4.2 No Project Alternative

4.2.1 Introduction

4.2.1.1 Alternative Description

The No Project Alternative describes the environment should the Klamath River Renewal Corporation's (KRRC's) Proposed Project to decommission the Lower Klamath Project not proceed. California Environmental Quality Act (CEQA) Guidelines Section 15126.6(e)(2) states that "The 'no project' analysis shall discuss the existing conditions at the time the notice of preparation is published, or if no notice of preparation is published, at the time environmental analysis is commenced, as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services." Specifically, where a CEQA document concerns revisions to an ongoing operation, "the 'no project' alternative will be the continuation of the existing … operation into the future."

In this instance, in the short term, the No Project Alternative would be no change from the current management conditions, other than as noted below with regard to 2017 flow requirements and cessation of certain KHSA measures related to water quality and habitat. The Lower Klamath Project facilities would remain in place and operate under annual FERC licenses. This short-term scenario is anticipated for the duration of the FERC proceeding for relicensing of the hydroelectric facilities, estimated at one to five years, depending on the time necessary to obtain water quality certification from California and Oregon, on the time to obtain Clean Water Act section 404 permits from the Army Corps of Engineers for construction work, and on whether Federal Energy Regulatory Commission (FERC) and the Army Corps of Engineers relies on existing environmental reviews. It also includes time to conduct planning and monitoring required prior to facilities modification and/or removal.

The outcome of such a proceeding has not yet been determined, although there are bounds to the uncertainty. It is clear that the continued operation of the Lower Klamath Project as permitted under annual licenses is infeasible, as federal agencies have imposed fish passage requirements, ramping requirements, and other significant changes to the Lower Klamath Project dam complexes and operations in the context of the PacifiCorp Klamath Hydroelectric Project relicensing (FERC Project No. 2082). These requirements were challenged and upheld under a trial-type administrative hearing (Section 241 of the Energy Policy Act of 2005). Additionally, any relicensing procedure would have to comply with conditions to meet water quality standards in California and in Oregon, and it is not clear that this would be possible with all (or perhaps any) of the Lower Klamath Project dams and reservoirs in place.

Projecting one specific No Project scenario for the long term would be speculative, in light of the above, and would be contrary to the CEQA Guidelines' mandate to disclose and assess the environmental impacts that would "reasonably be expected to occur in the foreseeable future." The potential future for the existing hydroelectric facilities could include the transfer, decommissioning, or relicensing with modifications of all or some of the dams and associated facilities. However, this Environmental Impact Report (EIR) addresses the environmental effects of a range of potential long-term operation and decommissioning scenarios that could occur: all of the dams remain in place with fish passage (Section 4.4 *Continued Operations with Fish Passage Alternative*); removal of

all (or substantially all) of the facilities (Proposed Project, Sections 2 and 3, Section 4.3 *Partial Removal Alternative*, Section 4.7 *No Hatchery Alternative*) or some of the dams, with fish passage on the remaining facilities (Section 4.5 *Two Dam Removal Alternative* and 4.6 *Three Dam Removal Alternative*). Therefore, while the long-term effects of the No Project Alternative cannot reasonably be ascertained with specificity, the range of potential long-term effects are found in the Proposed Project and the other alternatives.

In light of this uncertainty, the No Project Alternative analysis focuses on the reasonably foreseeable period of 0−5 years, as described below. Citations to the Proposed Project and other alternatives are provided for ease of reference in examining the effects of not implementing the Proposed Project in the long term.

Foreseeable Short-term Operations

For the next zero to five years, the Lower Klamath Project (i.e., J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate dams and associated facilities) and the remaining Klamath Hydroelectric Project facilities (East and West Side Powerhouses, Keno Dam, Fall Creek dam complexes—see also Section 2.6.2 *Relationship with Klamath Hydroelectric Project*) would continue to operate under annual licenses issued by FERC while the disposition of all the Lower Klamath Project facilities would be determined through the FERC relicensing process. This would include the potential of reaching another settlement agreement under that process. This timeframe also includes time for completion of any necessary planning or studies to undertake facilities modifications. The current annual license issued for Lower Klamath Project facilities under PacifiCorp's annual FERC licenses for Project No. 2082 has no requirements for additional fish passage or implementation of the prescriptions that are currently before FERC in the relicensing process. In the No Project Alternative analysis, the existing environmental conditions associated with the Lower Klamath Project and its operations would continue except as modified by:

- Court-ordered flushing and emergency dilution flows downstream of Iron Gate Dam, which became required after February 2017 (U.S. District Court 2017)

Please see Section 4.2.1.1 *[Alternative Description] Summary of Available Hydrology Information for the No Project Alternative* for a discussion of the effect of this addition on the analysis of the No Project Alternative).

- The cessation of certain interim measures (IMs) from the KHSA, as discussed in Section 4.2.1.1 *[Alternative Description] KHSA Interim Measures*. Some of these measures would continue to form part of the existing conditions, while others would cease.

There are various efforts underway in the Klamath Basin to improve water quality, as discussed in Section 3.24 *Cumulative Effects*. However the effects of these efforts, including efforts aimed at meeting Klamath River TMDLs are not analyzed for the reasonably foreseeable period under the No Project Alternative because the basin response to the restoration measures to meet the total maximum daily loads (TMDLs) during the short-term is too speculative.

Long-term water quality improvements that bring water quality in the Klamath Basin closer to the load allocations established in the TMDLs are foreseeable through a variety of implementation measures. However, TMDLs are not self-implementing, and the

extent of reasonably foreseeable financial resources are insufficient to implement the extensive efforts necessary to meet TMDL goals. While the TMDLs are expected to result in improvements to water quality conditions over time, the pace of attaining improvements and the specific implementation measures are not fully known. Additionally, the Klamath River TMDL includes load allocations for Copco No. 1 and Iron Gate reservoirs. As discussed in Section 3.2 *Water Quality*, removing the dams under the Proposed Project would rapidly and substantially move the Hydroelectric Reach and the Klamath River downstream of Iron Gate Dam towards achieving compliance. However, it is not clear the extent to which the allocations can be met absent dam removal, and within what timeframe. Water quality improvement measures in Oregon and California due to the Klamath TMDLs would result in long-term changes in water quality, so they are analyzed as part of the Proposed Project and other alternatives.

Summary of Available Hydrology Information for the No Project Alternative

Section 3.1.6 *Summary of Available Hydrology Information for the Proposed Project* describes information regarding the EIR's analysis of the 2013 Biological Opinion (BiOp) flow requirements.

In addition to the 2013 BiOp Flows, and until the reinitiated formal consultation is complete, the USBR is also required to manage *Ceratanova Shasta (C. Shasta)* infection among coho salmon in the Klamath River with additional winter-spring surface flushing flows and deep flushing flows, as well as emergency dilution flows. Flushing flows are designed to dislodge and flush out polychaete worms that host *C. Shasta* in the Klamath River. Emergency dilution flows were developed to reduce *C. Shasta* infections in coho salmon if certain disease thresholds in the Klamath River are exceeded. The details of the flushing flow and emergency dilution flow requirements are outlined in *Measures to Reduce Ceratanova Shasta Infection of Klamath River Salmonids: A Guidance Document* and US District Court Filing 111 (U.S. District Court 2017). The flushing flow and emergency dilution flow requirements include:

- Releasing surface flushing flows every year from Iron Gate Dam of at least 6,030 cfs for a 72-hour period during the winter period (November 1–April 30) sufficient to move surface sediments.
- Releasing deep flushing flows at least every other year (beginning in 2017) with the Klamath River flow measured at Iron Gate Dam averaging at least 11,250 cubic feet per second (cfs) over a single 24-hour period between February 15 and May 31, unless USBR determines that such flows are limited and/or precluded by inherent hydrologic, infrastructure, and/or public safety constraints.
- Releasing emergency dilution flows of downstream of Iron Gate Dam between April 1 to June 15 or when 80% of juvenile Chinook Salmon outmigration has occurred if either: (1) spore concentrations exceed five spores (non-specified genotype) per liter for the preceding sample based on quantitative polymerase chain reaction (qPCR) from water filtration samples at any sampling station, or (2) the prevalence of inflection (POI) of all captured juvenile Chinook salmon (both wild and hatchery) exceeds 20 percent in aggregate for the preceding week at the Kinsman Rotary Screw Trap. Emergency dilution flows are 3,000 cfs measured at Iron Gate Dam until spore or POI at Kinsman Trap decreases if flows at Iron Gate Dam are below 3,000 cfs when disease thresholds are met or exceeded. Emergency flows at Iron Gate Dam are maintained at 3,000 cfs or increased from 3,000 cfs to 4,000 cfs if disease levels remain above disease thresholds after flows

at Iron Gate Dam have been 3,000 cfs for at least seven days. The volume of emergency dilution releases is capped at 50,000 acre-feet (AF).

The requirements of the flushing and emergency dilution releases are in addition to the 2013 BiOp flow requirements, which must still be met by USBR. Water released during flushing and emergency dilution flows are not part of the Environmental Water Account detailed in the 2013 BiOp. The exact timing of the releases of flushing flows is left to the discretion of USBR, provided they occur within the specified timeframes for the releases. Provisions for adaptive management of the flushing and emergency dilution flows exist, provided consensus for an amended flow plan is reached among the applicable agencies and submitted to the U.S. District Court for the Northern District of California San Francisco Division.

The additional surface and deep flushing flows, along with the emergency dilution flows to manage *C. Shasta,* are within the range of historical Klamath River flows evaluated in the 2013 BiOp studies. For example, while infrequent (i.e., less than 1 percent of the time at Iron Gate Dam), daily average flows in the Klamath River exceed the deep flushing flow requirement of 11,250 cfs during some storm events in the period of analysis. Additionally, the duration of a deep flushing flow event is short (i.e., 24 hours plus the time to ramp down the flushing flow) and is designed to occur every other year (beginning in 2017), such that the overall period that deep flushing flows influence Klamath River hydrology is limited.

In summary, river flow-related environmental impacts under the EIR No Project Alternative are evaluated by synthesizing the existing 2013 BiOp hydrology including the winter-spring surface and deep flushing flows as well as emergency dilution flow requirements, the No Project Alternative hydrology analysis presented in the 2012 KHSA EIS/EIR (which is modeled using 2010 BiOp Flows), and the technical studies that supported the 2012 KHSA EIS/EIR. Additional analysis is undertaken when necessary to evaluate how the flushing and dilution flows impact conditions in the Klamath Basin.

KHSA Interim Measures

The KHSA includes a series of "interim measures" (IMs) (KHSA Section 1.2.4) that have been implemented by PacifiCorp since 2010 to assess and address environmental conditions and improve fisheries prior to dam removal. The KHSA defines the interim period as the period between the date that the KHSA was originally executed (February 18, 2010 (i.e., the Effective Date) and PacifiCorp's physical removal from a facility of any equipment and personal property that PacifiCorp determines has salvage value, and physical disconnection of the facility from PacifiCorp's transmission grid (i.e., Decommissioning). However, some of the IMs were either one-time measures that were already completed, or have been integrated into PacifiCorp's annual licenses as part of an Interim Conservation Plan (ICP). Additionally, it is assumed that flow and peaking operations associated with J.C. Boyle as specified in IMs 13 and 14 would continue. The ICP measures, therefore, form part of the existing conditions under the No Project Alternative. Assumptions regarding ICP and Non-ICP IMs are presented in Table 2.7-19.

Table 4.2-1. KHSA Interim Measures Relevant to California Under the No Project Alternative Compared with Existing Conditions and the Proposed Project.

Interim Measure	Interim Conservation Plan (ICP)[1]	Description	Existing Conditions	No Project Alternative	Proposed Project
IM1 – Interim Measures Implementation Committee (IMIC)	ICP	The IMIC is comprised of representatives from PacifiCorp, other parties to the KHSA (as amended on November 30, 2016), and non-signatory representatives from the State Water Board and Regional Water Board (see KHSA Appendix B, Section 3.2). The purpose of the IMIC is to advise on implementation of the Non-Interim Conservation Plan Interim Measures set forth in Appendix D of the Amended KHSA.	Ongoing	Would continue	Would continue separate from the Proposed Project[2]
IM2 – California Klamath Restoration Fund/Coho Enhancement	ICP	PacifiCorp would fund actions to enhance survival and recovery of coho salmon, including habitat restoration and acquisition.	Ongoing	Would continue	Would not continue
IM3 – Iron Gate Turbine Venting	ICP	PacifiCorp shall implement turbine venting on an ongoing basis beginning in 2009 to improve dissolved oxygen concentrations downstream of Iron Gate Dam.	Construction complete, implementation ongoing	Would continue	Would not continue
IM4 – Hatchery and Genetics Management Plan (See also IM19 and IM20)	ICP	PacifiCorp would fund the development and implementation of a Hatchery and Genetics Management Plan for the Iron Gate Hatchery.	Plan development is complete, implementation ongoing	Implementation would continue	Implementation would continue for eight years after removal of Iron Gate Dam as part of the Proposed Project, see also IM19 and IM20

Interim Measure	Interim Conservation Plan (ICP)[1]	Description	Existing Conditions	No Project Alternative	Proposed Project
IM5 – Iron Gate Flow Variability	ICP	PacifiCorp and USBR would annually evaluate the feasibility of enhancing fall and early winter flow variability to benefit salmonids downstream from Iron Gate Dam. In the event that fall and early winter flow variability can feasibly be accomplished, PacifiCorp would develop and implement flow variability plans. This IM would not adversely affect the volume of water available for Reclamation's Klamath Project or wildlife refuges.	Complete	Would continue	Would not continue
IM6 – Fish Disease Relationship and Control Studies	ICP	PacifiCorp has established a fund to study fish disease relationships downstream from Iron Gate Dam. PacifiCorp would consult with the Klamath River Fish Health Workgroup regarding selection, prioritization, and implementation of such studies.	Ongoing	Would continue	Would not continue
IM7 – J.C. Boyle Gravel Placement and/or Habitat Enhancement	Non-ICP	PacifiCorp would provide funding for the planning, permitting, and implementation of gravel placement or habitat enhancement projects, including related monitoring, in the Klamath River upstream of Copco No. 1 Reservoir.	Ongoing	Would not continue	Would not continue
IM8 – J.C. Boyle Bypass Barrier Removal	Non-ICP	PacifiCorp would remove the sidecast rock barrier approximately 3 miles upstream of the J.C. Boyle Powerhouse in the Bypass Reach, to improve upstream fish passage.	Complete	Completed, part of existing conditions	Completed, part of existing conditions

Interim Measure	Interim Conservation Plan (ICP)[1]	Description	Existing Conditions	No Project Alternative	Proposed Project
IM9 – J.C. Boyle Powerhouse Gage	Non-ICP	Upon the Effective Date, PacifiCorp shall provide the U.S. Geological Survey with continued funding for the operation of the existing gage below the J.C. Boyle Powerhouse.	Ongoing	Would not continue	Would not continue
IM10 – Water Quality Conference	Non-ICP	PacifiCorp shall provide one-time funding of $100,000 to convene a basin-wide technical conference on water quality within one year from the Effective Date of the KHSA.	Complete	Completed, part of existing conditions	Completed, part of existing conditions
IM11 – Interim Water Quality Improvements	Non-ICP	PacifiCorp shall spend up to $250,000 per year to be used for studies or pilot projects developed in consultation with the Implementation Committee to improve interim water quality in the Klamath River.	Studies and pilot projects ongoing	Would not continue	Studies and pilot projects would not continue. Water Quality Improvement Project would begin[2]
IM12 – J.C. Boyle Bypass Reach and Spencer Creek Gaging	Non-ICP	PacifiCorp shall install and operate stream gages at the J.C. Boyle Bypass Reach and at Spencer Creek.	Complete	Would not continue	Would not continue
IM13 – Flow Releases and Ramp Rates	Non-ICP	PacifiCorp would maintain current operations including instream flow releases of 100 cfs from J.C. Boyle Dam to the J.C. Boyle Bypass Reach and a 9-inch per hour ramp rate below the J.C. Boyle Powerhouse prior to transfer of the J.C. Boyle facility.	Ongoing	Would continue as part of existing operations	Would not continue
IM14 – 3,000 cfs Power Generation	Non-ICP	Upon approval by Oregon Water Resources Department, PacifiCorp would continue maximum diversions of 3,000 cfs at J.C. Boyle Dam for power generation.	Ongoing	Would continue as part of existing operations	Would not continue

Interim Measure	Interim Conservation Plan (ICP)[1]	Description	Existing Conditions	No Project Alternative	Proposed Project
IM15 – Water Quality Monitoring	Non-ICP	PacifiCorp shall fund long-term baseline water quality monitoring to support dam removal, nutrient removal, and permitting studies, and also will fund blue-green algae and blue-green algae toxin monitoring as necessary to protect public health. Funding of $500,000 shall be provided per year. The funding shall be made available beginning April 1, 2010 and annually on April 1.	Ongoing	Would not continue	Would not continue
IM16 – Water Diversions	Non-ICP	PacifiCorp shall seek to eliminate three screened diversions from Shovel (2) and Negro (1) Creeks and shall seek to modify its water rights as listed above to move the points of diversion from Shovel and Negro Creek to the mainstem Klamath River.	Not yet occurred	Would not occur	PacifiCorp would undertake separate from the Proposed Project —see Section 3.24 *Cumulative Effects*
IM17 – Fall Creek Flow Releases	Non-ICP	PacifiCorp would continue to provide a continuous flow release to the Fall Creek Bypass Reach targeted at 5 cfs.	Ongoing	Would continue as part of existing operations	Would continue as part of existing operations
IM18 – Hatchery Funding	Non-ICP	PacifiCorp shall fund 100 percent of Iron Gate Hatchery operations and maintenance necessary to fulfill annual mitigation objectives developed by the California Department of Fish and Wildlife in consultation with the National Marine Fisheries Service (NMFS) and consistent with existing FERC license requirements.	Ongoing	Percent of funding may not continue but hatchery would continue operations	Would not continue, see IM19 and IM20

Interim Measure	Interim Conservation Plan (ICP)[1]	Description	Existing Conditions	No Project Alternative	Proposed Project
IM19 – Hatchery Production Continuity	Non-ICP	PacifiCorp will begin a study to evaluate hatchery production options that do not rely on the current Iron Gate Hatchery water supply. Based on the study results, and within six months following the DRE's acceptance of the FERC surrender order, PacifiCorp will propose a post-Iron Gate Dam Mitigation Hatchery Plan (Plan) to provide continued hatchery production for eight years after the removal of Iron Gate Dam.	Ongoing	Would not continue	Would be complete
IM20 – Hatchery Funding After Removal of Iron Gate Dam	Non-ICP	After removal of Iron Gate Dam and for a period of eight years, PacifiCorp shall fund 100 percent of hatchery operations and maintenance costs necessary to fulfill annual mitigation objectives developed by CDFW in consultation with NMFS.	Not yet occurred	Would not occur	Would occur

[1] The Interim Conservation Plan refers to the plan developed by PacifiCorp through technical discussions with NMFS and USFWS regarding voluntary interim measures for the enhancement of coho salmon and suckers listed under the ESA, filed with FERC on November 25, 2008, or such plan as subsequently modified.

[2] Per the KHSA Appendix D, Non-Interim Conservation Plan Interim Measures, following the DRE's (Dam Removal Entity or KRRC) acceptance of the license surrender order, PacifiCorp shall provide funding of up to $5.4 million for implementation of projects approved by the Oregon Department of Environmental Quality (ODEQ) and the California State and Regional Water Quality Control Boards, and an additional amount of up to $560,000 per year to cover project operation and maintenance expenses related to those projects, these amounts subject to adjustment for inflation as set forth in Section 6.1.5 of the KHSA. PacifiCorp would provide funding for these nutrient reduction projects separate from the Proposed Project (see Section 3.24 *Cumulative Effects*).

4.2.1.2 Alternative Analysis Approach

As for the Proposed Project, the potential impacts of the No Project Alternative are analyzed in comparison to existing conditions. Unless otherwise indicated, the significance criteria, area of analysis, environmental setting, and impact analysis approach, including consideration of existing local policies, for all environmental resource areas under the No Project Alternative are the same as those described for the Proposed Project (see Section 3.1 *Environmental Setting Introduction* and individual resource area subsections in Section 3 *Environmental Setting, Impacts, and Mitigation Measures*). The time frame of analysis for the No Project Alternative differs from that of the Proposed Project, as described above.

4.2.2 Water Quality

As described for the Proposed Project Water Quality *Impact Analysis Approach* (Section 3.2.4), the approach to analyzing potential water quality impacts associated with the No Project Alternative involves quantitative numeric models, where possible and appropriate, and qualitative analyses otherwise. However, the time frame of the No Project Alternative is different from that of the Proposed Project. As described in Section 4.2.1.1 *Alternative Description – Foreseeable Short-term Operations*, the No Project Alternative considers reasonably foreseeable conditions over the period of 0−5 years.

