation	Increased streamflow resulting from implementation of ongoing projects expected to improve water-based recreation.	Similar but greater impacts compared to No-action. Increased lake levels may have some impacts on current location of campsites and trails at Eightmile Lake. However, these impacts are expected to be limited because lake level increase would be modest.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Greater benefits than Alternative 1 from increased flow; similar impacts for other recreation

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Land Use	Easements or property acquisition could be required for some ongoing projects. Long-term impacts on current land use trends. Development of up to 56.1 acres.	Similar but greater impacts compared to No-action. Potential land use change from market reallocation of water and increased water for domestic supply. Conversion of some upland areas from private to public ownership. Development of up to 254.9 acres.	Similar to Alternative 1	Similar to Alternative 1	Greater than Alternative 1	Similar to Alternative 1
Wilderness Area	Ongoing projects would likely be outside ALWA. No wilderness impacts are anticipated. Maintenance activities by IPID and USFWS in ALWA would remain unchanged.	Long-term impacts to wilderness character would include equipment related to projects in ALWA (i.e. solar panels). Concealing equipment and implementing architectural style to complement the area would minimize impacts.	Similar to Alternative 1	Similar to No Action.	Greater than Alternative 1	Similar to Alternative 1
Shorelines	Long-term impacts on shorelines would likely result from the COIC project, but are anticipated to be less than significant. These impacts would be mitigated by complying with the terms and conditions of local, state, and federal regulations.	Similar but greater impacts compared to No Action. Increased drawdown range at Eightmile lake is expected to impact shorelines, but impacts would be less than significant compared to current conditions.	Greater than Alternative 1	Similar to Alternative 1 Impacts from pump stations will be greater, however there would be no impact resulting from changes to drawdown range at Eightmile Lake.	Greater than Alternative 1	Greater than Alternative 1

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Utilities	No anticipated impacts on water-based utilities associated with this project. Power demand is not expected to significantly increase because of ongoing projects.	Increased water service potential related to increased domestic supply. Power demand is not expected to significantly increase because of projects.	Greater than Alternative 1 because of long-term power reliance.	Greater than Alternative 1 because of long-term power reliance.	Greater than Alternative 1	Greater than Alternative 1 because of long-term power reliance.
Transportation	No long-term impacts to transportation anticipated.	Reduced helicopter supported transport in the Wilderness Area related to IPID maintenance activities	No long-term impacts to transportation anticipated.	No long-term impacts to transportation anticipated.	Similar to Alternative 1	No long-term impacts to transportation anticipated. Similar to Alternative 1
Cultural Resources	For all projects, coordination with DAHP and mitigation measures would be required.	Alpine Lakes dams are eligible for listing under the National Register of Historic Places. Mitigation measures would be required to avoid significant adverse impacts. For all projects, coordination with DAHP and mitigation measures would be required.	Similar to Alternative 1	Less than Alternative 1	Greater than Alternative 1	Similar to Alternative 1

Resources	No-Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Indian Sacred Sites	No expected adverse impacts to Indian Sacred Sites.	Ongoing coordination with potentially affected tribes and compliance with regulations would ensure any potential issues would be addressed prior to construction.	Similar to Alternative 1	Similar to Alternative 1	Greater than Alternative 1	Similar to Alternative 1
Indian Trust Assets and Fishing Harvest	No significant long-term impacts as required by Guiding Principles.	No significant long-term impacts as required by Guiding Principles	No significant long-term impacts as required by Guiding Principles	No significant long-term impacts as required by Guiding Principles	No significant long-term impacts as required by Guiding Principles	No significant long-term impacts as required by Guiding Principles
Socioeconomics	Assumed lowest socioeconomic benefits because fewer projects would be implemented.	Lowest construction costs, job creation, long-term economic benefit, and second-lowest assumed fish increases of Program Alternatives	Highest construction costs, job creation, and long-term economic benefit of Program Alternatives. Second highest assumed fish increases.	Higher construction jobs and long-term economic benefit than Alternatives 1 and 4. Lowest assumed fish increases.	Higher construction jobs and long-term economic benefit than Alternative 1. third highest assumed fish increases.	Lowest construction costs, job creation, and long-term economic benefit of Program Alternatives. Highest assumed fish increases.
Environmental Justice	Ongoing projects are not expected to disproportionately impact minority or low-income communities.	Projects are not expected to disproportionately impact minority or low-income communities.	Projects are not expected to disproportionately impact minority or low-income communities.	Projects are not expected to disproportionately impact minority or low-income communities.	Projects are not expected to disproportionately impact minority or low-income communities.	Projects are not expected to disproportionately impact minority or low-income communities.

