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February 26, 2019

VIA HAND DELIVERY

Ms. Michelle Siebal
California State Water Resources Control Board
Division of Water Rights – Water Quality Certification Program
P.O. Box 2000
Sacramento, CA 95812-2000

Re: PacifiCorp Comments on the Draft Environmental Impact Report for the Lower Klamath Project License Surrender

Dear Ms. Siebal:

Thank you for the opportunity to provide comments on the Draft Environmental Impact Report for the Lower Klamath Project License Surrender (Draft EIR) issued by the California State Water Resources Control Board (the Board) on December 27, 2018, under the California Environmental Quality Act (CEQA). The Draft EIR evaluates potential impacts of the Klamath River Renewal Corporation's (KRRC) proposal to remove four dams on the Klamath River currently owned and licensed to PacifiCorp—J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate—as contemplated in the amended Klamath Hydroelectric Settlement Agreement (KHSA). To a lesser extent, the Draft EIR evaluates the potential effects of various alternatives to the proposed project that include the continued operations of PacifiCorp's Klamath hydroelectric facilities and partial removal. PacifiCorp's comments identify significant deficiencies in the draft EIR that must be corrected to ensure that the final EIR and certification are legally sufficient and defensible.[1]

Introduction

PacifiCorp fully supports the KHSA as a balanced outcome for its customers, so long as all of the customer protections embodied in the agreement are achieved. Successful settlement implementation will facilitate the policy preferences of the federal government, the states of California and Oregon, Klamath Basin Tribes, and other stakeholders. From the outset, PacifiCorp has consistently held that its customers must be protected against the unknown costs and risks of implementing these policy preferences, and the liability and indemnification provisions of the KHSA were expressly negotiated to accomplish these protections. PacifiCorp remains committed to securing these protections for its customers and continues to work with the KRRC to ensure that adequate protections are in place to satisfy this foundational requirement.

[1] PacifiCorp reserves the right to supplement these comments before the Board issues a final EIR and certification.

Because the Draft EIR is a critical waypoint for public input and engagement about the full range of potential environmental effects that may result from removal of four of the dams on the Klamath River, it is important to provide a deeper perspective and context for these comments to the Board. As noted by the Klamath River Expert Panel in its 2011 report on the effects of dam removal on Chinook salmon, Klamath dam removal "is an experiment in that many of the outcomes are difficult to predict, particularly those of greatest interest to stakeholders (e.g., increasing abundance of Chinook salmon)."[2] This experiment has been long-advanced by certain stakeholders who believe that dam removal is the only option for improving salmonid fisheries and water quality in the Klamath River. Unprecedented in size, scope, and potential impact, the project involves drawing down three expansive reservoirs, discharging millions of cubic yards of sediment, impacting 225 miles of river within and downstream of the project, and ending hatchery programs that currently conserve listed Coho salmon and support harvest opportunities for Chinook salmon. The project will have significant near-term impacts to these important species, and the hope of the KHSA is that any significant impacts will be outweighed by long-term benefits.

Dam removal is inherently risky, but the depth of uncertainty around the potential outcome of Klamath dam removal makes this action extraordinary. Some stakeholders have embraced the idea that dam removal will result in overall benefits to the river, while other stakeholders have expressed deep concern about the costs and risks of such an endeavor. Without doubt, this proceeding will highlight this divide and bring the underlying perspectives and analysis of each stakeholder group to the forefront. For PacifiCorp, comprehensive liability protection and indemnification is essential to support prudent utility decision-making. The KHSA's cost cap and liability protections are also central to our utility regulator's authorization for PacifiCorp to participate in the settlement process and collect $200 million in customer funds for dam removal. Without the negotiated protections of the KHSA, ultimate liability and risks from dam removal could likely fall upon PacifiCorp's customers.

Background on KHSA and PacifiCorp Customer Protections

Dam removal on the Klamath River is natural-resource-management decision that PacifiCorp, as a regulated utility, is unwilling to undertake because of the substantial risks and uncertain benefits. PacifiCorp's perspectives are informed by our past experience addressing fish passage requirements and water quality improvements through new project licenses. This does not mean that PacifiCorp disputes that dam removal may have positive effects on the river. It simply means that the outcome is unknown, the risks are high, and that it would be imprudent to expose PacifiCorp's customers to such far-reaching risks for an uncertain outcome.