Water Temperature

For the No Project Alternative, there would be no short-term sediment release due to removal of the Lower Klamath Project. As such, there would be no potential for changes in water temperature from existing conditions in the Klamath River Estuary due to sediment-related morphological changes in the estuary since sediment releases from dam removal would not occur (Potential Impact 3.2-2).

Water temperature existing conditions would not be altered by changes to the IMs implemented by PacifiCorp under the No Project Alternative (Table 2.7-19). IMs integrated into PacifiCorp's annual licenses as part of an ICP would continue implemented by PacifiCorp under the No Project Alternative, while IMs not incorporated into the ICP (non-ICP) would either cease or continue as listed in Table 2.7-19. The non-ICP IMs primarily relate to monitoring, funding, and hatcheries, so there would be no effect on water temperature from ending those IMs.

As described under the Proposed Project (Potential Impact 3.2-1), climate change would be anticipated to only significantly influence water temperature existing conditions in the long term (5+ years), so climate change is not discussed further for water temperature under the No Project Alternative. As noted in Section 4.2.1.1 *Alternative Description – Foreseeable Short-term Operations*, long-term outcomes are considered in the Proposed Project and other alternatives, thus long-term water temperature impacts are described in: Section 3.2.5.1 [*Water Quality*] *Water Temperature;* Section 4.3.2 *Water Quality*; Section 4.4.2 *Water Quality*; Section 4.5.2 *Water Quality*; Section 4.6.2 *Water Quality*; and Section 4.7.2 *Water Quality.*

Other potential impacts related to water temperature in the foreseeable short-term (0−5 years) under the No Project Alternative are discussed under a new impact heading, below.

Potential Impact 4.2.2-1 Seasonal alterations in water temperature due to continued impoundment of water in the reservoirs.

In general, the No Project Alternative would not affect the current ongoing changes to water temperature caused by the reservoirs and by dam operations, as described in Section 3.2.2.2 *Water Temperatur*e. The existing temperature conditions in the Lower Klamath Project reservoirs would continue under the No Project Alternative, including larger diel (i.e., 24-hour period) variations in summer water temperature due to hydropower peaking operations, seasonal reservoir stratification, and seasonal shifts in water temperature downstream of the reservoirs, as described under existing conditions in Section 3.2.2.2 *Water Temperature*.

Hydroelectric Reach

In the Hydroelectric Reach from the Oregon-California state line to the upstream end of Copco No. 1 Reservoir, daily hydropower peaking operations would continue to cause artificially high daily maximum water temperatures and daily variability in water temperatures that occur under existing conditions. In the remainder of the Hydroelectric Reach (i.e., Copco No. 1 and Iron Gate reservoirs) water temperatures would be the same as those described under the existing condition (see Section 3.2.2.2 *Water Temperature*), where spring, summer, and fall water temperatures would continue to be influenced by the thermal mass of Copco No. 1 and Iron Gate reservoirs, and the seasonal stratification patterns of the two reservoirs. It is unclear what, if any, steps could reduce the impact of the reservoirs on the thermal regime within the Hydroelectric Reach between Copco No. 1 Reservoir and Iron Gate Dam and comply with the Thermal Plan's ban on elevated temperature discharges into COLD interstate waters (Table 3.2-4). Improvements from existing conditions under the Proposed Project described in Potential Impact 3.2-1 would not occur under the No Project Alternative.

Middle and Lower Klamath River and Klamath River Estuary

The continued impoundment of water in Copco No. 1 and Iron Gate reservoirs under the No Project Alternative would maintain existing adverse late summer/fall water temperatures in the Hydroelectric Reach downstream of Copco No. 1 Reservoir and in the Middle Klamath River downstream of Iron Gate Dam (see Section 3.2.2.2 *Water Temperature*). Temperature effects of the dams do not extend downstream of the Salmon River confluence (see Section 3.2.2.2 *Water Temperature*). Implementation of the 2017 court-ordered flushing and emergency dilution flows downstream of Iron Gate Dam would not significantly alter the existing conditions for water temperature downstream of Iron Gate Dam in the Middle and Lower Klamath River, the Klamath River Estuary, and the Pacific Ocean nearshore environment, but the additional flushing and emergency dilution releases would potentially result in a temporarily more prominent seasonal shift in water temperature downstream of Iron Gate Dam during the releases. Water temperature existing conditions downstream of Copco No. 1 and Iron Gate dams are generally warmer than expected under natural conditions during late-summer and fall and cooler than expected under natural conditions during spring and early summer (see Section 3.2.2.2 *Water Temperature*). These existing conditions could be accentuated by the additional flushing and emergency dilution releases since these flows would potentially occur from November 1 to June 15 (see Section 4.2.1.1 *Alternative Description – Summary of Available Hydrology Information for the No Project Alternative*). However, these conditions would be accentuated only if releases occurred outside of winter and only for a brief time with surface flushing flows occurring for only 72-hours once every year, deep flushing flows occurring for only 24 hours once every other year, and emergency dilutions only occurring in some years if specific disease

conditions are met in the Klamath River. As such, the temporary accentuation of the existing fall or spring shifts in water temperature in the Middle Klamath River downstream of Iron Gate Dam during flushing and emergency dilution releases would result in a less than significant change to existing water temperature conditions. Therefore, there would be no change in water temperature existing conditions in the Middle and Lower Klamath River reaches downstream from the confluence with the Salmon River, including the Klamath River Estuary and the Pacific Ocean nearshore environment under the No Project Alternative.

Overall, there would be no change from existing, adverse conditions for water temperature in the Hydroelectric Reach, the Middle and Lower Klamath River, the Klamath River Estuary, or the Pacific Ocean nearshore environment in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative and the existing, adverse conditions for water temperature would continue to cause an exceedance of water quality standards as set forth in the Thermal Plan. Thus, there would be no significant impact to water temperature under the No Project Alternative.

Significance
No significant impact

Suspended Sediments
The No Project Alternative would not release the reservoir sediment stored behind the Lower Klamath Project dams because this alternative would not remove the existing dams. Thus, there would be no short-term increase in suspended sediment concentrations (SSCs) during drawdown (Potential Impact 3.2-3) and there would be no significant impact.

IMs integrated into PacifiCorp's annual licenses as part of an ICP would continue to be implemented by PacifiCorp under the No Project Alternative, while IMs not incorporated into the ICP (non-ICP) would either cease or continue as listed in Table **2.7-19**4.2-1. The non-ICP IMs primarily relate to monitoring, funding, and hatcheries, so there would be no change from existing conditions for suspended sediments from ending those IMs. J.C. Boyle gravel placement and/or habitat enhancement (IM7) (Table 4.2-1), including gravel augmentation downstream of Iron Gate Dam (PacifiCorp 2014a), would not continue under the No Project Alternative. Thus, any incidental sediment release occurring under the existing condition as a result of this activity would cease. Because of construction management practices employed, this currently does not cause a meaningful degree of sedimentation in the river, and so ceasing this practice would be unlikely to affect suspended sediments relative to existing conditions.

As noted in Section 4.2.1.1 *[No Project Alternative] Alternative Description – Foreseeable Short-term Operations*, the long-term outcomes, including climate change and changes in algal-derived (organic) suspended material due to nutrient reduction measures in Oregon and California, are considered for the Proposed Project and other alternatives, thus the long-term suspended sediment impacts are described in: Section 3.2.5.2 [*Water Quality*] *Suspended Sediments;* Section 4.3.2 *Water Quality*; Section 4.4.2 *Water Quality*; Section 4.5.2 *Water Quality*; Section 4.6.2 *Water Quality*; and Section 4.7.2 *Water Quality.*

Other potential impacts related to suspended sediments in the foreseeable short-term (0−5 years) under the No Project Alternative are discussed under new impact headings, below.

Potential Impact 4.2.2-2 Seasonal increases in algal-derived (organic) suspended material due to continued impoundment of water in the reservoirs.
The No Project Alternative would result in no change from existing conditions with respect to interception, decomposition, retention, and/or dilution[179] of algal-derived (organic) suspended material originating from Upper Klamath Lake (in Oregon) within J.C. Boyle Reservoir and the Hydroelectric Reach to Copco No. 1 Reservoir (Section 3.2.2.3 *Suspended Sediments* and Appendix C.2.1.1). With its shallow depth and short residence time, J.C. Boyle Reservoir does not provide suitable habitat for seasonal phytoplankton (including blue-green algae) blooms (Section 3.2.2.3 *Suspended Sediments* and Appendix C.2.1.1). The No Project Alternative would continue to result in the same adverse seasonal increases in algal-derived (organic) suspended material in Copco No. 1 and Iron Gate reservoirs as existing conditions, with subsequent release of suspended material to the Middle and Lower Klamath River, and eventually the Klamath River Estuary (Section 3.2.2.3 *Suspended Sediments*), and there would be no significant impact.

Nutrient reduction measures in Oregon and California due to the Klamath TMDLs only would result in long-term changes in algal-derived (organic) suspended material, so they are considered as part of the Proposed Project and other alternatives.

Significance
No significant impact

Potential Impact 4.2.2-3 Increases in suspended material due to implementation of 2017 court-ordered flushing and emergency dilution flows downstream of Iron Gate Dam.
Implementation of the 2017 court-ordered flushing and emergency dilution flows downstream of Iron Gate Dam would mobilize more sand, silt, and clay sized sediment downstream of Iron Gate Dam than under the existing conditions when the releases occur since the flushing releases are designed to mobilize such sediments. There would be an increase in suspended sediment concentrations (SSCs) under flushing flows compared to existing conditions, but the increase in SSCs downstream of Iron Gate Dam would have a limited duration much less the two-weeks that would result in a significant impact. Flushing flows would only occur for 72-hours (surface flushing) or 24-hours (deep flushing), so increases in SSCs due to flushing flows are unlikely to increase SSCs above 100 milligrams per liter (mg/L) for an entire two-week period (i.e., the suspended sediment threshold of significance; see Section 3.2.3.1 *Thresholds of Significance – Suspended Sediments*). While emergency dilution releases would potentially occur for a longer period, emergency dilution flows (3,000 to 4,000 cfs) are unlikely to increase SSCs since they are below the thresholds recognized to cause transport of suspended sediment in the Klamath River downstream of Iron Gate Dam (see USBR 2012). Thus, increases in SSCs due to implementation of the flushing and emergency dilution releases would have a less than significant impact on suspended sediment concentrations under the No Project Alternative.

[179] Dilution from coldwater springs downstream of J.C. Boyle Dam.

Significance
No significant impact

Nutrients
The No Project Alternative would not release the reservoir sediment or sediment-associated nutrients stored behind the Lower Klamath Project dams because this alternative would not remove the existing dams (Potential Impact 3.2-7).

There would be no change from existing conditions for nutrients in the Klamath River under the No Project Alternative due to changes in IMs implemented since IMs integrated into PacifiCorp's annual licenses as part of an ICP would continue under the No Project Alternative and IMs ending primarily relate to monitoring, funding, and hatcheries that would not alter nutrient compared to existing conditions. There would be no change from existing conditions for nutrients under the No Project Alternative due to ceasing J.C. Boyle gravel placement and/or habitat enhancement (IM7) (Table 4.2-1), including gravel augmentation downstream of Iron Gate Dam (PacifiCorp 2014), since gravel augmentation does not alter nutrients in the Klamath River under existing conditions.

As noted in Section 4.2.1.1 *[No Project Alternative] Alternative Description – Foreseeable Short-term Operations*, the long-term outcomes, including gradual increases in nutrients and organic matter in reservoir sediments (i.e., reservoir aging [USGS 2018]) that would potentially alter nutrients in the reservoirs and the Klamath River and decreases in nutrients from implementing nutrient reduction measures in Oregon and California as part of the Klamath TMDLs, are considered in the Proposed Project and other alternatives, thus long-term nutrient impacts are described in: Section 3.2.5.3 [*Water Quality*] *Nutrients;* Section 4.3.2 *Water Quality*; Section 4.4.2 *Water Quality*; Section 4.5.2 *Water Quality*; Section 4.6.2 *Water Quality*; and Section 4.7.2 *Water Quality.*

Other potential impacts related to nutrients in the foreseeable short-term (0−5 years) under the No Project Alternative are discussed under a new impact heading, below.

Potential Impact 4.2.2-4 Annual interception and retention of nutrients and seasonal release of nutrients due to continued impoundment of waters in the reservoirs.
Hydroelectric Reach
Nutrients in the Hydroelectric Reach would be the same as existing conditions (Section 3.2.2.4 *Nutrients*) in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative since this alternative would not remove the existing dams. The No Project Alternative would continue to result in the same small annual decreases in total phosphorus (TP) and total nitrogen (TN) through the Hydroelectric Reach as occurs under existing conditions, due to settling of particulate matter and retention of associated nutrients originating from upstream reaches, including Upper Klamath Lake (in Oregon), in J.C. Boyle, Copco No. 1, and Iron Gate reservoirs, and dilution by the coldwater springs located downstream of J.C. Boyle Reservoir (Section 3.2.2.4 *Nutrients*). Seasonal increases in TP, and to a lesser degree TN, in the Hydroelectric Reach would continue to occur under this alternative due to the release (export) of dissolved forms of phosphorus (ortho-phosphorus) and nitrogen (ammonium) from Copco No. 1 and Iron Gate reservoir sediments during summer and fall, when reservoir bottom waters are anoxic (i.e., through the process of internal nutrient loading, see Figure 3.2-2).

Middle and Lower Klamath River and Klamath River Estuary
Nutrients transport from the Hydroelectric Reach into the Klamath River downstream of Iron Gate Dam would be the same as existing conditions (Section 3.2.2.4 *Nutrients*) in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative since this alternative would not remove the existing dams. Dissolved forms of nutrients can be transported on a seasonal basis from Copco No. 1 and Iron Gate reservoirs downstream to the Middle Klamath River where they can stimulate excessive growth of periphyton (aquatic freshwater organisms attached to river bottom surfaces) (see also Section 3.4.2.2 *Periphyton*). In the downstream direction, nutrient effects of the Lower Klamath Project reservoirs diminish due to both tributary dilution and nutrient retention (see Section 3.2.2.4 *Nutrients*).

There would be no change from existing conditions for nutrients due to implementation of the 2017 court-ordered flushing and emergency dilution flows downstream of Iron Gate Dam under the No Project Alternative since suspended sediments transported by these releases would be primarily mineral (inorganic) sediments occurring in the Klamath River under existing conditions.

Significance
No significant impact

Dissolved Oxygen
The No Project Alternative would not release sediments stored behind the Lower Klamath Project dams because this alternative would not remove the existing dams. Thus, there would be no short-term depletion of oxygen from the river due to resuspension of unoxidized organic matter during drawdown (Potential Impact 3.2-9) and there would be no significant impact.

There would be no change from existing conditions for dissolved oxygen in the Klamath River under the No Project Alternative due to changes in IMs implemented since IMs integrated into PacifiCorp's annual licenses as part of an ICP would continue under the No Project Alternative and IMs ending primarily relate to monitoring, funding, and hatcheries that would not alter dissolved oxygen concentrations compared to existing conditions.

As noted in Section 4.2.1.1 *[No Project Alternative] Alternative Description– Foreseeable Short-term Operations*, the long-term outcomes, including climate change and variations in dissolved oxygen from implementing nutrient reduction measures in Oregon and California as part of the Klamath TMDLs, are considered in the Proposed Project and other alternatives, thus long-term dissolved oxygen impacts are described in: Section 3.2.5.4 [*Water Quality*] *Dissolved Oxygen;* Section 4.3.2 *Water Quality*; Section 4.4.2 *Water Quality*; Section 4.5.2 *Water Quality*; Section 4.6.2 *Water Quality*; and Section 4.7.2 *Water Quality.*

Other potential impacts related to dissolved oxygen in the foreseeable short-term (0−5 years) under the No Project Alternative are discussed under a new impact heading, below.

Potential Impact 4.2.2-5 Seasonal low dissolved oxygen concentrations due to continued impoundment of water in the reservoirs.

Hydroelectric Reach

The No Project Alternative in the Klamath River would result in no change from existing, adverse conditions in the reasonably foreseeable short-term (0−5 years) with respect to large summertime variations in dissolved oxygen in the Hydroelectric Reach and dissolved oxygen concentrations in the Middle Klamath River immediately downstream of Iron Gate Reservoir that fall below the Basin Plan minimum dissolved oxygen criteria (Section 3.2.2.5 *Dissolved Oxygen*). In J.C. Boyle Reservoir, summertime variations in dissolved oxygen, especially at depth, would continue to occur and potentially release water with low dissolved oxygen concentrations to the Klamath River immediately downstream of J.C. Boyle Dam during summer/late fall when dissolved oxygen concentrations would potentially be below 5 mg/L (Section 3.2.2.5 *Dissolved Oxygen* and Appendix C – *Section C.4.1*). The influence of J.C. Boyle Dam on dissolved oxygen concentration in the Klamath River decreases in the downstream direction as turbulent mixing and water velocities in the free-flowing river reach provides sufficient aeration under existing conditions (Appendix C – *Section C.4.1*). Due to seasonal stratification in Copco No. 1 and Iron Gate reservoirs that would occur under the No Project Alternative similar to existing conditions, adverse seasonal anoxia (0 mg/L dissolved oxygen) in reservoir bottom waters could continue to occur under this alternative, with seasonal stratification and associated anoxia typically beginning by May and lasting through October to early November (Section 3.2.2.5 *Dissolved Oxygen* and Appendix C – *Section C.4.1*). Daily dissolved oxygen concentration variations within the Lower Klamath Project reservoirs due to phytoplankton growth in the reservoir would continue, so there would be no change for existing conditions and no significant impact on dissolved oxygen in the Hydroelectric Reach for the reasonably foreseeable short-term (0−5 years) under the No Project Alternative.

Middle and Lower Klamath River and Klamath River Estuary

Immediately downstream of Iron Gate Dam, this alternative would continue to result in low dissolved oxygen in waters released from Iron Gate Reservoir during summer/late fall months, where concentrations regularly fall below 8.0 mg/L and the current Basin Plan minimum dissolved oxygen criteria based on percent saturation[180] (see also Section 3.2.2.5 *Dissolved Oxygen* and Appendix C – *Section C.4.2*). Further downstream, the effects of the Lower Klamath Project on dissolved oxygen diminish due to natural stream re-aeration, such that effects are not generally discernable by Seiad Valley (River Mile [RM] 132.7) (Section 3.2.2.5 *Dissolved Oxygen* and Appendix C – *Section C.4.2*).

Dissolved oxygen concentrations due to implementation of the 2017 court-ordered flushing and emergency dilution flows downstream of Iron Gate Dam would be similar to existing conditions, but dissolved oxygen would likely increase immediately downstream of Iron Gate Dam in the Middle Klamath River during releases due to increased turbulent mixing and aeration under the higher flushing flows. However, these conditions would be present for only a brief time between November 1 to May 31 since surface flushing flows occur for only 72-hours once every year and deep flushing flows occur for only 24-

[180] Minimum dissolved oxygen criteria of 85 percent saturation for the period April 1 through September 30, and below the minimum criterion of 90 percent saturation for the period October 1 to March 31, for the Klamath River from Oregon-California state line (RM 214.1) to the Scott River (RM 145.1); see also Table 3.2-4.

hours once every other year. The temporary, brief increases in dissolved oxygen due to flushing flows also generally would occur before reservoirs stratify, so flushing releases would not alter the low dissolved oxygen downstream of Iron Gate Dam that occur under existing conditions during summer/late fall months. Dissolved oxygen concentrations in the Middle Klamath River under emergency dilution releases (3,000 to 4,000 cfs) would be similar to existing conditions since the increase in flow and associated mixing and aeration would be relatively small compared to existing conditions.

Increases in sediment transport due to flushing flows under this alternative would dislodge periphyton from the riverbed and decrease periphyton abundance downstream of Iron Gate Dam in the Middle Klamath River immediately after releases (see also Potential Impact 4.2.4-1). The relationship between flushing and emergency dilution releases, streambed scour and changes in periphyton abundance from the releases, and daily variations in summertime dissolved oxygen due to photosynthesis by periphyton is not fully understood, but seasonal periphyton abundance variations due to seasonal flow changes are a natural process in river systems and occur under existing conditions in the Klamath River. Periphyton naturally re-grow following high winter flows under existing conditions, so periphyton are anticipated to re-grow similarly after flushing flows. While the frequency of flushing flows (i.e., annually for surface flushing and every other year for deep flushing) and the rate of periphyton re-growth may result in a reduction in periphyton abundance downstream of Iron Gate Dam, these reductions in periphyton abundance are expected to have a less than significant impact on daily variations in summertime dissolved oxygen in the Klamath River and dissolved oxygen would be similar to existing conditions. Thus, there would be no significant impact on dissolved oxygen concentrations in the Middle and Lower Klamath River, the Klamath River Estuary, and the Pacific Ocean nearshore environment under the No Project Alternative due to 2017 court-ordered flushing and emergency dilution flows.