4.27 Cumulative Impacts

Cumulative impacts are the sum of incremental effects of an action when added to other past, present, and reasonably foreseeable future actions. These impacts can be individually minor, but collectively significant impacts. To a degree, many of the cumulative impacts are discussed throughout this chapter are inherently cumulative because certain actions anticipated to continue into the future (conservation actions) are part of the impact analysis. Generally, an impact can be considered cumulative if the impacts of various actions occur at the same place, impacts to a specific resource are similar in nature, and impacts are long-term. This section highlights the major cumulative impacts that could result from the implementation of the Alternatives.

4.27.1 Past Actions

Since the late 19th and early 20th century logging, agricultural, and residential development altered the Icicle Creek Subbasin through the installation of dams on the Wenatchee (Lamb-Davis mill dam) and diversions on Icicle Creek. This created passage barriers, decreased flows, changed in stream morphology and floodplain function, water quality, and overall instream habitat degradation. The construction of LNFH in the mid-20th century and continued development have exacerbated these issues and have led to conflict of instream and out-of-stream water use.

In the early 20th century, seven lakes in the upper reaches of the watershed were altered with the installation of dams at their outlet. This resulted in water storage that has been used for irrigation and fish hatchery water supplies. The installation of these dams resulted in the flooding of some shoreline habitat and riparian area, which is regularly filled, released, and inundated each calendar year.

4.27.2 Present and Reasonably Foreseeable Future Actions

Present and reasonably foreseeable future actions that are anticipated in the project area that are relevant to the Icicle Strategy includes:

- New residential and commercial development. Ongoing residential and commercial development in the Icicle Creek Subbasin and Leavenworth area, which has been planned for as part of regional land use planning, would be facilitated by improvements in water supply that would occur under the Alternatives.
- Changes in agricultural crops. Agricultural development is not expected to increase in the project area, as there will be no increased irrigation acreage made available under the Icicle Strategy. However, the Alternatives would increase the

reliability of water supplies, which could lead to changes in crop type and irrigation application methodologies.

- Changes in precipitation patterns resulting from climatic changes. Climate Change is predicated to increase temperatures and change the patterns of precipitation in the Icicle Creek Subbasin. This is expected to shift the hydrograph so peak flows occur earlier in the year, with low flow periods spanning more of the summer months. These changes in streamflow are expected to impact habitat, water quality, water supply, and fish passage.
- Hatchery improvements. Improvements are planned at the LNFH and associated lakes, including routine maintenance activities, the Snow Lake Valve Replacement Project, and compliance activities under the Federal LNFH BiOp.
- IPID improvements. IPID plans improvements as outlined in its Irrigation Comprehensive Plan, which include ongoing operation and maintenance of all its infrastructure, including associated dams at the Alpine Lakes.
- Other habitat and conservation activities. Salmon recovery activities are ongoing in the area that include an annual funding cycle from multiple entities that fund construction-related projects to improve passage, water quality, habitat, and instream flow.
- City of Leavenworth activities. The City plans for municipal growth and infrastructure projects in the area as part of land use and water system planning updates that result in construction-related projects.

4.27.3 Cumulative Impacts of the Alternatives

Overall, the cumulative effect of the Icicle Strategy is expected to be beneficial. The Icicle Strategy is expected to provide benefit to the project area, as laid out in the Guiding Principles. The alternatives are intended to substantially improve low flow conditions, aquatic habitat, and water supply in the project area. The integrated planning approach developed for the Icicle Strategy is intended to improve water resources and the riverine ecosystem on a watershed scale. While all Program Alternatives are intended to improve streamflow, habitat, and supply issues in the project area, the cumulative impacts vary based between Alternatives.

Overall, cumulative impacts from implementing the Icicle Strategy are expected to be small. Project construction footprints are small, and generally in areas separated by great distances. Project pairing and project sequencing is planned by the co-leads with advice from the IWG to reduce temporal overlaps that could lead to cumulative impacts. Where project construction efforts can be combined, this may also reduce cumulative impacts.

4.27.3.1 Alternative 1 (Preferred Alternative)

Under Alternative 1, streamflow in lower Icicle Creek is anticipated to increase by 88 cfs. There would also be flow increases in other portions of Icicle Creek and several tributaries. This Alternative is expected to decrease the potential for adverse impacts from low flow, passage barriers, changes in stream morphology and floodplain function, water quality, and overall instream habitat degradation to accumulate and contribute to conditions that have negatively affected water resources in the project area.

Impacts of past actions in the ALWA would continue. Under Alternative 1, reoperation and restoration of storage would result in moderate, but less than significant impacts to baseline conditions. An additional 3.6 acres of lands would be inundated, but these lands had been inundated in the recent past. Mitigation measures would minimize impacts to aesthetics and wilderness character, and conservation acquisitions would occur. It is anticipated that after the initial construction phase, helicopter transport and annual operation trips would be less than current conditions under this alternative.

Improved water supply would lead to continued, ongoing residential and commercial development in the Icicle Creek Subbasin and Leavenworth area, which has been planned for as part of regional land use planning. This development could increase impacts on habitat that have resulted from past development. However, current regulations and overall instream flow benefit would minimize these impacts.

Agricultural development is not expected to increase in the project area, as there would be no increased irrigation acreage made available under the Icicle Strategy. However, Alternative 1 would increase the reliability of water supplies, which could lead to changes in crops and irrigation application methodologies. This is not expected to create cumulative impacts based on past, present, and foreseeable future actions.

The impacts of instream flow benefit would improve adaptability to climate change within the Icicle Creek Subbasin. Additionally, under this alternative there would be flexibility to manage flow based on conditions in the creek, ameliorating many of the flow impacts that are expected to result from climate change.

4.27.3.2 Alternative 2

The cumulative impacts to surface water under Alternative 2 is less than under Alternative 1. Under this alternative, streamflow in lower Icicle Creek is anticipated to increase by 83 cfs. There would also be flow increases in other portions of Icicle Creek and several tributaries. This Alternative is expected to decrease the potential for adverse impacts from low flow, passage barriers, changes in stream morphology and floodplain function, water quality, and overall instream habitat degradation to accumulate and contribute to conditions that have negatively affected water resources in the project area.

Impacts of past action in the ALWA would continue. An additional 3.6 acres of lands would be inundated, but these lands had been inundated in the recent past. Mitigation measures would minimize impacts to aesthetics and wilderness character, and

conservation acquisitions would occur. It is anticipated that after the initial construction phase, helicopter transport and annual operation trips would be the same or less than current conditions under this alternative.

Improved water supply would lead to continued, ongoing residential and commercial development in the Icicle Creek Subbasin and Leavenworth area, which has been planned for as part of regional land use planning. This development could increase impacts on habitat that have resulted from past development. However, current regulations and overall instream flow benefit would minimize these impacts.

Agricultural development is not expected to increase in the project area, as there would be no increased irrigation acreage made available under the Icicle Strategy. However, the Program Alternatives would increase the reliability of water supplies, which could lead to crop changes and irrigation application methodologies. This is not expected to create cumulative impacts based on past, current, and foreseeable future actions.

The impacts of instream flow benefit would improve adaptability to climate change within the Icicle Creek Subbasin. Additionally, under this alternative there would be flexibility to manage flow based on conditions in the creek, ameliorating many of the flow impacts that are expected to result from climate change.

4.27.3.3 Alternative 3

The cumulative impacts to surface water under Alternative 3 would be less than under any other Program Alternative. Under this alternative, streamflow in lower Icicle Creek is anticipated to increase by 70 cfs. This Alternative is expected to decrease the potential for adverse impacts from low flow, passage barriers, changes in stream morphology and floodplain function, water quality, and overall instream habitat degradation to accumulate and contribute to conditions that have negatively affected water resources in the project area.

Impacts of past action in the ALWA would continue. Helicopter transport and annual operation trips would remain the same as current conditions under this alternative.