Significance
No significant impact

pH
pH existing conditions would not be altered by changes to the IMs implemented by PacifiCorp under the No Project Alternative (see Table 2.7-19). IMs integrated into PacifiCorp's annual licenses as part of an ICP would continue implemented by PacifiCorp under the No Project Alternative, while IMs not incorporated into the ICP (non-ICP) would either cease or continue as listed in Table 2.7-19. The non-ICP IMs primarily relate to monitoring, funding, and hatcheries, so there would be no change from existing adverse conditions for pH from ending those IMs.

As noted in Section 4.2.1.1 *[No Project Alternative] Alternative Description– Foreseeable Short-term Operations*, the long-term outcomes, including climate change and variations in pH from implementing nutrient reduction measures in Oregon and California as part of the Klamath TMDLs, are considered in the Proposed Project and other alternatives, thus long-term pH impacts are described in: Section 3.2.5.5 [*Water Quality*] *pH;* Section 4.3.2 *Water Quality*; Section 4.4.2 *Water Quality*; Section 4.5.2 *Water Quality*; Section 4.6.2 *Water Quality*; and Section 4.7.2 *Water Quality.*

Other potential impacts related to pH in the foreseeable short-term (0−5 years) under the No Project Alternative are discussed under a new impact heading, below.

Potential Impact 4.2.2-6 Seasonal high pH and daily pH fluctuations due to continued impoundment of water in the reservoirs.

Hydroelectric Reach

The No Project Alternative would result in no change from the existing, adverse condition with respect to pH values that exceed the Basin Plan instantaneous maximum pH objective of 8.5 standard units (s.u.) and large daily fluctuations in the Hydroelectric Reach in Copco No. 1 and Iron Gate reservoirs during summertime periods of intense algal blooms (see Section 3.2.2.6 *pH*). The reservoirs would remain in place under the No Project Alternative, so there would be no change in pH from existing, adverse conditions due to conversion of the reservoir areas to free-flowing river and there would be no significant impact on pH in the Hydroelectric Reach under the No Project Alternative.

Middle and Lower Klamath River and Klamath River Estuary

As discussed above, the No Project Alternative would continue to result in the same pH values that exceed the Basin Plan instantaneous maximum pH objective of 8.5 s.u and large daily fluctuations in the Hydroelectric Reach in Copco No. 1 and Iron Gate reservoirs during summertime periods of intense algal blooms (see Section 3.2.2.6 *pH*). In the Middle and Lower Klamath River and Klamath River Estuary, pH exhibits large (0.5–1.5 pH units) daily fluctuations under existing conditions during periods of high photosynthesis and pH values also regularly exceed Basin Plan instantaneous maximum pH objective of 8.5 s.u. during late-summer and early-fall months (August–September), with the most extreme pH exceedances typically occurring from Iron Gate Dam to approximately Seiad Valley (see Section 3.2.2.6 *pH*). Under the No Project Alternative, existing conditions for pH would continue to occur for periods of high photosynthesis, particularly when large phytoplankton blooms are transported from Iron Gate Reservoir into the Middle and Lower Klamath River, with the most extreme pH exceedances typically occurring from Iron Gate Dam to approximately Seiad Valley (see Section 3.2.2.6 *pH*).

The pH in the Middle Klamath River likely would be similar to existing, adverse conditions with the 2017 court-ordered flushing and emergency dilution flows under the No Project Alternative since periphyton along the riverbed contributing to pH conditions would re-grow after reductions following releases and continue to alter pH in the river during summertime periods of high photosynthesis. Court-ordered flushing flows would mobilize sediment downstream of Iron Gate Dam between November 1 to May 31 (see Potential Impact 4.2.2-3) and dislodge periphyton from the riverbed and decrease periphyton abundance downstream of Iron Gate Dam in the Middle Klamath River immediately after releases (see Potential Impact 4.2.4-1). Emergency dilution releases (3,000 to 4,000 cfs) are below the flow recognized to mobilize sediment along the riverbed downstream of Iron Gate Dam, so there would be no change from existing conditions with respect to periphyton abundance due to these releases. While the relationship between flushing and emergency dilution releases, streambed scour and changes in periphyton abundance from the releases, and summertime increases in pH due to photosynthesis by periphyton is not fully understood, seasonal periphyton abundance variations due to seasonal flow changes are a natural process in river systems and occur under existing conditions in the Klamath River. Periphyton naturally re-grow following high winter flows under existing conditions, so periphyton are anticipated to re-grow similarly after flushing flows. While the frequency of flushing flows (i.e., annually for surface flushing and every other year for deep flushing) and the rate of periphyton re-growth may result in a reduction in periphyton abundance downstream of

Iron Gate Dam, these reductions in periphyton abundance are expected to have a less than significant impact on summertime increases in pH in the Klamath River due to periphyton photosynthesis. The Klamath River is a weakly buffered system and it is susceptible to photosynthesis-driven daily and seasonal swings in pH (see Section 3.2.2.6 *pH*), thus pH conditions in the Klamath River downstream of Iron Gate Dam are still anticipated to be similar to existing conditions even with reductions in periphyton abundance from flushing flows and there would be no significant impact to pH in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative.

Significance
No significant impact

Chlorophyll-*a* and Algal Toxins
There would be no change from existing conditions for chlorophyll-*a* and algal toxins, concentrations in the Klamath River under the No Project Alternative due to changes in IMs implemented since IMs integrated into PacifiCorp's annual licenses as part of an ICP would continue under the No Project Alternative and IMs ending primarily relate to monitoring, funding, and hatcheries that would not alter chlorophyll-*a* and algal toxins concentrations compared to existing conditions.

As noted in Section 4.2.1.1 *[No Project Alternative] Alternative Description – Foreseeable Short-term Operations*, the long-term outcomes, including climate change and decreases in chlorophyll-*a* and algal toxins from implementing nutrient reduction measures in Oregon and California as part of the Klamath TMDLs, are considered in the Proposed Project and other alternatives, thus long-term chlorophyll-*a* and algal toxin impacts are described in: Section 3.2.5.6 [*Water Quality*] *Chlorophyll-*a *and Algal Toxins;* Section 4.3.2 *Water Quality*; Section 4.4.2 *Water Quality*; Section 4.5.2 *Water Quality*; Section 4.6.2 *Water Quality*; and Section 4.7.2 *Water Quality.*

Other potential impacts related to chlorophyll-a and algal toxins in the foreseeable short-term (0−5 years) under the No Project Alternative are discussed under a new impact heading, below.

Potential Impact 4.2.2-7 Seasonal increases in chlorophyll-a and algal toxins due to continued impoundment of water in the reservoirs.
Hydroelectric Reach
The No Project Alternative would continue to result in the same adverse, large, seasonal phytoplankton blooms, including blue-green algae, in Copco No. 1 and Iron Gate reservoirs, that occur under existing conditions and produce seasonally high chlorophyll-*a* concentrations and periodically high levels of algal toxins. In the Hydroelectric Reach, seasonal phytoplankton (including blue-green algae) blooms originating from Upper Klamath Lake (in Oregon) would still be able to enter J.C. Boyle Reservoir under this alternative, but the short residence time of this reservoir would not support substantial additional growth of algae similar to existing conditions (Section 3.2.2.3 *Suspended Sediments* and Appendix C.2.1.1). Further downstream in the Hydroelectric Reach, adverse, large, seasonal phytoplankton blooms, including blue-green algae, would continue to occur in Copco No. 1 and Iron Gate reservoirs under the No Project Alternative similar to existing conditions, resulting in chlorophyll-*a* concentrations exceeding the TMDL target of 10 ug/L during the May to October growth season, and periodically high levels of algal toxins (concentrations greater than 0.8 and/or 4 ug/L

microcystin[181]) (see also Section 3.2.2.7 *Chlorophyll-a and Algal Toxins*). Overall, the No Project Alternative would result in no change from existing, adverse conditions and would continue to cause exceedances of water quality standards in the Hydroelectric Reach. Thus, there would be no significant impact to chlorophyll-a and algal toxins in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative in the Hydroelectric Reach.

Middle and Lower Klamath River and Klamath River Estuary

Downstream of Iron Gate Dam, chlorophyll-*a* and algal toxin trends generally would be similar to existing conditions under the No Project Alternative, with releases of chlorophyll-*a* and algal toxins (i.e., microcystin) in the Lower Klamath Project reservoirs to the Middle and Lower Klamath River, and eventually the Klamath River Estuary. Longitudinal and temporal variations in microcystin concentrations from upstream of Copco No. 1 Reservoir to Turwar indicate that Iron Gate Reservoir is the principal source of *Microcystis aeruginosa* cells to the Middle and Lower Klamath River (Otten et al. 2015) (see also Section 3.2.2.7 *Chlorophyll-a and Algal Toxins*). There would be no change to the habitat conditions that promote growth of *Microcystis aeruginosa* in Iron Gate Reservoir under existing conditions (see also Section 3.4.2.3 *Hydroelectric Reach*), so the export of *Microcystis aeruginosa* cells from this reservoir would also continue to occur under the No Project Alternative similar to existing conditions.

The 2017 court-ordered flushing and emergency dilution flows would result in no change from existing conditions for chlorophyll-*a* or algal toxins downstream of Iron Gate Dam, since releases would not alter conditions in Copco No. 1 or Iron Gate reservoirs that produce high chlorophyll-*a* concentrations and periodically high levels of algal toxins under existing conditions, and the court-ordered flushing and emergency dilution flows would primarily occur during winter and spring when chlorophyll-*a* and algal toxin concentrations in Iron Gate Reservoir would be low (see also Section 3.2.2.7 *Chlorophyll-a and Algal Toxins*). The 2017 court-ordered flushing and emergency dilution flows downstream of Iron Gate Dam would end by June 15, while monitoring data from the past five years (i.e., 2013 to 2018) indicates the abundance of blue-green algae and algal toxin concentrations (i.e., microcystin) in Iron Gate Reservoir increases above 0.8 ug/L or 4 ug/L after late June to early July (E&S Environmental Chemistry, Inc. 2013, 2014, 2015, 2016, 2018a, 2018b). Assuming blue-green algae cell counts and algal toxin concentrations from the past five years are representative of likely conditions in the reasonably foreseeable short-term (0−5 years), releases would end before elevated levels of chlorophyll-*a* or algal toxin concentrations occur in Iron Gate Reservoir, and there would be no changes from existing conditions for chlorophyll-a or algal toxin concentrations in the Middle and Lower Klamath River or the Klamath River Estuary. Overall, the No Project Alternative would result in no change from existing, adverse conditions and would continue to cause an exceedance of water quality standards in the Middle and Lower Klamath River and Klamath River Estuary. Thus, there would be no significant impact to chlorophyll-*a* and algal toxins due to flushing and

[181] Since the less than 4 ug/L criterion for microcystin in recreational waters is common to the California Klamath River TMDL, WHO, and Yurok Tribe criteria, and it is less than the Hoopa Valley Tribe recreational criterion, 4 ug/L microcystin is used as the threshold of significance for the Lower Klamath Project EIR water quality analysis. The current lowest CCHAB and Yurok Tribe posting limit for microcystin (0.8 ug/L) is also considered in the analysis although application of the lower threshold would in no case change the significance determinations in this EIR (see Section 3.2.3.1 *Thresholds of Significance – Chlorophyll-a and Algal Toxins*).

emergency dilution releases in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative in the Middle and Lower Klamath River and the Klamath River Estuary.

Significance
No significant impact

Inorganic and Organic Contaminants
There would be no change from existing conditions for inorganic and organic contaminants in the Klamath River under the No Project Alternative due to changes in IMs implemented since IMs integrated into PacifiCorp's annual licenses as part of an ICP would continue under the No Project Alternative and IMs ending primarily relate to monitoring, funding, and hatcheries that would not alter inorganic and organic contaminants in the Klamath River compared to existing conditions.

Increases in human or freshwater aquatic species' exposure to inorganic and organic contaminants associated with sediment release under the Proposed Project (Potential Impacts 3.2-14 and 3.2-15) would not occur because the dams and sediment deposits would remain in place. Herbicide application during restoration of the former reservoir areas would not occur, as the reservoirs would remain in place (Potential Impact 3.2-16).

There would be no change from existing conditions in the reasonably foreseeable short-term (0−5 years) with respect to changes in Iron Gate Hatchery operations on Klamath River water quality since Iron Gate Hatchery would continue existing operations (Potential Impact 3.2-17). Fall Creek Hatchery would not be reopened under this alternative and thus there would be no effects of hatchery discharges on water quality and thus no significant impact (Potential Impact 3.2-17). There would be no significant impacts on water quality from short-term construction activities on Parcel B lands since land transfer would not occur (Potential Impact 3.2-18).

As noted in Section 4.2.1.1 *[No Project Alternative] Alternative Description– Foreseeable Short-term Operations*, the long-term outcomes are considered in the Proposed Project and other alternatives, thus inorganic and organic contaminants impacts are described in: Section 3.2.5.7 *[Water Quality] Inorganic and Organic Contaminants;* Section 4.3.2 *Water Quality*; Section 4.4.2 *Water Quality*; Section 4.5.2 *Water Quality*; Section 4.6.2 *Water Quality*; and Section 4.7.2 *Water Quality.*

Other potential impacts related to inorganic and organic contaminants in the foreseeable short-term (0−5 years) under the No Project Alternative are discussed under a new impact heading, below.

Potential Impact 4.2.2-8 Human and freshwater aquatic species' exposure to inorganic and organic contaminants due to continued impoundment of water in the reservoirs.
The No Project Alternative would continue the existing condition with respect to human or freshwater aquatic species exposure to inorganic and organic contaminants (Section 3.2.2.7 *Inorganic and Organic Contaminants*). Implementation of the 2017 court-ordered flushing and emergency dilution flows downstream of Iron Gate Dam would have no effect on exposure pathways for inorganic and organic contaminants because the flow changes would not alter the Lower Klamath Project reservoir sediment deposits nor would they alter physical, chemical, or biological conditions within the river or reservoir

reaches that would change the potential for exposure to inorganic or organic contaminants compared with existing conditions. Overall, there would be no change in human or freshwater aquatic species' exposure to inorganic and organic contaminants relative to existing conditions, thus there would be no significant impact due to inorganic or organic contaminants in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative in the Hydroelectric Reach, the Middle and Lower Klamath River and the Klamath River Estuary.

Significance
No significant impact

4.2.3 Aquatic Resources

4.2.3.1 Key Ecological Attributes

Suspended Sediment
As described in Section 3.3.4.1 *Suspended Sediment*, the potential effects of suspended sediment on anadromous fish species were assessed using SRH-1D (Huang and Greimann 2010, as summarized in USBR 2012). Suspended sediment effects under the No Project Alternative are described in detail in Appendix E and summarized below. Under the No Project Alternative, suspended sediment would be the same as under existing conditions. Most suspended sediment is supplied by tributaries; Iron Gate Dam currently interrupts both fine and coarse sediment transport, so suspended sediment generally increases in a downstream direction. The Lower Klamath River downstream from the Trinity River confluence (RM 43.3) to the estuary mouth (RM 0) is listed as sediment impaired under Section 303(d) of the Clean Water Act (CWA).

Daily durations of SSC concentrations were modeled assuming the No Project Alternative occurred within each of the 49 years in the available hydrology record (1961–2009).

For each simulation year in the 49-year record, the duration of SSCs over a given threshold was calculated for each species and life-history stage (e.g., duration of SSC over 1,000 mg/L during spring-run Chinook salmon adult upstream migration). Species selected for the suspended sediment analysis included Chinook salmon (fall- and spring-runs), coho salmon, steelhead (summer and fall/winter runs), Pacific lamprey, and green sturgeon. The results of modeling all potential years were summarized for each life-stage of each species assessed. This information was used assess the impacts of SSCs on fish under a No Project Alternative, based on the concentration and duration of exposure using an approach described by Newcombe and Jensen's (1996). As described in Appendix E, Newcombe and Jensen (1996) reviewed and synthesized 80 published reports of fish responses to suspended sediment in laboratories, streams, and estuaries and established a set of equations to calculate "severity of ill effect" (SEV) indices. A suite of six equations were developed that evaluate the effects of suspended sediment (at various concentrations, durations of exposure, and particle sizes) on various taxonomic groups of fishes and life stages of species within those groups.

Because the suspended sediment varies with hydrology, and in order to account for (and compare) the range of results and impacts that might occur under the No Project Alternative, three scenarios were analyzed for the No Project Alternative with the goal of predicting the potential impacts to fish that has either a 90 percent (mild conditions for

fish), 50 percent (median conditions for fish) or 10 percent (extreme conditions for fish) probability of occurring, defined as follows:

- **Median conditions for fish:** This scenario represents the conditions that most often occur for each species and life stage—that is to say, SSCs and durations with a 50 percent exceedance probability for the mainstem Klamath River downstream from Iron Gate Dam. This means that under existing conditions there is an equal chance that the SSCs will be higher or lower than described. Exceedance probabilities were based on modeling SSCs for all water years from 1961 to 2009 with facilities in place.
- **Mild conditions for fish:** This scenario represents mild conditions of the potential sediment-related impacts to a species and life stage. It uses suspended sediment concentrations and durations with a 90 percent exceedance probability. This means that under these rare mild conditions for fish scenario the probability of these concentrations and durations being equal to or less than this level for each assessed species and life-stage in any one year is 10 percent, and the probability of them being exceeded is 90 percent.
- **Extreme conditions for fish:** This scenario represents extreme conditions for fish from potential sediment-related impacts. It uses SSCs and durations with a 10 percent exceedance probability. This means that under these rare extreme conditions for fish scenario the probability of these concentrations and durations being equal to or greater than this level for each assessed species and life-stage in any one year is 10 percent, and the probability of them being less than this level is 90 percent.

Under mild, median, or extreme conditions for fish, the magnitude and duration of the SSCs modeled for the No Project Alternative are expected to cause major stress to migrating adult and juvenile salmonids (SEV greater than 8) primarily during winter (see Appendix E for detailed analysis).

Bed Elevation and Grain Size Distribution

Under the No Project Alternative, reasonably foreseeable short-term (0−5 years) bed elevation and grain size distribution conditions downstream of Iron Gate Dam are expected to remain the same as existing conditions, since Lower Klamath Project dams will continue to trap sediment, as described in Appendix F and summarized in Section 3.11.2.2 *Geomorphology*.

Water Quality

Upper Klamath River—Hydroelectric Reach

Under the No Project Alternative, continued high rates of algal photosynthesis in the two largest reservoirs in the Hydroelectric Reach (Copco No. 1 and Iron Gate) would result in dissolved oxygen and pH values that would not consistently meet California Basin Plan water quality objectives (see Section 3.2 *Water Quality*). The bottom waters (i.e., hypolimnion) of Copco No. 1 and Iron Gate reservoirs would continue to have very low dissolved oxygen levels (< 1 mg/L to 5 mg/L) during summer stratification periods. Based on existing conditions, pH during summer through fall in Copco No. 1 and Iron Gate reservoirs would continue to range from just above neutral (7) to greater than 9 (slightly basic), with the highest values occurring during algal blooms. The ongoing presence of Copco No. 1 and Iron Gate reservoirs, the two largest reservoirs in the Hydroelectric Reach, would also continue to provide the conditions necessary for large seasonal blue-green algae blooms, including *Microcystis aeruginosa*, which can

produce a toxin and contribute to reduced health and increased mortality rates for fish and other aquatic resources both within the reservoirs and in areas downstream.

Middle and Lower Klamath River
Ongoing efforts to improve water quality conditions in this reach are underway through the TMDL process and considerable efforts to improve habitat are also underway (Hamilton et al. 2011). Once fully implemented, these efforts could reduce existing water quality degradation that contribute to reduced health and increased mortality rates for aquatic resources (described below) to some extent, but this process would be slower and more challenging than with the dams removed (Section 4.2.1 *Introduction*). In the interim, water quality conditions that may reduce survival of fish and other aquatic resources would persist downstream from Iron Gate Dam.

Modeling conducted for development of the California Klamath River TMDL indicates that under the No Project Alternative, dissolved oxygen concentrations immediately downstream from Iron Gate Dam would not meet the North Coast Basin Plan water quality objective of 85 percent saturation during August–September and the 90 percent saturation objective from October–November (Section 3.2.2.5 *Dissolved Oxygen*, Figure 3.2-20). Further downstream, near the confluence with the Shasta River, dissolved oxygen concentrations under the No Project Alternative would not meet the 90 percent saturation objective from October–November (Section 3.2.2.5 *Dissolved Oxygen*, Figure 3.2-21). In the Klamath River at Seiad Valley, concentrations would be mostly in compliance, with the exception of modeled values in November that would not meet the 90 percent saturation objective (Section 3.2.2.5 *Dissolved Oxygen*, Figure 3.2-21). By the Salmon River (RM 66) confluence, with full attainment of TMDL allocations, predicted dissolved oxygen concentrations would remain at or above the 85 percent saturation objective (as well as the 90 percent saturation objective, where applicable), meeting the Water Quality Control Plan for the North Coast Region (California Basin Plan) requirements.

Under the No Project Alternative, continued high rates of algal photosynthesis in the reservoirs would result in high pH values in the Lower Klamath River downstream from Iron Gate Dam. Under the No Project Alternative, pH would continue to be elevated with high diurnal variability during summer and early fall months.

The overall anticipated effect on dissolved oxygen in the Lower Klamath River under the No Project Alternative would be an increasing trend toward compliance with water quality objectives and support of designated beneficial uses, but with possible continued seasonally low dissolved oxygen downstream from Iron Gate Dam. The seasonally low dissolved oxygen levels in this reach would not consistently meet California Basin Plan and Hoopa Valley Tribe water quality objectives. The No Project Alternative would continue to periodically result in dissolved oxygen levels that may be deleterious to aquatic resources downstream from Iron Gate Dam, but adverse effects would be similar to or less than under existing conditions.

Water Temperature
Upper Klamath River—Hydroelectric Reach
Under the No Project Alternative, the effects of ongoing and future upstream water quality improvements under the TMDLs would improve water temperatures downstream of Keno Dam, as described in Section 3.2.2.2 *Water Temperature*. The river's thermal regime downstream from the reservoirs would continue to be out of phase with the

natural temperature regime (Hamilton et al. 2011). Unnatural temperature fluctuations would continue downstream from the J.C. Boyle Bypass Reach, from the mixture of cold-water inflow from Big Springs and the warmer water discharge from the J.C. Boyle Powerhouse (Hamilton et al. 2011).

Middle and Lower Klamath River

Under the No Project Alternative, the Lower Klamath River downstream from Iron Gate Dam would continue to have elevated water temperatures in the summer and fall in the near term. The reservoirs have the effect of changing the timing and magnitude of the thermal regime by increasing water temperatures in the fall as a result of the increased hydraulic residence time and thermal mass (Bartholow et al. 2005). Bartholow et al. (2005) and PacifiCorp (2004b) showed that the reservoirs delay seasonal thermal signatures by 18 days.

Dams would continue to increase late summer and early fall water temperatures in the Klamath River downstream from Iron Gate Dam (3.2.2.2 *Water Temperature*). Under the No Project Alternative in the fall, the dams would not decrease temperatures of water that is transported downstream from Upper Klamath Lake. This is due to the fact that powerhouse withdrawals for Copco No. 1 and Iron Gate Dams are primarily from the epilimnion (surface waters) (see Appendix C, Section C.1.1.4) which is heated by ambient air under existing reservoir operations. Unlike Shasta Dam or other deep reservoirs that support downstream tailwater fisheries by release of cold water from low level outlets, the location of dam outlets in the Klamath River cannot be adjusted to access large volumes of cold water in the bottom of the reservoirs (hypolimnion).

Under this alternative, the current phase shift and lack of temporal temperature diversity in the middle and lower Klamath River would persist, including current warm temperatures in late summer and fall (Hamilton et al. 2011). Juvenile and adult salmonids migrating in late summer and fall would continue to experience warm temperatures that could be deleterious to health and survival, including increased risk of disease, and high rates of delayed spawning and pre-spawn mortality (Hetrick et al. 2009). This phase shift and the resulting warm fall temperatures results in delayed adult upstream salmonid migration, which is believed to delay fall spawning (Dunsmore and Huntington 2006). Under the No Project Alternative, the existing cold-water temperatures in spring would likely continue to delay emergence and reduce growth rates of juveniles (Hardy et al. 2006).

In addition, the decrease in diel temperature variation compared with historical conditions is deleterious for salmonids. Historically, diel temperature variation would result in regular nighttime cooling of water, offering daily relief with significant bioenergetic benefits that helped fish persist under marginal water temperature conditions (NRC 2004). Under the No Project Alternative, the current lack of diel temperature variation would continue to reduce the value of thermal refuge habitat (Dunsmoor and Huntington 2006) and reduce the suitability of rearing habitat in the mainstem Klamath River (NRC 2004).

In addition to direct thermal stress, the potential for continued elevated water temperatures in the late summer/fall under the No Project Alternative could result in indirect stressors on salmonids including an increased intensity and duration of algal blooms, decreased dissolved oxygen levels, and conditions conducive to disease

(Bartholomew and Foott 2010). These effects would adversely impact cold-water fish communities and would be deleterious to warm-water fish communities as well.

Klamath River Estuary and Pacific Ocean Nearshore Environment
Under the No Project Alternative, water temperatures in the Klamath River Estuary and Pacific Ocean would remain similar to the existing conditions and climate change would continue to play a role in future temperatures as described above.

Fish Disease and Parasites
As described in Section 3.3.2.3 *Habitat Attributes Expected to be Affected by the Proposed Project [Fish Disease and Parasites]*, The ongoing presence of the dams under the No Project Alternative would continue to contribute to the static flows, immobile substrate, seasonally warm water temperatures, and planktonic food sources in the mainstem Klamath River that are favorable for polychaetes and for *C. shasta* and *P. minibicornis* (Hetrick et al. 2009). Salmon carcasses would continue to concentrate downstream from Iron Gate Dam, where the polychaete hosts are abundant, facilitating the cross infection between the fish and the polychaetes. Under the No Project Alternative, mortality associated with *C. shasta* and *P. minibicornis* would be expected to worsen or remain similar to existing conditions. These conditions would continue to adversely affect salmon outmigrating from tributaries downstream from Iron Gate Dam, including those from the Shasta and Scott rivers. However, additional winter-spring surface flushing flows and deep flushing flow requirements outlined in *Measures to Reduce Ceratanova Shasta Infection of Klamath River Salmonids: A Guidance Document* and U.S. District Court Filing 111 (U.S. District Court 2017a–c; described in Section 4.2.3) is predicted to help reduce juvenile salmon disease below Iron Gate Dam. As described in Section 3.1.6 *Summary of Available Hydrology Information for the Proposed Project*, 2017 court-ordered flushing flows were required in 2017 and 2018, with the intent of reducing disease in the Lower Klamath River by mobilizing bedload sediments. In addition, court ordered emergency dilution flows were required in 2018. As described in Section 3.1.6, the 2017 court-ordered flows include a requirement to ensure that certain high flows are reached each winter, and also include an emergency dilution requirement if juvenile fish disease reaches high levels in the infection nidus. The emergency dilution flows were used in 2018. While the flushing flows have not been occurring over a long enough time to allow collection of enough data on the efficacy of the flushing flows, the necessity to use the emergency dilution flows in 2018 suggest that the addition of the flushing flows is insufficient on its own to resolve the issue of fish disease downstream of Iron Gate Dam. Therefore, the No Project Alternative would result in continued substantial deleterious effects on salmon because of fish disease and parasites.

Algal Toxins
Upper Klamath River - Hydroelectric Reach
Continued impoundment of water at the Lower Klamath Project reservoirs under the No Project Alternative would continue to support suitable growth conditions for toxin-producing nuisance algal species such as *Microcystis aeruginosa* in Copco No. 1 and Iron Gate reservoirs, resulting in high seasonal concentrations of algal toxins in the Hydroelectric Reach. This would result in continued bioaccumulation of microcystin in fish tissue for species in the Hydroelectric Reach and could be deleterious to fish health (Section 3.2.2.7 *Chlorophyll-a and Algal Toxins*).

Middle and Lower Klamath River
Continued impoundment of water within the Lower Klamath Project reservoirs under the No Project Alternative would continue to support suitable growth conditions for toxin-producing nuisance algal species such as *Microcystis aeruginosa* in Copco No. 1 and Iron Gate reservoirs and subsequent transport of high seasonal concentrations of algal toxins to the Klamath River downstream from Iron Gate Dam. This would also support continued bioaccumulation of microcystin in fish and muscle tissue for species downstream from the dam (3.2.2.7 *Chlorophyll-a and Algal Toxins*).

Aquatic Habitat and Instream Flows
Under the No Project Alternative, hydrology and aquatic habitat of the Klamath River from its headwaters to the estuary would generally remain the same as under existing conditions. However, additional winter-spring surface flushing flows and deep flushing flow requirements outlined in *Measures to Reduce Ceratanova Shasta Infection of Klamath River Salmonids: A Guidance Document* and U.S. District Court Filing 111 (U.S. District Court 2017a–c; described in Section 4.2.3) is predicted to help reduce juvenile salmon disease below Iron Gate Dam.

Activities currently underway to improve aquatic habitat and recover salmonid populations within the Klamath Basin would continue at their current levels. Recovery actions to improve aquatic habitat under the Klamath River Coho Salmon Recovery Plan (NMFS 2014) would continue, depending on available funding. These actions are anticipated to improve aquatic habitat conditions over time relative to current conditions within the areas that anadromous fish currently have access to. However, anadromous fish would continue to be blocked by Lower Klamath Project dams from access to a substantial quantity of historical habitat (described in Section 3.3.5.8 *Aquatic Habitat*).

4.2.3.2 Aquatic Resource Potential Impacts, Impacts, and Mitigation

Potential Impact 4.2.3-1 Effects on coho salmon critical habitat quality and quantity due to continued operations of the Lower Klamath Project.
In the short term, under the No Project Alternative, habitat conditions that support Primary Constituent Elements (PCEs) of designated critical habitat for coho salmon would continue to be impaired (NMFS 1999, 2010). Spawning habitat would continue to be impaired by sediment and instream flows within tributary streams, with little occurrence of mainstem spawning. Rearing habitat would continue to be impaired as result of habitat degradation, high water temperatures, and disease within tributaries and the mainstem. Flows would continue to be regulated by the existing 2013 BiOp, but they also would include the winter-spring surface and deep flushing flows as well as emergency dilution flow requirements (see Section 4.2.1.1 *[Alternative Description] Summary of Available Hydrology Information for the No Project Alternative*). In general, flows that support PCEs would continue to be depleted, both within tributaries and within the mainstem Klamath River, similar to existing conditions. While the quality of PCEs would likely improve gradually over time through the actions undertaken under the Klamath River Coho Salmon Recovery Plan (NMFS 2014), potential variations in the implementation schedule for recovery actions, and the time until recovery actions have a measurable effect, means that in the short term, recovery actions would not be likely to improve PCE's. Additionally, in the short term under the No Project Alternative, coho salmon access to upstream tributaries such as Jenny Creek, Fall Creek, and Shovel Creek would remain inaccessible by Lower Klamath Project facilities. Overall, under the

No Project Alternative, there would be no change from existing adverse conditions for coho salmon critical habitat in the reasonably foreseeable short-term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-2 Effects on Southern Resident Killer Whale critical habitat quality due to alterations to salmon populations due to continued operations of the Lower Klamath Project.
The Klamath River may affect PCEs of critical habitat for Southern Resident Killer Whales through its potential contribution of Chinook salmon to the food supply for Southern Resident Killer Whales, the survival and fecundity of which appears dependent upon the abundance of this species (Ward et al. 2009, Ford et al. 2009). However, data on the Southern Resident Killer Whale diet indicate that based on the migratory range and behavior of the population, the Klamath River salmon are anticipated to provide less than one percent of the diet of Southern Resident Killer Whales in most months under current and future conditions. While Southern Resident Killer Whales have been shown to consume Klamath River Chinook Salmon, the Klamath River is considered by NMFS and WDFW tenth out of the top ten priority Chinook Salmon populations for Southern Resident Killer Whales (NMFS 2018b, NMFS and WDFW 2018). Under the No Project Alternative, there would be no change in Klamath-origin Chinook salmon as compared to existing conditions, and therefore no significant impact.

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-3 Effects on eulachon critical habitat quality due to continued operations of the Lower Klamath Project.
Under the No Project Alternative, there are no major actions that are likely to alter PCEs of critical habitat for eulachon in the Klamath River Estuary. In the reasonably foreseeable short-term (0−5 years), there would be no change from existing conditions for eulachon critical habitat, and therefore no significant impact.

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-4 Effects on Chinook and coho salmon Essential Fish Habitat (EFH) quality due to continued operations of the Lower Klamath Project.
Under the No Project Alternative, EFH for Chinook and coho salmon would be expected to remain similar to current conditions. Access to habitat would be limited to current levels. Conditions under the No Project Alternative would continue to contribute to elevated concentrations of disease parasites and would provide the conditions required for the cross infection of fish and polychaetes (Hetrick et al. 2009, Hamilton et al. 2011). These interacting factors could decrease the viability of Chinook and coho salmon populations in the future (Hetrick et al. 2009, Hamilton et al. 2011). Under the No Project Alternative, there would be no change from existing adverse conditions for Chinook and coho salmon EFH in the reasonably foreseeable short-term (0−5 years).

Significance
No change from existing adverse conditions in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-5 Effects on groundfish Essential Fish Habitat (EFH) quality due to continued operations of the Lower Klamath Project.
Under the No Project Alternative, sediment and habitat conditions in the estuary are not substantially altered by the Lower Klamath Project, and nearshore ocean would remain the same as they are under existing conditions. Under the No Project Alternative, there would be no change from existing conditions for groundfish EFH in the reasonably foreseeable short-term (0−5 years), and therefore no significant impact.

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-6 Effects on pelagic fish Essential Fish Habitat (EFH) quality due to continued operations of the Lower Klamath Project.
Under the No Project Alternative, sediment and habitat conditions in the estuary and nearshore ocean would not be altered by the Lower Klamath Project, and they would continue to be the same as they are under existing conditions. Under the No Project Alternative, there would be no change from existing conditions for pelagic fish EFH in the reasonably foreseeable short-term (0−5 years), and therefore no significant impact.

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-7 Effects on the fall-run Chinook salmon population due to continued operations of the Lower Klamath Project.
To help determine if the Proposed Project would advance restoration of the salmonid fisheries of the Klamath Basin, a Chinook Salmon Expert Panel was convened to attempt to answer specific questions that had been formulated by the project stakeholders to assist with assessing the effects of the Proposed Project compared with existing conditions (Goodman et al. 2011). In response to comments the Panel stated with certainty that under the No Project Alternative, fall-run Chinook salmon within the Klamath River will continue to decline[182]. However, as described in detail in Section 3.3.2.1 *Aquatic Species [Chinook salmon]*, although abundances are low compared to historical numbers (Table 3.3-2), in a recent review of the population status of Chinook salmon, the BRT (Williams et al. 2011) concluded that the current Klamath Basin population (which includes hatchery fish) appears to have been fairly stable for the past 30 years and is not currently in decline.

As described in Section 3.2.2 *Water Temperature*, under the No Project Alternative, the thermal regimes downstream from Iron Gate Dam would continue to be altered as a result of the Lower Klamath Project reservoirs and operations, particularly retention time of water in the reservoirs. Under existing conditions maximum temperatures in the Klamath River downstream from Iron Gate Dam to the Klamath River Estuary regularly exceed the range of chronic effects temperature thresholds (55.4–68°F) for full salmonid support in California (North Coast Regional Board 2010, Sinnott 2010a, 2011a, 2012a; Watercourse Engineering, Inc. 2011a, 2011b, 2012, 2013, 2014, 2015, 2016; Hanington

[182] Page 69 of Appendix C of the July 20, 2011 Addendum to Goodman et al. 2011.

2013; Hanington and Ellien 2013) (see Appendix C for more detail). These detrimental temperature exceedances would continue under the No Project Alternative.

Under the No Project Alternative, Iron Gate Dam would continue to block fall-run Chinook salmon access to hundreds of miles of historical habitat, which used to extend upstream to the Sprague, Williamson, and Wood Rivers (Hamilton et al. 2005, Hamilton et al. 2016). This includes around 76 miles of potential habitat within the Lower Klamath Project, based on approximately 54 miles of potential anadromous fish (steelhead) habitat in the Project Reach (NMFS 2006a, DOI 2007)[183], reduced in consideration of the more limited distribution of Chinook salmon relative to steelhead (DOI 2007), and including over 22 miles inundated by Klamath Hydroelectric Project reservoirs (Cunanan 2009). The current reservoirs inundate sections of the river that had high sinuosity and complex channels that historically provided excellent salmonid spawning and rearing habitats (Hetrick et al. 2009). The consequences of this ongoing loss of habitat to the population could include reduced resilience to recover from catastrophic disturbances of natural or anthropogenic origin, such as wildfire or chemical spills. Under the No Project Alternative, access to cold water habitat would continue to be severely limited, reducing opportunities for the fall-run Chinook salmon of all life stages to access refuge habitat that would increase resiliency of the population to disturbance. Under the No Project Alternative, the system of reservoirs and dams in the hydroelectric reach would continue to create conditions conducive to the spread of parasites among the fall-run Chinook salmon population downstream from Iron Gate Dam, especially where adults (and carcasses) tend to congregate in high numbers, just downstream from Iron Gate Dam (Stocking and Bartholomew 2007, Bartholomew and Foott 2010), but also in other locations further downstream. Additional factors related to the Lower Klamath Project would continue to exacerbate the risk of disease downstream from Iron Gate Dam, including increased water temperatures and dampened flow and thermal variability, reduced dissolved oxygen concentrations, loss of sediment transport through the reach due to capture of sediment by the dams, and reservoirs contributing plankton to the filter-feeding polychaete hosts of the myxozoan parasites (as discussed above in Section 4.2.3.1 *Key Ecological Attributes [Fish Disease and Parasites]*). Under the No Project Alternative, downstream-migrating juvenile Chinook salmon may continue to have high disease infection rates (Bartholomew and Foott 2010) during summer months in some years. Heavy parasite loads may increase disease-related mortality in outmigrant smolts, particularly when water temperatures are high, or may reduce ocean survival by affecting growth or fitness (Scheuerell et al. 2009).

However, additional winter-spring surface flushing flows and deep flushing flow requirements outlined in *Measures to Reduce Ceratanova Shasta Infection of Klamath River Salmonids: A Guidance Document* and U.S. District Court Filing 111 (U.S. District Court 2017a–c; described in Section 4.2.3) is predicted to help reduce juvenile salmon disease below Iron Gate Dam. As described in Section 3.1.6 *Summary of Available Hydrology Information for the Proposed Project*, 2017 court-ordered flushing flows were required in 2017 and 2018, with the intent of reducing disease in the Lower Klamath River by mobilizing bedload sediments. In addition, court ordered emergency dilution flows were required in 2018. As described in Section 3.1.6, the 2017 court-ordered flows include a requirement to ensure that certain high flows are reached each winter, and also include an emergency dilution requirement if juvenile fish disease

[183] This also takes into consideration slight differences in the NMFS (2006a) definition of the Project Reach from what is used in this report.

reaches high levels in the infection nidus. The emergency dilution flows were used in 2018. While the flushing flows have not been occurring over a long enough time to allow collection of enough data on the efficacy of the flushing flows, the necessity to use the emergency dilution flows in 2018 suggest that the addition of the flushing flows is insufficient on its own to resolve the issue of fish disease downstream of Iron Gate Dam. Therefore, the No Project Alternative would result in continued substantial deleterious effects on fall-run Chinook salmon because of fish disease and parasites.

Effects of suspended sediment on fall-run Chinook salmon under the No Project Alternative and existing conditions are described in Appendix E.3.1.1. Overall, fall-run Chinook salmon use the mainstem Klamath River for spawning, rearing, and as a migratory corridor. Although SSCs under existing conditions and the No Project Alternative are relatively high in the mainstem downstream from Orleans, and even more so downstream from the Trinity River (State Water Resources Control Board 2006, North Coast Regional Board 2010) (Appendix E and Section 3.2.2.3 *Suspended Sediments*), they are relatively low in the reach downstream from Iron Gate Dam where most mainstem spawning occurs. Suspended sediment concentrations and durations during upstream and downstream migration, even under extreme conditions for fish, are low enough that they have limited effects on fish, although physiological stress and reduced growth rates are possible. In general, fall-run Chinook salmon under the No Project Alternative would be relatively unaffected by SSCs, because smolt outmigration primarily occurs when SSCs are naturally low (similar to existing conditions).

Under the No Project Alternative, ongoing hatchery operations would continue to mitigate for habitat lost due to construction of Iron Gate Dam by releasing millions of juvenile and yearling Chinook salmon annually. These fish may compete with the progeny of natural-origin fish for food and other limited resources, such as thermal refugia, as described in Section 3.3.2.3 *Habitat Attributes Expected to be Affected by the Proposed Project [Fish Hatcheries]*. In addition, hatchery releases can increase disease infection rates through crowding and, where mortality occurs, concentrated release of myxospores on top of the area of highest polychaete densities. Data from Ackerman et al. (2006) indicate that substantial straying of Iron Gate Hatchery fish may be occurring into important tributaries of the Middle Klamath River. Straying has the potential to reduce the reproductive success of natural salmonid populations (Mclean et al. 2003, Chilcote 2003, Araki et al. 2007) and negatively affect the diversity of the populations via outbreeding depression[184] (Reisenbichler and Rubin 1999).

Under the No Project Alternative, the interruption of sediment transport processes by the dams would continue, reducing spawning gravel supply to downstream reaches and changing the dynamics of channel morphology and riparian vegetation communities that create and maintain rearing habitats for fry and juvenile fall-run Chinook salmon. Lack of sediment transport is also likely to be contributing to the high densities of polychaetes downstream from Iron Gate Dam that host salmonid parasites, through reduction of scour that would otherwise help limit periphyton growth (FERC 2007, Hetrick et al. 2009). Under the No Project Alternative, there would be no change from existing conditions for fall-run Chinook salmon in the reasonably foreseeable short-term (0−5 years).