Improved water supply would lead to continued, ongoing residential and commercial development in the Icicle Creek Subbasin and Leavenworth area, which has been planned for as part of regional land use planning. This development could increase impacts on habitat that have resulted from past development. Current regulations would minimize potential impacts to riparian and floodplain habitat. However, under this alternative flow benefits would not be perfectly matched with increased domestic use. This, when considered with past impacts, could decrease streamflow during critical low-flow periods, decrease water quality metrics such as dissolved oxygen and temperatures, and increase passage issues in Icicle Creek.

Agricultural development is not expected to increase in the project area, as there would be no increased irrigation acreage made available under the Icicle Strategy. However, the

Program Alternatives would increase the reliability of water supplies, which could lead to crop changes and irrigation application methodologies. This is not expected to create cumulative impacts based on past, current, and foreseeable future actions.

The impacts of instream flow benefit would improve adaptability to climate change within the Icicle Creek Subbasin.

4.27.3.4 Alternative 4

Under this alternative, streamflow in lower Icicle Creek is anticipated to increase by 131 cfs. There would also be flow increases in other portions of Icicle Creek and several tributaries. This Alternative is expected to decrease the potential for adverse impacts from low flow, passage barriers, changes in stream morphology and floodplain function, water quality, and overall instream habitat degradation to accumulate and contribute to conditions that have negatively affected water resources in the project area.

Impacts of past action in the ALWA would continue and likely increase. Under Alternative 4, reoperation and modification of storage would result in impacts to baseline conditions. An additional 13.6 acres of lands would be inundated. Mitigation measures would minimize impacts to aesthetics and wilderness character, and conservation acquisitions would occur. It is anticipated that after the initial construction phase, helicopter transport and annual operations trips would be less than current conditions under this alternative.

Improved water supply would lead to continued, ongoing residential and commercial development in the Icicle Creek Subbasin and Leavenworth area, which has been planned for as part of regional land use planning. This development could increase impacts on habitat that have resulted from past development. However, current regulations and overall instream flow benefit would minimize these impacts.

Agricultural development is not expected to increase in the project area, as there would be no increased irrigation acreage made available under the Icicle Strategy. However, the Program Alternatives would increase the reliability of water supplies, which could lead to crop changes and irrigation application methodologies. This is not expected to create cumulative impacts based on past, current, and foreseeable future actions.

The impacts of instream flow benefit would improve adaptability to climate change within the Icicle Creek Subbasin. Additionally, under this alternative there would be flexibility to manage flow based on conditions in the creek, ameliorating many of the flow impacts that are expected to result from climate change.

4.27.3.5 Alternative 5

The cumulative impacts to surface water under Alternative 5 is greater than under Alternative 1. Under this alternative, streamflow in lower Icicle Creek is anticipated to increase by 195 cfs. There would also be flow increases in other portions of Icicle Creek and several tributaries. This Alternative is expected to decrease the potential for adverse

impacts from low flow, passage barriers, changes in stream morphology and floodplain function, water quality, and overall instream habitat degradation to accumulate and contribute to conditions that have negatively affected water resources in the project area.

Impacts of past action in the ALWA would continue. Under Alternative 1, reoperation and restoration of storage would result in moderate, but less than significant impacts to baseline conditions. An additional 3.6 acres of lands would be inundated, but these lands had been inundated in the recent past. Mitigation measures would minimize impacts to aesthetics and wilderness character, and conservation acquisitions would occur. It is anticipated that after the initial construction phase, helicopter transport and annual operations trips would be less than current conditions under this alternative.

Improved water supply would lead to continued, ongoing residential and commercial development in the Icicle Creek Subbasin and Leavenworth area, which has been planned for as part of regional land use planning. This development could increase impacts on habitat that have resulted from past development. However, current regulations and overall instream flow benefit would minimize these impacts.

Agricultural development is not expected to increase in the project area, as there would be no increased irrigation acreage made available under the Icicle Strategy. However, the Program Alternatives would increase the reliability of water supplies, which could lead to crop changes and irrigation application methodologies. This is not expected to create cumulative impacts based on past, current, and foreseeable future actions.

The impacts of instream flow benefit would improve adaptability to climate change within the Icicle Creek Subbasin. Additionally, under this alternative there would be flexibility to manage flow based on conditions in the creek, ameliorating many of the flow impacts that are expected to result from climate change.