[184] Outbreeding depression is the displacement of locally adapted genes in a wild population.

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-8 Effects on the spring-run Chinook salmon population due to continued operations of the Lower Klamath Project.
In a recent review of the population status of Chinook salmon, the Biological Review Team (BRT) (Williams et al. 2011) concluded that the current Chinook population (which includes hatchery fish) appears to have been fairly stable for the past 30 years and is not currently in decline, despite dramatic reductions in comparison to historical abundance (Table 3.3-2). However, the BRT was concerned about the relatively few populations of spring-run Chinook salmon in the Upper Klamath Trinity River ESU and the low numbers of spawners within those populations (Williams et al. 2011).

Under the No Project Alternative, poor water quality conditions caused partly by nutrient enrichment through release of blue-green algae from Lower Klamath Project reservoirs, during spring-run Chinook salmon upstream and downstream migration may cause high stress to adults and juveniles. Water quality in the mainstem Klamath River downstream from Iron Gate Dam is adversely affected by Lower Klamath Project facilities (Section 3.2.2.2 *Water Temperature*) including altered seasonal water temperature patterns, low dissolved oxygen, and increased nutrient input, as well occasional blooms of the toxic blue-green algae *Microcystis aeruginosa*. Although water quality tends to improve downstream of Iron Gate Dam to the Salmon River (the current upstream extent of spring-run Chinook distribution in the Klamath River), the effect of water quality alterations caused by Lower Klamath Project facilities is that conditions (especially water temperature and dissolved oxygen) during much of the summer are critically stressful for spring-run Chinook salmon that are present during the period June through September. Under existing conditions maximum temperatures in the Klamath River downstream from Iron Gate Dam to the Klamath River Estuary regularly exceed the range of chronic effects temperature thresholds (55.4–68°F) for full salmonid support in California (North Coast Regional Board 2010, Sinnott 2010a, 2011a, 2012a; Watercourse Engineering, Inc. 2011a, 2011b, 2012, 2013, 2014, 2015, 2016; Hanington 2013; Hanington and Ellien 2013) (see Appendix C for more detail). These detrimental temperature exceedances would continue under the No Project Alternative. Spring Chinook salmon that are stressed by high temperatures, whether adults or juveniles, likely have lower survival rates, especially when challenged by additional water quality factors, such as low dissolved oxygen, the presence of toxic blue-green algae (*Microcystis aeruginosa*) and fish diseases, and high pH and un-ionized ammonia (3.2.2.6 *pH*). Under the No Project Alternative, downstream-migrating juvenile Chinook salmon may continue to have high disease infection rates (Bartholomew and Foott 2010) during summer months in some years. Heavy parasite loads may increase disease-related mortality in outmigrant smolts, particularly when water temperatures are high, or may reduce ocean survival by affecting growth or fitness (Scheuerell et al. 2009).

However, additional winter-spring surface flushing flows and deep flushing flow requirements outlined in *Measures to Reduce Ceratanova Shasta Infection of Klamath River Salmonids: A Guidance Document* and U.S. District Court Filing 111 (U.S. District Court 2017a–c; described in Section 4.2.3) is predicted to help reduce juvenile salmon disease below Iron Gate Dam. As described in Section 3.1.6 *Summary of Available Hydrology Information for the Proposed Project*, 2017 court-ordered flushing flows were required in 2017 and 2018, with the intent of reducing disease in the Lower Klamath River by mobilizing bedload sediments. In addition, court ordered emergency dilution

flows were required in 2018. As described in Section 3.1.6, the 2017 court-ordered flows include a requirement to ensure that certain high flows are reached each winter, and also include an emergency dilution requirement if juvenile fish disease reaches high levels in the infection nidus. The emergency dilution flows were used in 2018. While the flushing flows have not been occurring over a long enough time to allow collection of enough data on the efficacy of the flushing flows, the necessity to use the emergency dilution flows in 2018 suggest that the addition of the flushing flows is insufficient on its own to resolve the issue of fish disease downstream of Iron Gate Dam. Therefore, the No Project Alternative would result in continued substantial deleterious effects on spring-run Chinook salmon because of fish disease and parasites.

Under the No Project Alternative high water temperatures during summer may also reduce the growth of juvenile spring-run Chinook salmon juveniles that are rearing and migrating downstream to the ocean due to greater metabolic requirements. Because size is correlated with ocean survival (Scheuerell et al. 2009), this could lead to reduced smolt survival and subsequently, reduced escapement under the No Project Alternative. Finally, high temperatures can selectively reduce the survival of fish expressing the life history of migrating later in the summer (the "summer-run"), thus reducing genetic and life-history diversity. High water temperatures likely limit adult holding and summer rearing habitat for spring-run Chinook salmon in the main spawning tributaries, the Salmon and Trinity Rivers, which would likely reduce overall production under the No Project Alternative. Low flows in dry years can cause migration barriers to form, reducing habitat available to spawning and rearing fish.

Under the No Project Alternative, Iron Gate Dam would continue to block spring-run Chinook salmon access to their historical habitat, which used to extend upstream to the Sprague, Williamson, and Wood Rivers (Hamilton et al. 2005). This includes around 76 miles of potential habitat within the Lower Klamath Project, based on approximately 54 miles of potential anadromous fish (steelhead) habitat in the Project Reach (NMFS 2006a, DOI 2007)[185], reduced in consideration of the more limited distribution of Chinook salmon relative to steelhead (DOI 2007), and including over 22 miles inundated by Klamath Hydroelectric Project reservoirs (Cunanan 2009). The current reservoirs inundate sections of the river that had high sinuosity and complex channels that historically provided excellent salmonid spawning and rearing habitats (Hetrick et al. 2009). In addition, access would continue to be blocked to hundreds of miles of habitat upstream of J.C. Boyle Reservoir (Hamilton et al. 2005). The consequences of ongoing blockage of Spring-run Chinook habitat under the No Project Alternative could include reduced resilience to Spring-run Chinook population for recovery from catastrophic disturbances of natural or anthropogenic origin, such as wildfire or chemical spills. Because areas upstream of Iron Gate Dam include cold-water refugia, opportunities for the population to adapt to changing climate are reduced, whether these changes are a result of short- or long-term cycles or trends.

Effects of suspended sediment on spring-run Chinook salmon under the No Project Alternative and existing conditions are described in Appendix E.3.1.2. Overall, spring-run Chinook salmon mostly use the mainstem Klamath River as a migratory corridor during adult migration, and downstream smolt migration. Although suspended sediment under existing conditions is relatively high in the mainstem Klamath River downstream

[185] This also takes into consideration slight differences in the NMFS (2006a) definition of the Project Reach from what is used in this report.

from Orleans, and especially downstream from the Trinity River (Appendix E.3.1.2), increases in suspended sediment in the mainstem Klamath River during critical migratory periods are currently low enough in concentration and short enough in duration that effects are limited to physiological stress and possibly inhibited growth, even during extreme conditions for fish. Current suspended sediment conditions and timing would remain unchanged under the No Project Alternative.

One of the main spawning streams for spring-run Chinook salmon, the Salmon River, has dramatically increased course sediment production over historical conditions as a result of legacy mining, road construction, timber harvest, and wildfire disturbance which leads to habitat degradation (Elder et al. 2002). Habitat degradation, much of which is a direct result of increased sedimentation, is believed to be the primary cause of the decline of the spring-run salmon population in the Klamath River system. Under the No Project Alternative, spawning and rearing habitat would remain in a degraded condition in both quantity and quality, and salmon production may be low in some years.

Under this alternative, dams would continue to block access to historical habitat, and spring-run Chinook salmon are likely to remain at significantly suppressed levels over the years of analysis (50 years). Under the No Project Alternative, there would be no change from existing conditions for spring-run Chinook salmon in the reasonably foreseeable short-term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-9 Effects on coho salmon populations due to continued operations of the Lower Klamath Project.
Under the No Project Alternative, Iron Gate Dam would continue to block access by coho salmon to historical habitat which used to extend upstream at least as far as Spencer Creek (Hamilton et al. 2005), including an estimated 76 miles of potential habitat within the Lower Klamath Project, based on approximately 54 miles of potential anadromous fish (steelhead) habitat in the Project Reach (NMFS 2006a, DOI 2007),[186] reduced in consideration of the more limited distribution of coho salmon relative to steelhead (DOI 2007), and including over 22 miles inundated by Klamath Hydroelectric Project reservoirs (Cunanan 2009), and habitat within the bypass reaches. The current reservoirs inundate sections of the river that had high sinuosity and complex channels that historically provided excellent salmonid spawning and rearing habitats (Hetrick et al. 2009). The consequences of this ongoing loss of habitat to the population would include reduced resilience to recover from catastrophic disturbances of natural or anthropogenic origin, such as wildfire or chemical spills (Hamilton et al. 2011). Under the No Project Alternative access to cold water habitat would continue to be severely limited. Because areas upstream of the Iron Gate Dam include cold-water refugia for adult salmon and outmigrating smolts, opportunities for the population to adapt to changing temperatures would continue to be reduced. The above factors, which would continue under the No Project Alternative, reduce the natural genetic and life-history diversity found in Klamath Basin subpopulations of coho salmon that provide adaptive capacity and a sufficient number of subpopulations so that the population can withstand catastrophic events (NMFS 2014).

[186] This also takes into consideration slight differences in the NMFS (2006a) definition of the Project Reach from what is used in this report.

Under the No Project Alternative, upstream-migrating adult coho salmon would continue to be exposed to high water temperatures and poor water quality in part caused by Lower Klamath Project facilities (Section 3.2.2.2 *Water Temperature*) in the mainstem Klamath River, which can cause physiological stress, delay migration, reduce coldwater refugia, and increase mortality from disease. Under existing conditions maximum temperatures in the Klamath River downstream from Iron Gate Dam to the Klamath River Estuary regularly exceed the range of chronic effects temperature thresholds (55.4–68°F) for full salmonid support in California (North Coast Regional Board 2010, Sinnott 2010a, 2011a, 2012a; Watercourse Engineering, Inc. 2011a, 2011b, 2012, 2013, 2014, 2015, 2016; Hanington 2013; Hanington and Ellien 2013) (see Appendix C for more detail). High water temperatures may promote higher incidence of disease or parasitism, which may increase direct and indirect mortality (Stutzer et al. 2006, NMFS 2010a). During a 2008 PIT-tag study of juvenile coho salmon in the Shasta River, Chesney et al. (2009) found juvenile coho salmon only in areas where temperatures were moderated by cold springs; the remainder of potential rearing habitat was too warm (>68°F). These detrimental temperature exceedances would continue under the No Project Alternative.

Effects of suspended sediment on coho salmon under the No Project Alternative and existing conditions are described in Appendix E.3.1.3. Under the No Project Alternative, SSCs in the mainstem would be sufficiently high and of long enough duration that coho salmon would continue to experience major physiological stress and reduced growth in most years.

Under the No Project Alternative, additional factors related to the Lower Klamath Project would continue to exacerbate the risk of disease downstream from Iron Gate Dam, including increased water temperatures and dampened flow and thermal variability, reduced dissolved oxygen concentrations, loss of sediment transport through the reach due to capture of sediment by the dams, and reservoirs contributing plankton to the filter-feeding polychaete hosts of the myxozoan parasites (as discussed above in Section 4.2.3.1 *Key Ecological Attributes [Fish Disease and Parasites]*). Under the No Project Alternative, downstream-migrating juvenile coho salmon may continue to have high disease infection rates (Bartholomew and Foott 2010) during summer months in some years. Heavy parasite loads may increase disease-related mortality in outmigrant smolts, particularly when water temperatures are high, or may reduce ocean survival by affecting growth or fitness (Holtby et al. 1990).

However, additional winter-spring surface flushing flows and deep flushing flow requirements outlined in *Measures to Reduce Ceratanova Shasta Infection of Klamath River Salmonids: A Guidance Document* and U.S. District Court Filing 111 (U.S. District Court 2017a–c; described in Section 4.2.3) is predicted to help reduce juvenile salmon disease below Iron Gate Dam. As described in Section 3.1.6 *Summary of Available Hydrology Information for the Proposed Project*, 2017 court-ordered flushing flows were required in 2017 and 2018, with the intent of reducing disease in the Lower Klamath River by mobilizing bedload sediments. In addition, court ordered emergency dilution flows were required in 2018. As described in Section 3.1.6, the 2017 court-ordered flows include a requirement to ensure that certain high flows are reached each winter, and also include an emergency dilution requirement if juvenile fish disease reaches high levels in the infection nidus. The emergency dilution flows were used in 2018. While the flushing flows have not been occurring over a long enough time to allow

collection of enough data on the efficacy of the flushing flows, the necessity to use the emergency dilution flows in 2018 suggest that the addition of the flushing flows is insufficient on its own to resolve the issue of fish disease downstream of Iron Gate Dam. Therefore, the No Project Alternative would result in continued substantial deleterious effects on coho salmon because of fish disease and parasites.

Under the No Project Alternative hatchery operations would continue. High numbers of hatchery fish may continue to impact the genetics and conditions for wild coho salmon (Noakes et al. 2000) in the Klamath Basin, as described in Section 3.3.2.3 *Habitat Attributes Expected to be Affected by the Proposed Project [Fish Hatcheries]*. Data from Ackerman et al. (2006) indicate that substantial straying of Iron Gate Hatchery fish may be occurring into important tributaries of the Middle Klamath River. Straying has the potential to reduce the reproductive success of natural salmonid populations (Mclean et al. 2003, Chilcote 2003, Araki et al. 2007) and negatively affect the diversity of the populations via outbreeding depression[187] (Reisenbichler and Rubin 1999).

Coho salmon populations in the Klamath Basin are in decline; less than 70 percent of streams historically used by coho salmon in the Basin still contain small populations (NRC 2004). The No Project Alternative would likely support the continuation of blocked habitat access, water temperature impacts, and disease risk in the Klamath River that have helped to cause this decline (NMFS 2014). More detail on current conditions for coho salmon can be found in the NMFS (2010a) *BO on operation of the Klamath Project between 2010 and 2018*. Under the No Project Alternative, there would be no change from existing adverse conditions for coho salmon from all populations within the Klamath River watershed in the reasonably foreseeable short-term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short term (0−5 years)

Potential Impact 4.2.3-10 Effects on the steelhead population due to continued operations of the Lower Klamath Project.
Summer steelhead use the mainstem Klamath River primarily as a migration corridor because most spawning and rearing occurs in Klamath River tributaries. Under the No Project Alternative, summer steelhead spawning and rearing habitat availability and distribution would continue to be restricted during summer and fall to reaches downstream from Seiad Valley by high water temperatures farther upstream (NRC 2004). Conditions in the mainstem are generally suitable for adult upstream migration during the peak of migration (March through June); however, high water temperatures in the summer may restrict upstream migration of adults arriving towards the end of the typical migration season (FERC 2007). Prior to dams and major flow regulation, temperatures would have been cooler in the summer and fall months for adult migrating steelhead, potentially supporting a broader migratory period (Bartholow et al. 2005, FERC 2007). Altered flow patterns downstream from Iron Gate Dam associated with Lower Klamath Project facilities may thus be affecting the population by selecting for earlier-arriving fish, potentially reducing life-history diversity in the population. The effects to population dynamics experienced in existing conditions would continue under the No Project Alternative. In addition, under the No Project Alternative the altered flow and water temperature patterns would continue to cause an ongoing loss of habitat that might otherwise be contributing to smolt production, survival, and escapement.

[187] Outbreeding depression is the displacement of locally adapted genes in a wild population.

Fall and winter steelhead are more widely distributed than any other anadromous salmonid downstream from Iron Gate Dam. Under the No Project Alternative, steelhead would continue to be restricted from accessing 360 miles of historical habitat along the mainstem Klamath River upstream to the Sprague, Williamson, and Wood Rivers (Huntington 2006), including cold-water refugia that could buffer the population from the warming effects of climate change (Hamilton et al. 2005). In addition, there are around 80 miles of potential habitat for steelhead within the Klamath Hydroelectric Project that are currently inaccessible, comprising approximately 58 miles of anadromous habitat with the Project reach (NMFS 2006a, DOI 2007), that includes over 22 miles inundated by Klamath Hydroelectric Project reservoirs (Cunanan 2009) and habitat within the bypass reaches. The current reservoirs inundate sections of the river that had high sinuosity and complex channels that historically provided excellent salmonid spawning and rearing habitats (Hetrick et al. 2009). As with summer steelhead, fall and winter steelhead use the mainstem primarily as a migration corridor to access tributaries for spawning. Under the No Project Alternative, high summer water temperatures in the summer months would continue to cause density-independent mortality on juveniles that have left spawning tributaries to rear in the mainstem.

Effects of suspended sediment on steelhead under the No Project Alternative and existing conditions are described in Appendix E.3.1.4. Overall, steelhead use the mainstem Klamath River as a migratory corridor during adult migration, and downstream smolt migration, and for juvenile rearing. SSCs under the No Project Alternative would continue to be relatively high in the mainstem Klamath River downstream from Orleans, and especially downstream from the Trinity River (State Water Control Board 2006, North Coast Regional Board 2010) (see Appendix E.3.1.4, and Section 3.2.2.3). However, SSCs in the mainstem Klamath River during critical migratory periods, even during extreme conditions for fish, would continue to be low enough with short exposure times that effects on steelhead would likely be limited to physiological stress and possibly reduced growth rates (Appendix E.3.1.4). Conditions for juvenile steelhead rearing in the mainstem would likely be worse and include mortality of up to 20 percent during extreme conditions for fish, but in general steelhead appear resilient to the suspended sediment regimes that occur under existing conditions and would persist under the No Project Alternative.

Under the No Project Alternative, additional factors related to the Lower Klamath Project would continue to exacerbate the risk of disease downstream from Iron Gate Dam, including increased water temperatures and dampened flow and thermal variability, reduced dissolved oxygen concentrations, loss of sediment transport through the reach due to capture of sediment by the dams, and reservoirs contributing plankton to the filter-feeding polychaete hosts of the myxozoan parasites (as discussed above in Section 4.2.3.1 *Key Ecological Attributes [Fish Disease and Parasites]*). Under the No Project Alternative, downstream-migrating juvenile steelhead may continue to have high disease infection rates (Bartholomew and Foott 2010) during summer months in some years (although steelhead are generally resistant to *C. shasta)*. Heavy parasite loads may increase disease-related mortality in outmigrant smolts, particularly when water temperatures are high, or may reduce ocean survival by affecting growth or fitness (FERC 2007).

However, additional winter-spring surface flushing flows and deep flushing flow requirements outlined in *Measures to Reduce Ceratanova Shasta Infection of Klamath*

River Salmonids: A Guidance Document and U.S. District Court Filing 111 (U.S. District Court 2017a–c; described in Section 4.2.3) is predicted to help reduce juvenile salmon disease below Iron Gate Dam. As described in Section 3.1.6 *Summary of Available Hydrology Information for the Proposed Project*, 2017 court-ordered flushing flows were required in 2017 and 2018, with the intent of reducing disease in the Lower Klamath River by mobilizing bedload sediments. In addition, court ordered emergency dilution flows were required in 2018. As described in Section 3.1.6, the 2017 court-ordered flows include a requirement to ensure that certain high flows are reached each winter, and also include an emergency dilution requirement if juvenile fish disease reaches high levels in the infection nidus. The emergency dilution flows were used in 2018. While the flushing flows have not been occurring over a long enough time to allow collection of enough data on the efficacy of the flushing flows, the necessity to use the emergency dilution flows in 2018 suggest that the addition of the flushing flows is insufficient on its own to resolve the issue of fish disease downstream of Iron Gate Dam. Therefore, the No Project Alternative would result in continued substantial deleterious effects on steelhead because of fish disease and parasites.

Habitat conditions for juvenile steelhead rearing in the mainstem below Iron Gate Dam are generally suitable, except for reaches upstream of Seiad Valley where summer water temperatures are considered stressful. Under existing conditions maximum temperatures in the Klamath River downstream from Iron Gate Dam to the Klamath River Estuary regularly exceed the range of chronic effects temperature thresholds (55.4–68°F) for full salmonid support in California (North Coast Regional Board 2010, Sinnott 2010a, 2011a, 2012a; Watercourse Engineering, Inc. 2011a, 2011b, 2012, 2013, 2014, 2015, 2016; Hanington 2013; Hanington and Ellien 2013) (see Appendix C for more detail). These detrimental temperature exceedances would continue under the No Project Alternative. Juvenile outmigration peaks in the spring and extends through the summer and fall. Growth during their rearing and outmigration may be reduced by high temperatures (unless food availability is high) due to increased metabolism, which can reduce ocean survival (Scheuerell et al. 2009). High summer water temperatures causing physiological stress to fish can also make them more vulnerable to mortality from disease or other compounding factors. These conditions, and the resulting effects on juvenile steelhead in the mainstem Klamath River, would remain unchanged under the No Project Alternative. Under the No Project Alternative, there would be no change from existing conditions for steelhead in the reasonably foreseeable short-term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-11 Effects on the Pacific lamprey population due to continued operations of the Lower Klamath Project.
Pacific lamprey populations appear to have been in decline since the late 1980s in the Klamath Basin (Larson and Belchik 1998 as cited in Hamilton et al. 2011), and are considered “vulnerable” throughout their range by the American Fisheries Society (Jelks et al. 2008, as cited in Hamilton et al. 2011). Major factors believed to be affecting their populations include barriers to upstream migration at dams; dewatering of larval habitat through flow regulation; reducing larval habitat by increasing water velocity and/or reducing sediment deposition areas; and susceptibility to contaminants in the larval stage (Close et al. 2002, as cited in Hamilton et al. 2011).

Under the No Project Alternative, Iron Gate Dam would continue to form a barrier to Pacific lamprey migration, which represents an ongoing loss of available habitat and productive capacity. Although the exact upstream extent of suitable habitat for Pacific lamprey prior to the completion of the Lower Klamath Project dams and associated facilities is unknown, it is believed that Pacific lamprey would have migrated at least as far as Spencer Creek (Hamilton et al. 2005), including an estimated 80 miles of potential habitat within the Lower Klamath Project, based on approximately 58 miles of potential anadromous fish (steelhead) habitat in the Project Reach (NMFS 2006a, DOI 2007),[188] and including over 22 miles inundated by Klamath Hydroelectric Project reservoirs (Cunanan 2009), and habitat within the bypass reaches. The loss of this portion of spawning and larval rearing habitat reduces the viability of the Klamath Basin population by contracting its distribution within the watershed and reducing abundance.

Under the No Project Alternative, the dams would continue to reduce sediment supply to the mainstem Klamath River downstream from Iron Gate Dam, which may limit availability of gravel-cobble substrates for nest building and fine sediment for burrowing. Armoring of substrate would continue to occur downstream of Iron Gate Dam and would continue to also reduce spawning habitat quality. Despite these effects, in part caused by Lower Klamath Project facilities, the overall effect to Pacific lamprey populations in the Klamath Basin is likely to be small because (1) the effects of the dam on fine sediment and gravel/cobble substrates diminish with distance downstream because of input from tributaries and become less significant downstream from Cottonwood Creek (RM 185.1) (which is approximately 8 RM downstream of Iron Gate Dam), and (2) a large proportion of the population may spawn and rear in large tributaries to the mainstem, such as the Trinity, Salmon, Shasta, and Scott rivers.

Effects of suspended sediment on Pacific lamprey under the No Project Alternative and existing conditions are described in Appendix E.3.1.5. Overall, under all conditions, Pacific lamprey under the No Project Alternative are anticipated to suffer from stressful levels of suspended sediment while rearing and migrating through the mainstem Klamath River during winter, with exposure durations generally much longer under extreme conditions for lamprey. Because there are multiple year-classes of lamprey with a broad spatial distribution in the Klamath River Basin at any given time, and since adults may migrate upstream throughout the year (and thus some adults avoid peaks in SSC), Pacific lamprey populations may be well-adapted to persisting through years when SSCs are high in the mainstem.

The effects of Lower Klamath Project dams and reservoirs would continue to affect water quality downstream from Iron Gate Dam under the No Project Alternative, which may reduce habitat quality for spawning and rearing Pacific lamprey, as well as reproductive success. Under existing conditions maximum temperatures in the Klamath River downstream from Iron Gate Dam to the Klamath River Estuary regularly exceed the range of chronic effects temperature thresholds (64.4–71.6°F) for Pacific lamprey spawning and rearing (Meeuwig et al. 2005) (see Appendix C for more detail). These detrimental temperature exceedances would continue under the No Project Alternative.

Flow management under the No Project Alternative would continue to modify temperature and instream flow patterns relative to pre-project conditions which would

[188] This also takes into consideration slight differences in the NMFS (2006a) definition of the Project Reach from what is used in this report.

continue to alter the migration of patterns of adult, ammocoete, and macropthalmia Pacific lamprey (Stone et al. 2002, Luzier and Miller 2009), and may reduce survival (Stone et al. 2002). Under the No Project Alternative, regulated flow patterns and their potential effect on Pacific lamprey would remain the same as under existing conditions.

Under the No Project Alternative, Pacific lamprey populations in the Klamath Basin may remain at current levels or population numbers may continue to decline over the long term (Close et al. 2010). Because so little is known of Pacific lamprey life history and habitat requirements compared to those of anadromous salmonids, it is more difficult to predict the potential effects of alternatives on their abundance and distribution. Under the No Project Alternative, there would be no change from existing conditions for Pacific lamprey in the reasonably foreseeable short term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-12 Effects on the green sturgeon population due to continued operations of the Lower Klamath Project.
Green sturgeon spend a majority of their lives in estuaries, bays, and nearshore waters, with adults only returning to fresh water to spawn after more than 15 years and spawning every 4 years on average (Klimley et al. 2007).

Northern green sturgeon spawn in the Rogue, Klamath, and Umpqua rivers. The Klamath Basin supports the largest spawning population of Northern Green Sturgeon (Moyle 2002), so it plays a critically important role in the viability and persistence of the entire DPS. In the Klamath River mainstem, green sturgeon spawn and rear in the lower 67 miles, downstream from Ishi Pishi Falls which forms a natural migratory barrier to green sturgeon. Concentration of spawning in only a very few areas renders these spawning populations vulnerable to local catastrophic impacts. A loss of any of the few spawning areas would have much greater effects than the loss of a spawning population of salmon that spawn in many other streams throughout their range.

Under existing conditions maximum temperatures in the Klamath River downstream from Iron Gate Dam to the Klamath River Estuary (including downstream of Ishi Pishi Falls) regularly exceed the range of temperature thresholds for green sturgeon spawning and egg incubation (62.6–78.8°F) (Van Eenennaam et al. 2005, Cech et al. 2000) (see Appendix C for more detail), especially during low water years. These detrimental temperature exceedances reducing the reproductive success of green sturgeon would continue under the No Project Alternative.

Effects of suspended sediment on green sturgeon under the No Project Alternative and existing conditions are described in Appendix E.3.1.6. Under existing conditions, green sturgeon in the Klamath River mainstem are regularly exposed to SSCs documented to cause major physiological stress, reduced growth, and mortality in other fish species, especially during their egg and larval stages, and the year-round juvenile rearing period. Exposure of green sturgeon to these SSCs would continue under the No Project Alternative. However, based on the persistence of their population under these conditions, these metrics likely overestimate effects on green sturgeon. Under the No Project Alternative, there would be no change from existing conditions for green sturgeon in the reasonably foreseeable short-term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-13 Effects on Lost River and shortnose sucker populations due to continued operations of the Lower Klamath Project.
Under current conditions, Lost River and shortnose suckers in the Area of Analysis suffer mortality by entrainment in hydroelectric turbines at all Lower Klamath Project hydroelectric facilities (PacifiCorp 2013). Additionally, suckers would continue to be stranded due to peaking operations downstream of J.C. Boyle Dam (PacifiCorp 2013).

Under the No Project Alternative, there would be no change from existing conditions for Lost River and shortnose sucker populations in the reasonably foreseeable short term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-14 Effects on the redband trout population due to continued operations of the Lower Klamath Project.
Resident trout upstream of Iron Gate Dam are considered to be redband trout. Before construction of the Lower Klamath Project dams and associated facilities, redband trout in the area belonged to one population, with no migration barriers isolating populations from one another (NMFS 2006a). Under the No Project Alternative, genetic exchange and movement by redband trout between reaches would continue to be limited by the partially functional J.C. Boyle fish ladder (NMFS 2006a) and lack of fish ladders at the Copco No. 1 and 2 Dams, as would access to productive spawning habitat in Spencer Creek in the J.C. Boyle Bypass and Peaking Reaches (NMFS 2006a). The fragmentation of this population into several smaller, isolated subpopulations renders each more vulnerable to extinction due to stochastic events (wildfire, landslides, disease outbreaks, etc.) and limits genetic exchange among subpopulations.

Under the No Project Alternative, habitat connectivity for redband trout in the Klamath River would continue to be compromised by structural features of the Lower Klamath Project dams and associated facilities developments as well as by project operations. Fish downstream from J.C. Boyle Dam would continue to be hindered or obstructed from migrating to spawning grounds in Spencer Creek by the ineffective fish ladder at J.C. Boyle Dam, which poses a partial passage barrier (Hamilton et al. 2011). Spencer Creek is a highly productive spawning and rearing habitat for rainbow/redband trout (Hamilton et al. 2011). The stock of rainbow/redband trout in the bypass and peaking reaches below J.C. Boyle Dam is currently restricted from Spencer Creek and other suitable habitat upstream of the J.C. Boyle Dam (NMFS 2006a). Migration over the Copco No. 1 and 2 dams is in the downstream direction only, as there is no fishway. These conditions would remain unchanged under the No Project Alternative and the redband trout population would continue to suffer the effects of restricted habitat connectivity.

Under existing conditions, the lack of fully functioning fish screens at Iron Gate, Copco No. 1, and Copco No. 2 dams results in entrainment and loss of juvenile redband trout and reduces recruitment of redband trout to downstream reaches (DOI 2007). All Lower Klamath Project hydropower facilities use Francis turbines. A 1987 report prepared by the Electric Power Research Institute (EPRI 1987) concluded that fish mortality from

entrainment at hydroelectric projects using Francis turbines averaged 24 percent. It is estimated that "several tens of thousands of resident fish" are annually entrained at "each of the Projects" facilities (NMFS 2006a), and it is likely that these entrainment and mortality rates would continue under the No Project Alternative.

The health and productivity of redband trout in the J.C. Boyle Peaking Reach and J.C. Boyle Bypass Reach would continue to be affected under the No Project Alternative. Obstruction of sediment transport at J.C. Boyle Dam has altered substrates and channel features in the peaking and bypass reaches (FERC 2007). High flows have mobilized and removed sediment from storage sites and transported it downstream, reducing habitat quality for redband trout as well as for the macroinvertebrates they feed on (NMFS 2006a). These effects would continue under the No Project Alternative. In the J.C. Boyle Peaking Reach, redband trout numbers would continue to be subject to large fluctuations in flows that would: (1) cause fluctuations in water temperature and pH, (2) strand fish, (3) displace fish downstream, (4) reduce fry habitat along channel margins, (5) reduce access to suitable gravels where they are affected by flow fluctuations, and (6) reduce macroinvertebrate food production by reducing the area of the channel suitable for their survival (City of Klamath Falls 1986, Addley et al. 2005, as cited in Hamilton et al. 2011). All of these conditions could result in substantial declines in redband trout abundance in this reach.

Under the No Project Alternative, diversion of water at continue to alter flows downstream, as occurs under existing conditions. Reduced flows in the 1.4-mile-long Copco No. 2 Bypass Reach would continue to prevent redband trout from using what would otherwise be habitat suitable for spawning and rearing. Productivity of redband trout in the bypass and peaking reaches downstream of J.C. Boyle Dam would continue to be suppressed by Lower Klamath Project effects that limit spawning and rearing habitat in these reaches (Hamilton et al. 2011). Under existing conditions, spawning of redband trout downstream of J.C. Boyle Dam appears limited to an area just downstream from the emergency canal spillway (Hamilton et al. 2011). Patches of gravel that might otherwise be suitable for spawning are rendered inaccessible to redband trout by reductions in instream flows (NMFS 2006a, Hamilton et al. 2011). These conditions would continue under the No Project Alternative.

Reduced redband trout abundance and distribution upstream of Iron Gate Dam attributable to Lower Klamath Project features and operations would continue under the No Project Alternative. Habitat connectivity and suitability are substantially reduced in the Hydroelectric Reach due in part to Lower Klamath Project facilities isolating population units by limiting migration and reducing habitat suitability. Apparent phenotypic changes in the redband trout in these reaches would likely be maintained or continue under the No Project Alternative, such as declines in size (Jacobs et al. 2007, as cited in Hamilton et al. 2011) and condition factor (ODFW 2003, as cited in Hamilton et al. 2011). The effect of the No Project Alternative would be no change from existing conditions for redband trout in the reasonably foreseeable short-term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-15 Effects on the eulachon population due to continued operations of the Lower Klamath Project.

Under the No Project Alternative, habitat conditions in the estuary for eulachon would remain the same as they are under existing conditions. Although very little is known about the factors leading to decline of the eulachon, there is no evidence that the No Project Alternative would contribute to a continued decline of the population. The No Project Alternative would therefore have no significant impact on eulachon in the reasonably foreseeable short-term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-16 Effects on the longfin smelt population due to continued operations of the Lower Klamath Project.
Longfin smelt populations in the Klamath River are discussed in Section *3.3.2.1 Aquatic Species [Longfin smelt]* of this EIR. The No Project Alternative would have no effect on longfin smelt and there would be no change from existing conditions in the reasonably foreseeable short-term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-17 Effects on species interactions between introduced resident fish species and native aquatic species due to continued operations of the Lower Klamath Project.
Introduced fish species threaten the diversity and abundance of native fish species through competition for resources, predation, interbreeding with native populations, and causing potential physical changes to the invaded habitat (Moyle 2002). Introduced resident species occur within reservoirs upstream of Iron Gate Dam, and infrequently downstream from Iron Gate Dam. Under the No Project Alternative, conditions favorable for introduced species would continue to occur within the Lower Klamath Project reservoirs (Buchanan et al. 2011). The No Project Alternative would not change habitat conditions or alter populations of introduced resident fish species. The impacts of these introduced species on native aquatic species would remain unchanged in the short term relative to existing conditions.

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-19 Effects on freshwater mollusks populations due to continued operations of the Lower Klamath Project.
Freshwater mollusk populations in the Klamath River are discussed in Section *3.3.2.1 Aquatic Species [Freshwater mollusks]* of this EIR. Four species of native freshwater mussels have been observed within the Klamath Basin, including Oregon floater (*A. oregonensis*), California floater (*A. californiensis*), western ridged mussel (*G. angulata*), and western pearlshell mussel (*M. falcata*). Seven to eight species of fingernail clams and peaclams (Family: Sphaeriidae) also occur in the Hydroelectric Reach and from Iron Gate Dam to Shasta River. Based on freshwater mollusk life history and habitat preferences, freshwater mollusks are strongly affected by alterations to instream flows, suspended sediment, and bedload sediment. Under the No Project Alternative there would be no change in instream flows, suspended sediment, or bedload sediment, and thus under the No Project Alternative there would be no change from existing conditions for freshwater mussels in the reasonably foreseeable short-term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-20 Effects on fish species from alterations to benthic macroinvertebrates due to continued operations of the Lower Klamath Project.
Under existing conditions, J.C. Boyle peaking operations kill, through stranding, large numbers of young fish and aquatic invertebrates that are the primary prey food for resident trout (NMFS 2006a). Current peaking operations reduce the production of sessile organisms, like macroinvertebrates, by 10 to 25 percent (Administrative Law Judge (2006). Fluctuations in the peaking reach are considered to be a contributing factor to the lower macroinvertebrate drift rates (NMFS 2006a). Under the No Project Alternative, there would be no change from existing adverse conditions on effects of alterations to benthic macroinvertebrates on fish species in the reasonably foreseeable short-term (0−5 years).

Significance
No significant impact in the reasonably foreseeable short-term (0−5 years)

Potential Impact 4.2.3-21 Alterations to aquatic habitat from implementation of California Klamath Restoration Fund/Coho Enhancement (IM2)
Under the No Project Alternative, in the short term, PacifiCorp would continue to provide funding for the California Klamath Restoration Fund/Coho Enhancement Fund as an Interim Measure (IM2) (Table 4.2-1). This would continue to fund the implementation of specific projects or actions that would create, maintain, and improve access by coho salmon to important tributary habitats downstream from Iron Gate Dam that are within the potential range of the Upper Klamath coho salmon population. The PacifiCorp IM2 projects involve removal of existing fish passage barriers, improving/maintaining habitat cover and complexity at coldwater refugia sites, providing livestock exclusion, increasing the duration and/or extent of coldwater refugia sites, enhancing habitat in rearing tributaries, restoring connectivity of juvenile rearing habitat in tributaries of the Upper Klamath, Scott, and Shasta Rivers, funding a program to provide flow augmentation in key reaches used for coho spawning and juvenile rearing in the Upper Klamath, Scott, and Shasta Rivers, enhancing habitat in rearing tributaries of the Upper Klamath, Scott, and Shasta Rivers, and protecting summer rearing habitat in tributaries of the Upper Klamath, Scott, and Shasta Rivers (PacifiCorp 2012).

Based on anticipated improvements in habitat availability and habitat quality, continued implementation of the Coho Enhancement Fund under the No Project Alternative would continue to provide benefits to fall-run Chinook salmon, spring-run Chinook salmon, steelhead, Pacific lamprey, freshwater mussels, and benthic macroinvertebrates in the short term. These actions are also beneficial for coho salmon (particularly from the Upper Klamath River Population Unit). Implementation of the Coho Enhancement Fund under the No Project Alternative would have no significant impact (no change from existing conditions) on redband trout, shortnose and Lost River suckers, green sturgeon, eulachon, and Southern Resident Killer Whales, since these species are not found in or near the river reaches associated with IM2 projects or actions.

Significance

Beneficial for coho salmon, fall-run Chinook salmon, spring-run Chinook salmon, steelhead, Pacific lamprey, freshwater mussels, and benthic macroinvertebrates in the reasonably foreseeable short-term (0−5 years)

No significant impact for redband trout, shortnose and Lost River suckers, green sturgeon, eulachon, and Southern Resident Killer Whales in the reasonably foreseeable short-term (0−5 years)

4.2.4 Phytoplankton and Periphyton

4.2.4.1 Phytoplankton

As discussed in more detail in Section 3.4 *Phytoplankton and Periphyton*, phytoplankton are aquatic microscopic organisms, including algae, bacteria, protists, and other single-celled plants, that obtain energy through photosynthesis and float in the water column of still or slowly flowing waters such as lakes or reservoirs. Excess growth of these organisms can cause nuisance water quality conditions, such as extreme diel (daily) fluctuations in dissolved oxygen and pH (see Section 3.4.2.1 *Phytoplankton*). Under the No Project Alternative, phytoplankton existing conditions, including adverse, large, seasonal blue-green algae blooms, would continue to occur in the Klamath River. In the Hydroelectric Reach, seasonal phytoplankton (including blue-green algae) blooms originating from Upper Klamath Lake in Oregon would still be able to enter J.C. Boyle Reservoir under this alternative, but the short residence time of this reservoir would not support substantial additional growth of phytoplankton similar to existing conditions (Section 3.2.2.3 *Suspended Sediments* and Appendix C.2.1.1). Further downstream in the Hydroelectric Reach, adverse, large, seasonal phytoplankton blooms, including blue-green algae, would continue to occur in Copco No. 1 and Iron Gate reservoirs under the No Project Alternative similar to existing conditions (see also Section 3.4.2.3 *Hydroelectric Reach*) since the reservoirs would remain in place. Overall, the No Project Alternative would result in no change from existing adverse conditions, so there would be no significant impact to phytoplankton in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative in the Hydroelectric Reach.

The Lower Klamath Project reservoirs would remain in place under the No Project Alternative, so Copco No. 1 and Iron Gate reservoirs would continue to provide ideal habitat conditions for the proliferation of large seasonal blooms of *Aphanizomenon flos-aquae*, *Anabaena flos-aquae*, and *Microcystis aeruginosa*, which subsequently become the source of these species to the Middle and Lower Klamath River, and eventually the Klamath River Estuary (see also Section 3.4.2.3 *Hydroelectric Reach* and Section 3.4.2.4 *Middle and Lower Klamath River*). Genetic analysis of *Microcystis aeruginosa* variations at Klamath River locations upstream of Copco No. 1 Reservoir, within Copco No. 1 and Iron Gate reservoirs, and at multiple Klamath River locations from downstream of Iron Gate Dam to Turwar indicate that Iron Gate Reservoir is the principal source of *Microcystis aeruginosa* cells to the Middle and Lower Klamath River (Otten et al. 2015) (see also Section 3.4.2.4 *Middle and Lower Klamath River*). There would be no change to the habitat conditions that promote growth of *Microcystis aeruginosa* in Iron Gate Reservoir under existing conditions (see also Section 3.4.2.3 *Hydroelectric Reach*), so the export of *Microcystis aeruginosa* cells from this reservoir would also continue to occur under the No Project Alternative similar to existing conditions.