4.28 Unavoidable Adverse Impacts

Significant unavoidable adverse impacts are generally considered to be impacts that remain more than moderate after mitigation. Potentially significant impacts were identified for several resources in Chapter 4. Many of these impacts are related to short-term construction activities, although some long-term impacts were identified. With mitigation measures, such as compliance with applicable local, state, and federal regulations and the use of BMPs, most impacts would likely be less than moderate after mitigation. The following sections summarize impacts and mitigation measures.

4.28.1 Earth, Surface Water, Water Quality, Shorelines, and Fish

The potential for increased erosion and sedimentation resulting from increased stream flow was identified as a potential impact. However, this increased potential for erosion and sedimentation is expected to be non-significant given that increased flows would remain within the natural flow range. The potential for occurrence of these impacts would be mitigated by following the required regulatory permits for construction and operation of projects. Additional impacts include fish and redds stranding associated with releases from the Alpine Lakes. Alpine Lakes releases could be timed and managed to minimize any concerns of water quality and fish habitat impacts. Mitigation measures are expected to result in impacts being less than moderately significant.

Benefits to vegetation, riparian habitat, floodplain function, and the riverine ecosystem are anticipated to counteract these impacts. The primary long-term impact associated with the Program Alternatives is increased flow, habitat, and improved water quality.

4.28.2 Aesthetics, Recreation, and Wilderness

Potential impacts to aesthetics could result from construction of the COIC and the IPID pump stations if the COIC Irrigation Efficiencies and Pump Exchange, IPID Dryden Pump Exchange Project, or IPID Full Piping and Pump Exchange Project are implemented. The COIC Irrigation Efficiencies and Pump Exchange Project is included in all Program Alternatives. The IPID Dryden Pump Exchanges are included in Alternative 2, 3, and 5. Potential impacts could be minimized based on siting or use of vegetation screening.

Aesthetic impacts are also possible under the Alpine Lakes Optimization, Modernization, and Automation Project. This project is included in Alternative 1, Alternative 4, and Alternative 5. The greatest potential long-term impact is from new equipment installed to automate lake releases. This equipment also has the potential to impact wilderness character. Designing structures to blend into the natural environment and using local construction materials can minimize these impacts. Mitigation measures are expected to result in impacts being less than moderately significant.

The Eightmile Lake Storage Restoration Project also has the potential to create visual impacts. This project is proposed under Alternative 1, 2, and 5. One potential impact is the dam replacement structure. This also has the potential to impact wilderness character. Involving an architect in the design of the facility to ensure it matches the look of the current dam structure and blends into the natural environment would help minimize this impact. The increase in lake level also has the potential to impact user experience at Eightmile Lake. However, with the modest rise in lake level, this impact would be minor. Additionally, this condition existed in the past, as recently as the 1990's. Mitigation measures are expected to result in impacts being less than moderately significant.

Storage enhancement projects proposed under Alternative 4 have the potential to impact aesthetics, wilderness character, and recreation. These impacts and specific mitigation measures would be addressed in project-level environmental review.

While impacts to wilderness character is a controversial issue, this analysis found that long-term impacts to wilderness character can be mitigated through construction techniques and timing/management of draw down at the Alpine Lakes. Additionally, benefits to wilderness character would result from fewer maintenance trips and reduced helicopter use within the ALWA.

4.28.3 Land Use

All land acquisitions or easements for projects proposed in the Program Alternatives would need to provide appropriate compensation in accordance with applicable state or federal regulations. Any land acquired under the Habitat Protection and Enhancement Project, which is included in all Program Alternatives, would require a willing seller.

Residential development impacts of the No-action alternative would likely be on the order of 56.1 acres of impervious surface at a minimum. It may be larger or smaller depending on the outcome of the City of Leavenworth and Ecology water right litigation. Residential development impacts of the action alternatives would increase to 264.9 acres of impervious surface because more domestic water supply would be made available. Mitigation measures are expected to result in impacts being less than moderately significant.

4.28.4 Climate Change

Changes in stream flow and water availability caused by climate change would constrain instream and out-of-stream uses. The Program Alternatives would provide for increased stream flow and the flexibility to adaptively manage flow in response to conditions. Mitigation measures are expected to result in impacts being less than moderately significant.

4.28.5 Cultural Resources

Four of the dams and water release structures at the Alpine Lakes are eligible for listing on the National Register of Historic Places. To reduce cultural resources impacts associated with the Alpine Lakes Optimization, Modernization, and Automation Project and the Eightmile Storage Restoration Project, coordination with DAHP would occur to identify appropriate mitigation. With implementation of mitigation, these projects are not anticipated to result in any significant impacts on cultural resources. Mitigation measures might include maintaining some historical infrastructure and ensuring structure design is consistent with the historical structures. Mitigation measures are expected to result in impacts being less than moderately significant.

For all projects that involve ground disturbance, additional cultural resource review would be required once specific locations for project elements are identified.

Coordination with affected tribes and DAHP would help minimize any potential impacts. Prior to construction, any potential long-term impacts affecting cultural resources would be addressed.

4.29 Irreversible and Irretrievable Commitments of Resources

This section discusses the permanent loss of or commitment of resources that would be associated with the Program Alternatives. Irretrievable and irreversible commitments are the use or removal of a resource (including time and money spent), that cannot be recovered. These commitments often apply to nonrenewable resources.

For the Program Alternatives, irretrievable commitments would include time and money. Additionally, a small amount of land that was previously submerged would be submerged again under Alternative 1, 2, and 5, and additional lands would be submerged under Alternative 4. Table 4-9 provides a summary of irreversible and irretrievable commitments associated with building the Program Alternatives.

Table 4-9
Irreversible and Irretrievable Commitments

	Direct Construction Costs (millions)	Submerged Lands (acres)
Alternative 1	$82.0	3.6
Alternative 2	$91.4	3.6
Alternative 3	$89.0	0
Alternative 4	$87.8 +	> 13.6
Alternative 5	$177.3	3.6

Notes: Costs include 25-percent contingency. An additional 25-percent contingency was added for all projects in the wilderness area. Construction costs for Upper Klonaqua Lake Storage Enhancement Project unknown at this time

In addition to the resources described in Table 4-9, Program Alternatives that result in non-wilderness uses within he ALWA has the potential to cause irretrievable commitments to wildness resources. Alternative 1, 2 and 5 include changes to already occurring or historical uses within the ALWA. Alternative 4 calls for expanded storage within the ALWA.

Each Program Alternative also includes irreversible commitments of water, soil, rock, and energy for construction of projects.

4.30 Environmental Commitments

Environmental commitments are measures or practices to reduce or avoid adverse effects resulting from project operations (long-term impacts). The co-leads would have the primary responsibility to ensure these met if an action is implemented. The project elements proposed in the Program Alternatives are at various stages in the planning process, so the detail of specific mitigation measures varies. Additional measures would be developed during project-level environmental review if needed. The following sections summarize major environmental commitments for the Icicle Strategy.

4.30.1 Earth, Surface Water, Water Quality, Shorelines, & Fish

Impacts to these resources are generally mitigated for through applicable Federal, State, and local environmental review and permitting processes. In most cases, impacts would be mitigated by following the required regulatory permits for the construction and operation of projects.

Construction facilities in accordance with all applicable design requirements, and monitoring to ensure that potential impacts do not develop during operations would minimize potential earth impacts. Dam safety permits and inspection and monitoring requirements would identify any emerging long-term issues with water storage facilities

Table 5-2 provides a list of all applicable permits for each project considered in the Program Alternatives.

4.30.2 Aesthetics, Recreation, and Wilderness

Involving an architect in the design of facilities would ensure they meet management objects and minimize potential impacts on aesthetics and wilderness character. Coordination and consultation with the USFS, would limit impacts on recreation and wilderness character. Projects that require a special use permit issued by the USFS may also require additional measures to project aesthetics, recreation, and wilderness character. A minimum tools analysis would be done to minimize impacts during project construction.

4.30.3 Land Use

All land acquisitions or easements for project proposed in the Alternatives would need to provide appropriate compensation in accordance with applicable State or Federal regulations. Any land acquired under the Habitat Enhancement project, which is included in all Program Alternatives, would require a willing seller. All changes in land use would have to comply with Chelan County’s comprehensive plan and land use zoning.

4.30.4 Cultural Resources

Consultation with DAHP would occur to identify appropriate mitigation for impacts to cultural resources. Adherence with the National Historic Preservation Act would be required as part of the CWA Section 404 review.

For all projects that involve ground disturbance, additional cultural resource review would be required once specific locations for project elements are identified. Coordination with affected tribes and DAHP would help minimize any potential impacts.