The 2017 court-ordered flushing and emergency dilution flows would result in no change from existing conditions for phytoplankton in the Klamath River. In the Hydroelectric Reach, habitat conditions in Copco No. 1 or Iron Gate reservoirs that result in adverse, large, seasonal phytoplankton blooms, including blue-green algae, would continue to be the same as existing conditions under these releases. In the Middle Klamath River and further downstream in the Lower Klamath River, the Klamath River Estuary, and the Pacific Ocean nearshore environment, court-ordered flushing and emergency dilution flows would result in no change from existing conditions for phytoplankton since the releases would primarily occur during winter and spring when phytoplankton abundance in Iron Gate Reservoir would be low (see also Section 3.4.2.3 *Hydroelectric Reach*). Court-ordered flushing and emergency dilution flows downstream of Iron Gate Dam would end by June 15, while monitoring data from the past five years (i.e., 2013 to 2018) indicates the abundance of blue-green algae in Iron Gate Reservoir increases after late June to early July (E&S Environmental Chemistry, Inc. 2013, 2014, 2015, 2016, 2018a, 2018b). Assuming blue-green algae cell counts and algal toxin concentrations from the past five years are representative of likely conditions in the reasonably foreseeable short-term (0−5 years), releases would end before elevated levels of blue-green algae occur in Iron Gate Reservoir. There would be no changes from existing conditions for blue-green algae abundance in the reasonably foreseeable short-term (0−5 years), thus there would be no significant impact to phytoplankton in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative in the Middle and Lower Klamath River, the Klamath River Estuary, and the Pacific Ocean nearshore environment.

Under the No Project Alternative, reservoir sediment deposits would not be mobilized in the Hydroelectric Reach, Middle and Lower Klamath River, the Klamath River Estuary, and the Pacific Ocean nearshore environment, so there would be no short-term increases in sediment-associated nutrients that could potentially stimulate nuisance and/or noxious phytoplankton growth in those reaches (Potential Impact 3.4-1). Thus, there would be no significant impact.

As described under the Proposed Project (Potential Impact 3.2-1), climate change would be anticipated to only significantly influence existing conditions in the long term (5+ years), so climate change is not discussed further for phytoplankton under the No Project Alternative. Similarly, other long-term processes that would potentially alter phytoplankton abundance such as the gradual increase in nutrients and organic matter in reservoir sediments (i.e., reservoir aging [USGS 2018]) and implementation of nutrient reduction or other measures in Oregon and California to meet Klamath River TMDLs are not analyzed as part of the reasonably foreseeable short-term (0−5 years). As noted in Section 4.2.1.1 *[No Project Alternative] Alternative Description– Foreseeable Short-term Operations*, the long-term outcomes are considered in the Proposed Project and other alternatives, thus the long-term potential impacts to phytoplankton are described in: Section 3.4.5.1 *Phytoplankton;* Section 4.3.4.1 *Phytoplankton*; Section 4.4.4.1 *Phytoplankton*; Section 4.5.4.1 *Phytoplankton*; Section 4.6.4.1 *Phytoplankton*; and Section 4.7.4.1 *Phytoplankton.*

4.2.4.2 Periphyton

As discussed in more detail in Section 3.4, periphyton are aquatic organisms including aquatic plants, algae, and bacteria that live attached to underwater surfaces such as rocks on a riverbed. Some degree of periphyton growth is an important part of stream ecosystem function. Excess growth of these organisms can cause nuisance water

quality conditions, such as extreme diel (daily) fluctuations in dissolved oxygen and pH (see Section 3.4.2.2 *Periphyton* for detail. Under the No Project Alternative, periphyton existing conditions would continue to occur in the Klamath River, since there would be no substantial change to the periphyton habitat conditions along the margins and riverbed of the Klamath River. In the Hydroelectric Reach from J.C. Boyle Reservoir through the J.C. Boyle Bypass and Peaking Reach to Copco No. 1 Reservoir, the flows and hydropower peaking operations would continue, thus there would be no change from existing conditions that do not currently support excessive periphyton mats in the J.C. Boyle Peaking Reach due to the generally high gradient and velocity (see Section 3.4.2.2 *Periphyton*). Further downstream from Copco No. 1 Reservoir to Iron Gate Dam, the reservoirs would remain in place, so there would be no change in the limited habitat conditions for periphyton growth that occur under existing conditions. Thus, there would be no significant impact to periphyton in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative in the Hydroelectric Reach.

Under the No Project Alternative, reservoir sediment deposits would not be mobilized in the reasonably foreseeable short-term (0−5 years) to the Hydroelectric Reach, Middle and Lower Klamath River, or the Klamath River Estuary, and there would be no increases in sediment-associated nutrients in these river reaches that could stimulate nuisance periphyton growth. Additionally, there would be no conversion of the reservoir areas to free-flowing river or elimination of hydropower peaking operations under the No Project Alternative, so there would be no change in periphyton abundance from existing conditions due to increased low-gradient channel margin habitat conditions. While nutrients do not appear to be limiting periphyton growth in the Klamath River from Iron Gate Dam to approximately Seiad Valley (RM 132.7) (and potentially farther downstream) (see also Potential Impact 3.4-5), nutrients would be similar to existing conditions under the No Project Alternative (see Section 4.2.2 *Water Quality, Nutrients*), so periphyton growth or abundance would be the same relative to existing conditions due to nutrients conditions under this alternative. There would be no change in nutrient transport from existing conditions in the Hydroelectric Reach, the Middle and Lower Klamath River, the Klamath River Estuary, and the Pacific Ocean nearshore environment in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative, since the reservoirs would continue to intercept upstream nutrients and phytoplankton cells containing nutrients generated in the reservoirs and seasonal export of nutrients from reservoir sediments would continue to occur.

As described under the Proposed Project (Potential Impact 3.2-1), climate change would be anticipated to only significantly influence existing conditions in the long term (5+ years), so climate change is not discussed further for periphyton under the No Project Alternative. Similarly, other long-term processes that would potentially alter periphyton abundance such as implementation of nutrient reduction or other measures in Oregon and California to meet Klamath River TMDLs are not analyzed as part of the reasonably foreseeable short-term (0−5 years). As noted in Section 4.2.1.1 *[No Project Alternative] Alternative Description– Foreseeable Short-term Operations*, the long-term outcomes, including nutrient build-up in the reservoirs and the basin response to the nutrient reduction measures, are considered in the Proposed Project and other alternatives, thus the long-term potential impacts to phytoplankton are described in: Section 3.4.5.2 *Periphyton;* Section 4.3.4.2 *Periphyton*; Section 4.4.4.2 *Periphyton*; Section 4.5.4.2 *Periphyton*; Section 4.6.4.2 *Periphyton*; and Section 4.7.4.2 *Periphyton.*

Other potential impacts related to periphyton in the foreseeable short-term (0−5 years) under the No Project Alternative are discussed under a new impact heading, below.

Potential Impact 4.2.4-1 Variations in nuisance periphyton species abundance downstream of Iron Gate Dam due to implementation of 2017 court-ordered flushing and emergency dilution flows.

In the Middle and Lower Klamath River, seasonal shifts in water temperature downstream of the reservoirs and flow modification due to the continuing presence of the Lower Klamath Project dams would continue to support periphyton growth, including nuisance periphyton species, in the Middle and Lower Klamath River similar to existing conditions, but court-ordered flushing flows and emergency dilution releases would reduce periphyton abundance in the Middle Klamath River downstream of Iron Gate Dam relative to existing conditions. Higher fall water temperatures occurring under existing conditions due Iron Gate Dam (see Section 3.2.2.2 *Water Temperature*) would continue in the Middle Klamath River to the confluence with the Salmon River under the No Project Alternative (see Section 4.2.2 *Water Quality*), thus periphyton growth would continue to be promoted in this reach of the Middle Klamath River similar to existing conditions. Water temperature downstream of the confluence with the Salmon River, including the Klamath River Estuary and the Pacific Ocean nearshore environment, and its influence on periphyton growth and abundance would be the same as under existing conditions under the No Project Alternative, since there is no influence of the dams on water temperature downstream of the confluence with the Salmon River.

While the presence of the Lower Klamath Project dams would continue to support periphyton growth in the Middle and Lower Klamath River as described for existing conditions (Section 3.4.2.4 *[Periphyton] Middle and Lower Klamath River*), 2017 court-ordered flushing releases downstream of Iron Gate Dam under the No Project Alternative would increase mobilization of riverbed sediment downstream of Iron Gate Dam between November 1 to May 31 (see Potential Impact 4.2.2-3). Emergency dilution releases (3,000 to 4,000 cfs) are below the flow recognized to mobilize sediment along the riverbed downstream of Iron Gate Dam. Increases in sediment transport due to flushing flows under this alternative would dislodge periphyton from the riverbed and decrease periphyton abundance downstream of Iron Gate Dam in the Middle Klamath River immediately after releases. Currently, there are not sufficient data to determine how far downstream of Iron Gate Dam the effect of bed turnover and scouring on periphyton would extend under the 2017 court-ordered flushing flows. This analysis assumes that periphyton scouring potential would extend from Iron Gate Dam until approximately the Shasta River (RM 179.5), as the first major tributary that would contribute additional flows to the mainstem river. While periphyton naturally re-establish and re-grow following high winter flows under existing conditions and periphyton are anticipated to re-establish and re-grow similarly after flushing flows, the frequency of flushing flows (i.e., annually for surface flushing and every other year for deep flushing) would result in a reduction in periphyton abundance downstream of Iron Gate Dam in the Middle Klamath River to approximately the confluence with the Salmon River. Overall, flushing releases under this alternative would reduce dense growth of periphyton relative to existing conditions, and would be beneficial in the reasonably foreseeable short-term (0−5 years) under the No Project Alternative.

Significance

Beneficial for the Middle Klamath River from Iron Gate Dam to the Shasta River (RM 179.5)

No significant impact for the Middle Klamath River from the confluence with the Shasta River (RM 179.5) and the Lower Klamath River

4.2.5 Terrestrial Resources

Except for the potential impacts to foothill yellow-legged frogs and Western Pond Turtles due to 2017 flow requirements (see Potential Impact 4.2.5-1, below) there would be no change to terrestrial resources in the short term under the No Project Alternative. Thus, except for Potential Impact 4.2.5-1, under the No Project Alternative short term conditions for terrestrial resources would be the same as the existing conditions described in Section 3.5.2 *Terrestrial Resources, Environmental Setting,* including the subsections: 3.5.2.1 *Vegetation Communities,* 3.5.2.2 *Invasive Plant Species,* 3.5.2.3 *Culturally Significant Plant Species*, 3.5.2.4 *Non-special-status Wildlife,* 3.5.2.4 *Special-status Species*, and 3.5.2.6 *Wildlife Corridors and Habitat Connectivity.*

4.2.5.1 Vegetation Communities

Under the No Project Alternative, in the short term (0−5 years), there would be no habitat loss or gain for wetland or riparian vegetation as compared with existing conditions, since ground-disturbing construction activities, reservoir drawdown, and dam removal would not occur. Thus, there would be no significant impacts to wetland or riparian vegetation in the short term (0−5 years) under the No Project Alternative.

4.2.5.2 Culturally Significant Species

Under the No Project Alternative, in the short term (0−5 years), there would be no habitat loss or gain for culturally significant plant species as compared with existing conditions since the Lower Klamath Project reservoirs and associated riparian habitat would remain unchanged and would continue to provide habitat for these species. Thus, there would be no significant impacts to culturally significant plant species in the short term (0−5 years) under the No Project Alternative.

4.2.5.3 Special-status Species

Under the No Project Alternative, in the short term (0−5 years), there would be no habitat loss or gain for special-status plant and wildlife species as compared with existing conditions since the Lower Klamath Project reservoirs would remain and would continue to provide habitat for western pond turtle, multiple bird species, including waterfowl and bald eagles, bats, and other special-status wildlife and plants that are supported by the Lower Klamath Project reservoirs and Iron Gate Hatchery. Populations of special-status plant and wildlife species and rare natural vegetation communities would continue to be influenced by various stressors in the Klamath Basin, including habitat degradation from the Lower Klamath Project and invasive species.

Klamath River hydrology in the short term (0−5 years) would be similar to existing conditions under the No Project Alternative with the addition of the 2017 court-ordered flushing and emergency dilution flows released from Iron Gate Dam to the Middle Klamath River; these flows are described in detail in Section 4.2.1.1 *[No Project Alternative] Alternative Description – Summary of Available Hydrology Information for the No Project Alternative*. Potential Impact 4.2.5-1 (below) assesses the potential for

the additional court-ordered flow releases from Iron Gate Dam to affect breeding foothill yellow-legged frog in the short term (0−5 years).

Since Iron Gate Hatchery would continue to obtain water from Iron Gate Reservoir, no flow diversion would occur in Bogus Creek to supply water to Iron Gate Hatchery; therefore, there would be no significant impact to aquatic amphibians and reptiles in the short term (0−5 years) under the No Project Alternative.

Since no dewatering of the reservoirs or sediment would be released from behind the dams during the dam removal process, no elevated suspended sediment concentrations (SSCs) would occur nor would they have the potential to affect special-status amphibians and reptiles. Thus, there would be no SSC-associated impacts to special-status amphibians and reptiles in the short term (0−5 years) under the No Project Alternative.

Under the No Project Alternative, there would be no construction-related impacts on special-status plant and wildlife species, including nesting birds or bats, as no construction activities with the potential to remove suitable nesting/roosting habitat would occur in the short term. Thus, there would be no significant impacts to special-status plant and wildlife species in the short term (0−5 years) under the No Project Alternative.

Potential Impact 4.2.5-1 Effects of 2017 court-ordered flushing and emergency dilution flows released from Iron Gate Dam on foothill yellow-legged frog and western pond turtle breeding.

To manage the fish parasite *C. shasta*, mandatory surface flushing flows in the winter-spring, deep flushing flows, and emergency dilution flows would occur in the short-term (0−5 years) in the Middle Klamath River downstream of Iron Gate Dam under the No Project Alternative (see Section 4.2.1.1 *[No Project Alternative] Alternative Description – Summary of Available Hydrology Information for the No Project Alternative*).

The winter-spring surface flushing flow of 6,030 cfs is designed to occur for a 72-hour period between November 1 and April 30 (U.S. District Court 2017). This flow would be sufficient to move surface sediments (i.e., sand and potentially pea-sized gravel). The beginning of the foothill yellow-legged frog breeding season (typically April 22 through early July) overlaps with this flushing flow for about one week (April 22 through April 30). Mean daily flows in April are generally 2,000–3,000 cfs (Figure 3.6-4, Section 3.6.2.2 *Basin Hydrology*). Foothill yellow-legged frogs are known to time their egg-laying with the flow pattern of a given year, initiating egg-laying on the descending limb of the spring hydrograph (i.e., when flows are trending down) (Seltenrich and Pool 2002). If the winter-spring surface flushing flows were to occur early in the foothill yellow-legged frog breeding season, individuals may delay breeding (Gonsolin 2010 and GANDA 2008); otherwise there is a potential for eggs to be scoured, if present, during the winter-spring surface flushing flows.

The deep flushing flows are designed to occur in one 24-hour period at least every other year (U.S. District Court 2017). This one-day flow will consist of an average flow of 11,250 cfs and occur any time between February 15 and May 31. Mean daily flows observed between April and May at Iron Gate Dam are typically between about 2,500–3,500 (Figure 3.6-4 Section 3.6.2.2 *Basin Hydrology*). This deep flushing flow may scour or damage eggs attached to submerged rocks and pebbles during the one-month period that egg-laying overlaps with the deep flushing flows (April 22–May 31). Tadpoles,

which hatch between 5–37 days following egg-laying, could be present in May and could be displaced by the deep flushing flows, which would likely result in injury or mortality because the species is not adapted to high flows.

Both the annual surface flushing and deep flushing flows are implemented through flow augmentation when the required flows are not met naturally (i.e., in the case of a dry water year). The flows are timed, where possible, to occur during high precipitation events, in order to reduce the impact on water supplies. This means that any foothill yellow-legged frogs in the area would already be exposed to high flows, though supplementation would make these flows higher. Because the flows are designed to cause bed mobilization, the supplementation would be more likely to cause an impact than the precipitation event alone.

The emergency dilution flows of 3,000–4,000 cfs are designed to occur between April 1 and June 15 if certain disease thresholds are present in the river (U.S. District Court 2017). Existing flows are typically at or above 3,000 cfs for approximately 50 percent of April, 25 percent of May, and 5 percent of June (Figure 3.1-1; Section 3.1.6.2 *Comparison of Klamath River Flows under 2013 Biological Opinion and KBRA*). The emergency dilution flows may scour or damage any eggs that are present between April 22 and June 15, when the flows overlap with the typical foothill yellow-legged frog breeding season. Additionally, direct impacts may result from stranding of eggs if breeding occurs along the river edge during the emergency dilution flows, and the subsequent receding flows reduce the wetted channel and dewatered egg masses. Tadpoles, which hatch between 5 and 37 days following egg-laying, could also be displaced by the emergency dilution flows.

Although survey data are limiting for characterizing the presence of foothill yellow-legged frog in the Klamath River (i.e., this species has not been documented since 1976), occurrences are known in tributaries and presumably individuals have the potential to be present in the mainstem river as well. Due to the listing status of the foothill yellow-legged frog (i.e., State Candidate Threatened), direct mortality or harm to an individual would result in a significant impact. Thus, if eggs, juvenile and/or adult foothill yellow-legged frogs are present in the Middle Klamath River immediately downstream of Iron Gate Dam, direct impacts from scouring and displacement due to the court-ordered flushing and dilution flows may occur. The likelihood of this occurring is not high, because of the lack of certainty that individuals are present in the upper Middle Klamath River and the timing of flow supplementation to occur with natural high flows. However, if present and affected, this would be a significant impact.

Due to the low likelihood of locating eggs during high flow events, mitigation typically employed to reduce impacts to this species (i.e., rescuing and relocating eggs) would be ineffective. Modification of the flows to avoid the potential presence of foothill yellow-legged frog is not feasible. The USBR, which is responsible for the court-ordered flow releases, is a federal agency with a mandate to maximize agricultural deliveries as possible. Therefore, it is not feasible for the agency to adjust its decision-making to accommodate a candidate state-listed and state species of special concern that it does not have a particular obligation to protect. Thus, this would be a significant and unavoidable impact.

Since western pond turtles' nest on land and usually above the floodplain, up to several hundred meters from water (Ashton et al. 1997), there would be no significant impacts to

their nests due to the 2017 court-ordered flushing and emergency dilution flows. While the flushing and dilution flows may disperse juvenile and adult western pond turtles, this would be a less than significant impact because although this species is considered an aquatic species, they are known to spend a considerable portion of their lives in upland habitats and may move to upland habitats during high winter flows.

Significance

Significant and unavoidable for foothill yellow-legged frog breeding populations, if present, in the Middle Klamath River immediately downstream of Iron Gate Dam in the short term (0−5 years)

No significant impact for western pond turtle in the Middle Klamath River immediately downstream of Iron Gate Dam in the short term (0−5 years)

4.2.5.4 Wildlife Corridors and Habitat Connectivity

In the short term under the No Project Alternative, the reservoirs and dams would continue to present a barrier to movement for some terrestrial wildlife species (Section 3.5.5.4). Salmon and other fish species would not be able to migrate to reaches upstream of Iron Gate Dam, and thus they would not provide nutrient-rich food for terrestrial species located upstream of Iron Gate Dam. Marine-derived nutrients would not be subsequently deposited into terrestrial habitats and productivity of the terrestrial ecosystem as a whole would not change from existing conditions. There would be no significant impact in the short term compared with existing conditions.

4.2.6 Flood Hydrology

Under the No Project Alternative, there would be no changes to the Lower Klamath Project facilities or operations that would affect flood hydrology in the short term (0−5 years). The existing condition, as described in Section 3.6.2 *Flood Hydrology, Environmental Setting,* would continue. Specifically, there would be no increases in downstream surface water flows during reservoir drawdown that could change flood risks, no changes to flood hydrology due to removal of recreational facilities currently located along the banks of the existing reservoirs, and no changes to flood risks due to downstream sediment deposition as compared with existing conditions, since reservoir drawdown and dam removal would not occur. Thus, there would be no significant impacts to the aforementioned aspects of flood hydrology in the Area of Analysis in the short term (0−5 years) under the No Project Alternative. Potential impacts to the 100-year floodplain inundation extent downstream of Iron Gate Dam, and the potential for dam failure, under the No Project Alternative are discussed further below.

Potential Impact 4.2.6.1 The FEMA100-year floodplain inundation extent downstream from Iron Gate Dam could change due to 2017 flow requirements, potentially exposing people and/or structures to a substantial risk of damage, loss, injury, or death involving flooding.

Under the No Project Alternative, the dams would remain in place and the Lower Klamath Project would continue to operate in the short term (0−5 years) under annual licenses issued by FERC. The 2013 BiOp requirements for the upstream USBR Klamath Irrigation Project and the 2017 court-ordered flushing and emergency dilution flows would determine how instream flows through the Lower Klamath Project and

releases from Iron Gate Dam are managed (NMFS and USFWS 2013, U.S. District Court 2017).

The 100-year floodplain inundation extent in the Klamath River between RMs 193 and 174 (i.e., from Iron Gate Dam to Humbug Creek) was modeled by USBR (2012), including a "WithDams_100yr" scenario that assumes 2010 BiOp flows and Lower Klamath Project dams remain in place. Floodplain inundation maps illustrating the USBR (2012) model results are presented in Appendix K of this EIR. Because the overall magnitude of the 2010 BiOp flows is consistent with that of the 2013 BiOp flows, and the 2017 court-ordered flushing and emergency dilution flows are within the range of historical Klamath River flows evaluated in 2013 BiOp studies (see also Section 4.2.1.1 *[No Project Alternative] Alternative Description – Summary of Available Hydrology Information for the No Project Alternative*), the 100-year floodplain inundation extent previously modeled by USBR (2012) also serves as the Lower Klamath Project EIR No Project Alternative 100-year floodplain inundation extent. The USBR (2012) 100-year floodplain inundation extent corresponds closely with the current FEMA 100-year flood boundary, however there are some differences between the two modeled inundation extents. These differences are attributable to the use of different hydrographic base data for flood events and the use of enhanced elevation data by USBR (2012). The USBR (2012) analysis is based on LiDAR data with elevation values sufficient to support 2-foot contours along the reach of the Klamath River from Iron Gate Dam (RM 193) to Happy Camp (RM 108.3).

Based on a review of detailed 2010 and 2009 aerial imagery under the USBR (2012) "WithDams_100yr" scenario, 671 structures including mobile homes, houses, farm sheds, bridges, and other features large enough to cast a shadow, are potentially at risk of flooding in a 100-year storm event if the dams remain in place. Many of the structures are mobile homes that move annually or seasonally. Within the FEMA 100-year floodplain, there are 481 structures at risk, including bridges (USBR and CDFG 2012), if the dams remain in place. As described in Section 3.6.5 *Flood Hydrology, Potential Impacts and Mitigation*, the KRRC has determined that there are 34 legally-established habitable structures located within the existing 100-year floodplain between Iron Gate Dam (RM 193) and Humbug Creek (RM 174) (Appendix B: *Definite Plan*). Under the No Project Alternative, these 34 structures would be exposed to a substantial risk of damage or loss involving flooding.

Overall, in the short term (0−5 years), flows under the No Project Alternative would not change from existing adverse conditions, thus the extent of 100-year floodplain inundation in the Klamath River downstream of Iron Gate Dam as modeled by USBR (2012) would not change (see Appendix K for 100-year floodplain inundation maps).

Significance

No significant impact in the short term (0−5 years)

Potential Impact 4.2.6.2 The FEMA 100-year floodplain inundation extent downstream from J.C. Boyle Dam could change due to 2017 flow requirements between the California-Oregon state line and Copco No. 1 Reservoir, potentially exposing people and/or structures to a substantial risk of damage, loss, injury, or death involving flooding.

As part of prior flood-inundation hydrologic and hydraulic modeling conducted for dam removal analyses, USBR (2012) did not conduct 100-yr floodplain mapping within the

Hydroelectric Reach; however, FEMA (2016) mapping includes an existing conditions 100-yr floodplain boundary for the Klamath River, including the Hydroelectric Reach (see Appendix K).

As described for the Proposed Project analysis of Potential Impact 3.6-4 (see Section 3.6.5.2), J.C. Boyle Reservoir provides no storage and the dam typically operates in spill mode at flows above plant capacity (i.e., approximately 6,000 cfs; Table 2-1 in USBR 2012). Existing-conditions peak flows in the Hydroelectric Reach are not attenuated as a result of J.C. Boyle Dam. As is the case for the Middle Klamath River downstream of Iron Gate Dam, flows under the No Project Alternative would not change from existing conditions in the short term (0−5 years), and thus the 100-year floodplain inundation extent in the Klamath River from the Oregon-California state line downstream to Copco No. 1 Reservoir as modeled by FEMA (2016) would also not change from existing conditions (see Appendix K for 100-year floodplain inundation maps). Therefore, there would be no significant impact.

Significance
No significant impact in the short term (0−5 years)

Potential Impact 3.6-6 Dam failure could flood areas downstream of the Lower Klamath Project.
The Lower Klamath Project dams collectively store over 169,000 acre-feet of water when they are full. The dams are inspected regularly and the probability of failure has been found to be low. In the short term (0−5 years), if a dam failed, it could inundate a portion of the downstream watershed. The risk of failure in the next 0−5 years under the No Project Alternative remains the same low risk as under existing conditions. The 0−5 year period is a small fraction of the expected lifetime of the facilities, and the facilities would continue to undergo the same requirements for continuing inspection and maintenance.

Significance
No significant impact in the short term (0−5 years)

4.2.7 Groundwater

Under the No Project Alternative, in the short term (0−5 years), there would be no change in groundwater/ surface water interactions related to the Lower Klamath Project reservoirs as compared with existing conditions, since reservoir drawdown and dam removal would not occur. Groundwater conditions would remain as described in Section 3.7.2 *Groundwater, Environmental Setting*. Thus, there would be no significant impacts to groundwater in the Area of Analysis in the short term (0−5 years) under the No Project Alternative.

4.2.8 Water Supply/Water Rights

Under the No Project Alternative, in the short term (0−5 years), there would be no change in the amount of surface water flow available for diversion under existing water rights in the Middle or Lower Klamath River or Upper Klamath Lake/Keno Reservoir due to operations of the Lower Klamath Project. Thus, except for the changes due to 2017 flow requirements described in Potential Impact 4.2.8-1 below, the existing conditions,

as described in Section 3.8.3 *Water Supply/Water Rights, Environmental Setting,* would remain in the short term.

Potential Impact 4.2.8-1 Water availability changes from coordinated operations under 2017 flow requirements

With Iron Gate Dam continuing to block fish passage, it is assumed that the 2017 flushing and emergency dilution flow requirements will continue under the No Project Alternative in the short term. The 2017 flow requirements determine how instream flows through the Lower Klamath Project and releases from Iron Gate Dam are managed (NMFS and USFWS 2013, U.S. District Court 2017; see Section *[No Project] Alternative Description – Summary of Available Hydrology Information for the No Project Alternative*). The 2017 flow requirements require use of more water than the 2013 flow requirements, in that the USBR must guarantee at Iron Gate Dam, annual flushing flows and bi-annual deep flushing flows. Additionally, USBR must maintain an additional 50,000 acre feet of water until approximately June 15 annually, as a reserve in case emergency dilution flows are needed. The amount of water required to maintain the flow requirements is not fixed, because the requirements work in tandem with available high flows. Thus, the amount of water that USBR must withhold from deliveries in order to ensure the flow minimums are met will vary each year. Additionally, in some years, the 50,000 acre-feet of water held in reserve for dilution flows will be available for delivery to the Klamath Irrigation Project later in the year, while in other years it will not. While it is not possible to quantify the reduction in water available for Klamath Irrigation Project deliveries, it is reasonable to assume that there will be some level of reduced deliveries in most, if not all, years. In 2018, the amount of Klamath Irrigation Project Supply water required to meet 2017 flow requirements was 76,713 acre-feet. As noted in Potential Impact 3.8-2, the potential for the Lower Klamath Project dams to somewhat ameliorate reductions in water deliveries would be uncertain in light of stated operational changes. Despite this uncertainty, there would remain some potential for coordinated operations to reduce the amount of supply by up to 20,000 acre-feet in drought situations. As discussed in Section 3.8 *Water Supply/Water Rights*, coordinated efforts do not affect releases downstream of Iron Gate Dam, and therefore do not impact water rights downstream. The Lower Klamath Project is not required to operate in such a manner as to extend USBR deliveries.

The potential for coordinated operations under the 2017 flow requirements has no significant impact as compared to the exiting condition.

Significance

No significant impact in the short term (0−5 years)

4.2.9 Air Quality

In the short term under the No Project Alternative, there would be no additional construction above existing conditions. Therefore, unlike under the Proposed Project (Potential Impacts 3.9-1−3.9-6), short-term impacts associated with increased air emissions due to dam removal and construction activities would not occur. Conditions would remain consistent with the operation of existing Lower Klamath Project facilities and there would be no air quality impacts in the reasonably foreseeable period (0−5 years), relative to existing conditions described in Section 3.9.3 *Air Quality, Environmental Setting*.

4.2.10 Greenhouse Gas Emissions

In the short term under the No Project Alternative, there would be no change to the level of power production, and no additional construction above existing conditions, described in Section 3.10.2 *Greenhouse Gas Emissions, Environmental Setting*. Therefore, unlike under the Proposed Project (Potential Impacts 3.10-1–3.10-5), there would be no impacts related to greenhouse gas emissions in the short term (0−5 years) relative to existing conditions.

4.2.11 Geology, Soils, and Mineral Resources

In the short term under the No Project Alternative (0−5 years), there would be no changes in the operations or facilities of the Lower Klamath Project, so the existing conditions would continue, as described in Section 3.11 *[Geology, Soils, and Mineral Resources] Environmental Setting*. Specifically, there would be no changes in geologic hazards, the hillslope stability of reservoir slopes, or the stability of the earthen dam embankments at J.C. Boyle or Iron Gate dams as compared with existing conditions, since reservoir drawdown and dam removal would not occur. There would also be no soil disturbance associated with dam removal construction activities. In the short term, the No Project Alternative would continue existing operations and, therefore, would have no significant impact on the aforementioned aspects of geology and soils within the Hydroelectric Reach compared to existing conditions.

Since reservoir drawdown and dam removal would not occur, erosion of the sediment deposits stored within the Lower Klamath Project reservoirs, downstream sedimentation, and downstream bank erosion due to the release of these sediment deposits would not occur, and there would be no significant impact . Rather, in the short term under the No Project Alternative, J.C. Boyle, Iron Gate, and Copco No. 1 reservoirs would continue to trap sediment at rates similar to historical rates. Based on historical sediment trapping rates and sediment levels in each reservoir, an estimated 2.4 million cubic yards of sediment would be deposited in the reservoirs over the next 5 years. Studies indicate that the trapping efficiency of J.C. Boyle Dam may decrease slightly as the reservoir capacity decreases, but this is not expected to be a factor over the next five years (USBR 2012).

The continued interception of sand, gravel and coarser sediment supplied by sources upstream of Iron Gate Dam would continue to coarsen the channel bed and reduce the size and frequency of mobile coarse sediment deposits in the Hydroelectric Reach and in the Middle Klamath River from Iron Gate Dam to approximately the Scott River, limiting the amount and quality of spawning gravel deposits in these reaches (see also Appendix F). While the winter-spring surface flushing flows and deep flushing flow requirements at Iron Gate Dam (Section 4.2.1.1 *[No Project Alternative] Alternative Description – Summary of Available Hydrology Information for the No Project Alternative)* would increase the mobility of existing surficial fine sediment deposits and infilled fine sediment from the armor layer, with potential for slight mobilization of the armor layer in some locations, new sediment supply would not occur. Overall, maintenance of static channel features would represent no change from existing adverse conditions for the Middle Klamath River between Iron Gate Dam and the confluence with the Scott River.

In the short term under the No Project Alternative, the presence of Copco No. 1 Reservoir would continue to prevent access to the known mineral resource of diatomite beds located at the southern shore near Copco No. 1 Dam (see Section 3.11.2.1 *Regional Geology, Mineral Resources* and Potential Impact 3.11-7). Because of their location in the reservoir and existing erosion resulting from wave action, the diatomite resources are currently inaccessible for extraction purposes. In the short term there would be no change from existing conditions with respect to the diatomite beds under the No Project Alternative because the resources would continue to be inaccessible. The No Project Alternative would have no significant impact on mineral resources relative to existing conditions in the short term.

4.2.12 Historical Resources and Tribal Cultural Resources

In the short term under the No Project Alternative, dam removal construction and reservoir drawdown would not occur, and Lower Klamath Project operations would continue and there would be no change from existing conditions for historical resources and tribal cultural resources, as described in section 3.12.2 *Historical Resources and Tribal Cultural Resources*. Thus, there would be no construction- or restoration-related impacts to known, or as yet unknown, tribal cultural resources (Potential Impacts 3.12-1, 3.12-4, and 3.12-5), no potential shifting and exposure of existing tribal cultural resources within the Lower Klamath Project reservoir footprints or located along the Klamath River (Potential Impacts 3.12-2, 3.12-3, 3.12-7), nor increased potential for looting (Potential Impacts 3.12-6, 3.12-8), since reservoir drawdown would not occur. The potential for impacts to tribal cultural resources due to wave erosion in the annual reservoir fluctuation zone would continue, as described under Potential Impacts 3.12-2 and 3.12-8 of the Proposed Project. The potential beneficial effects on the Klamath Cultural Riverscape related to Proposed Project implementation (including the beneficial effects of the contributing factors of fisheries improvement and improved cultural use of riverine waters through water quality improvements—see Potential Impacts 3.12-9 and 3.12-10) would not occur under the No Project Alternative. Additionally, there would be no impacts to Copco No. 1 Dam, Copco No. 2 Dam, and Iron Gate Dam, their associated hydroelectric facilities, and the Klamath River Hydroelectric Project District (Potential Impact 3.12-11), because the Lower Klamath Project would remain in place. Potential impacts to submerged historic-period archaeological resources (Potential Impacts 3.12-12 through 3.12-16) within the reservoir footprints and along the Klamath River would not occur. Overall, conditions for historical resources and tribal cultural resources would remain consistent with existing conditions, and there would be no significant impacts in the short-term period (0−5 years).

4.2.13 Paleontologic Resources

Under the No Project Alternative, there would be no change in construction or operations of the facilities that could affect paleontologic resources in the short term (0−5 years), thus there would be a continuation of existing conditions as described in 3.13.2 *Paleontologic Resources, Environmental Setting*. Specifically, there would be no downcutting or erosion of the Hornbrook Formation located downstream of Iron Gate Dam due to drawdown of the Lower Klamath Project reservoirs. Therefore, relative to existing conditions, there would be no significant impact to paleontologic resources.

4.2.14 Land Use and Planning

In the short term under the No Project Alternative, there would be no change to ongoing project operations, practices, or land uses, or facilities that would affect Land Use and Planning; therefore, the existing condition would continue, as described in Section 3.14.2 *Land Use and Planning, Environmental Setting.* In the short term under the No Project Alternative, there would be no additional construction above existing conditions, and no changes of land use under KHSA section 7.6.4, which relates to disposition of Parcel B lands. Specifically, there would be no significant impacts to established communities associated with dam removal, or conflicts with applicable land use plans, policies, or regulations. In contrast to the Proposed Project, road maintenance changes would not occur, and fencing would not be needed as the Lower Klamath Project reservoirs would remain in place. Conditions would remain consistent with the existing operation of Lower Klamath Project facilities.

4.2.15 Agriculture and Forestry Resources

In the short term under the No Project Alternative, agriculture and forestry resource management would continue to be implemented as per existing conditions described in Section 3.15.2 *Agriculture and Forestry Resources, Environmental Setting*. No farmland would be directly or indirectly converted to non-agricultural use. No forest lands would be converted to non-forest use and, in general, the No Project Alternative would maintain the status quo with regard to Williamson Act contracts and zoning. Thus, there would be no reasonably foreseeable short-term (0−5 years) impacts to agriculture and forestry resources relative to existing conditions.

4.2.16 Population and Housing

In the short term under the No Project Alternative, there would be no changes that would alter the existing trends in population and housing as described in Section 3.16.2 *Population and Housing, Environmental Setting*. No short-term potential impacts to population and housing associated with construction for dam removal would occur. Thus, unlike under the Proposed Project (Potential Impacts 3.16-1 and 3.16-2), there would be no influx of temporary workers relative to the existing conditions. Population and housing would follow current trends, and there would be no significant impact.

4.2.17 Public Services

In the short term under the No Project Alternative, there would be no increase in construction related to the Lower Klamath Project facilities in the reasonably foreseeable period (0−5 years). Thus, the potential public services impacts associated with dam removal and construction activities under the Proposed Project would not occur for the No Project Alternative, and the existing condition as described in Section 3.17.2 *Public Services, Environmental Setting* would continue. Relative to existing conditions, public services response times for emergency fire, police, and medical services would not increase due to construction and demolition activities, there would be no increased risk of wildfires and need for firefighting measures due to construction and demolition activities, and there would be no potential effects on schools services and facilities. Conditions would remain consistent with the existing operation of Lower Klamath Project facilities, and there would be no significant impact to public services.

4.2.18 Utilities and Service Systems

In the short term under the No Project Alternative, there would be no increase in construction related to operations of the Lower Klamath Project facilities in the reasonably foreseeable period (0−5 years). Therefore, the potential Utilities and Service Systems impacts associated with dam removal construction activities would not occur, and the existing condition as described in Section 3.18 *Utilities and Service Systems, Environmental Setting* would continue. Relative to existing conditions, there would be no need for construction of new wastewater treatment facilities, or expansion of existing facilities to serve new recreational facilities or construction work crews, no need for construction of new stormwater drainage facilities, or expansion of existing facilities, no generation of large volumes of waste due to dam removal and construction activities requiring landfill capacity. Conditions would remain consistent with the operation of existing Lower Klamath Project facilities, and there would be no significant impact to utilities and service systems in the short term.

4.2.19 Aesthetics

Under the No Project Alternative, the operations and facilities of the Lower Klamath Project would remain the same for the short term. Therefore, visual impacts resulting from project construction and reservoir drawdown would not occur, and the existing condition would continue, as described in Section 3.19.2 *Aesthetics, Environmental Setting*. There would be no loss of open water vistas, no changes in flows and channel morphology, no changes in visual water quality due during periods of elevated SSCs, and no exposure of bare areas of sediment and rock, all due to reservoir drawdown. In addition, there would be no long-term visual changes from either removal of the Lower Klamath Project facilities, or construction of new infrastructure and improvements to existing infrastructure. There would also be no construction equipment, staging areas, and demolition areas that could detract from the natural surroundings, and no nighttime construction or security lighting that would adversely affect nighttime views under the No Project Alternative. The existing Lower Klamath Project facilities and their operations are already a part of the environmental baseline. Aesthetic conditions would remain consistent with surrounding recreational, agricultural, open space and rural residential land uses, and visual presence of the Lower Klamath Project facilities, and there would be no significant impacts to aesthetics in the short term (0−5 years).

4.2.20 Recreation

In the short term under the No Project Alternative, there would be no change to existing recreation facilities and opportunities, as dam removal construction, recreation facilities removal (and potential construction of additional facilities) and reservoir drawdown would not occur. The existing condition as described in Section 3.20.2 *Recreation, Environmental Setting,* would continue. Thus, there would be: no restrictions, noise, dust, and/or sediment release due to dam removal activities that would impact existing recreational facilities; no changes to, or loss of, local or regional reservoir-based recreation activities and facilities due to reservoir drawdown; no increase in the use of regional recreational facilities due to the loss facilities at the Lower Klamath Project reservoirs; and no construction of new or expanded recreational facilities due to dam removal. There would also be no changes to, or loss of, river conditions that support whitewater boating, or other river-based recreation, including fishing; and no potential impacts to Wild and Scenic River resources, designations, or eligibility for listing due to

dam removal activities. Conditions for recreation would remain consistent with existing conditions, and there would be no significant impact in the short term (0−5 years) .

4.2.21 Hazards and Hazardous Materials

In the short term under the No Project Alternative, there would be no change to the current operations of the Lower Klamath Project, and therefore no change related to hazards and hazardous materials. Therefore, the existing condition as described in Section 3.21.2 *Hazards and Hazardous Materials, Environmental Setting,* would continue. There would not be significant dam removal and construction impacts associated with the transport and use of hazardous materials during project construction activities, and there would not be a need for implementation of an emergency response plan associated with construction activities. The existing hazardous materials that have been identified at the Lower Klamath Project dams and associated facilities would remain. Since reservoirs would remain, there would be no increased risk from wildfires under the No Project Alternative. Conditions would remain consistent with the operation of existing Lower Klamath Project facilities, and there would be no significant impacts related to hazards and hazardous materials in the short term (0−5 years), as compared to existing conditions.

4.2.22 Transportation and Traffic

In the short term under the No Project Alternative, there would be no change to the operations or facilities of the Lower Klamath Project that would potentially impact transportation and traffic, and therefore the existing conditions would continue, as described in Section 3.22.2 *Transportation and Traffic, Environmental Setting*. No potential impacts associated with increased vehicular traffic, or increases in potential conflicts with vehicular and non-vehicular traffic, as part of construction-related activities would occur. No improvements to roads, bridges or culverts would occur beyond the typical levels of maintenance already occurring under existing conditions. Conditions would remain consistent with the operation of existing Lower Klamath Project facilities and there would be no significant impacts to Transportation and Traffic in the short term (0−5 years) compared with existing conditions.

4.2.23 Noise

In the short term under the No Project Alternative, there would be no change to the operations or facilities of the Lower Klamath Project that would potentially impact noise. Therefore, the existing condition as described in Section 3.23.2 *Noise, Environmental Setting,* would continue. No potential impacts associated with noise and vibration levels from dam removal construction and reservoir restoration would occur. Therefore, there would be no significant impact related to noise under the No Project Alternative compared with existing conditions.