Minimizing customer risk was PacifiCorp's primary goal in joining the original KHSA in 2009 and the amended KHSA in 2016. Faced with the unknown costs and risks associated with

[2] Goodman, D., M. Harvey, R. Hughes, W. Kimmerer, K. Rose, G. Ruggerone. 2011. Klamath River Expert Panel: Scientific Assessment of Two Dam Removal Alternatives on Chinook Salmon: Addendum to Final Report at 312 (July 20, 2011).

obtaining a new Federal Energy Regulatory Commission (FERC) license for the project, PacifiCorp agreed to support the dam removal project embraced by California, Oregon the federal government, Klamath Basin Tribes, and other stakeholders, as long as four key principles were met: (1) PacifiCorp would transfer the dams to another entity responsible for their removal; (2) our customers' financial contribution to dam removal would be capped; (3) our customers would be protected from the potentially significant liabilities associated with dam removal and its potential known and unknown consequences; and (4) PacifiCorp would continue to operate the dams for the benefit of its customers until the facilities were decommissioned. These principles are bedrock anchors for PacifiCorp's support of this endeavor and well-known to all KHSA signatories.

Over the past three years, PacifiCorp has worked closely with the KRRC and our other settlement partners to advance the KHSA. The KRRC's efforts have produced noteworthy progress, but significant uncertainties remain—particularly for PacifiCorp's customers. FERC has yet to approve PacifiCorp and the KRRC's joint license application to transfer the license for the four facilities that are planned to be removed to the KRRC. That approval is a critical component of the KHSA and constitutes a key customer protection for PacifiCorp. FERC must determine that the KRRC has the financial, technical, and legal capacity to become the licensee, and FERC has stated that it will apply a heightened public- interest standard to that determination due to the unique nature of this endeavor. The KRRC is scheduled, on April 29, 2019, to provide FERC with revised cost estimates, a detailed insurance and risk-mitigation package, and the plan to address costs and liabilities that exceed the $450 million in funding available under the KHSA. After receiving this information, FERC may be in a position to rule on the request to transfer the license.

The KRRC also has yet to satisfy certain contractual preconditions to license transfer that protect PacifiCorp and the states of California and Oregon. Most importantly, KRRC must demonstrate that it has adequate funding to complete the project and that it has the capacity to fulfill its obligation to indemnify PacifiCorp and its customers. Central to both the cost and indemnification determinations is KRRC's ability to contract with a liability transfer company (LTC) consistent with KHSA Appendix L. The LTC is a cornerstone of obtaining FERC approval of the application to transfer the license for the Klamath dams to KRRC, so that KRRC can proceed to surrender the license and remove the dams. The LTC will provide a critical financial buffer if dam-removal costs or liability claims exceed the fixed funding available under the KHSA by providing assurances to all stakeholders in this process that a capitalized entity will support the KRRC to respond to potential unforeseen consequences or costs. PacifiCorp expects that our determinations under KHSA Section 7.1.4 will be reviewed by our state utility regulators in Oregon and California to determine whether PacifiCorp's decisions are prudent and in our customers' best interest.

Compliance with California Environmental Quality Act

The Draft EIR is critical in furthering the work the settlement partners are performing. The Draft EIR is intended to provide the Board and the public, including the KHSA signatories, FERC, and other regulators with a transparent and accurate accounting of potential project impacts. From that accounting, the Board can determine whether to issue or deny a Clean Water Act section 401 Water Quality Certification for the dam-removal project, and what conditions should be imposed on the project to avoid or mitigate significant environmental impacts associated with that decision. The DEIR will also inform the settlement parties about how best to manage risk, and it will help our utility regulators evaluate whether the continued collection of funds from our customers is prudent in light of how customer risks are proposed to be mitigated. And the DEIR will aid FERC to evaluate whether license transfer and dam removal are in the public interest. Ultimately, flaws in the Draft EIR's analysis that confuse, minimize or inaccurately portray existing conditions and potential significant impacts will compromise successful KHSA implementation and dam removal.

While PacifiCorp cannot justify bearing the risk of dam removal, resource agencies—like the Board—can certainly elect to approve a project despite uncertain outcomes or significant risks. But before determining that the risks and significant environmental impacts of dam removal are worth the potential benefits, a factually and legally accurate environmental impact report must be developed, and the Board may be required to adopt a statement documenting why the project should be approved despite significant unmitigated environmental impacts. And the environmental impact report should be based on the most current and best available scientific information. Indeed, the fundamental purpose of CEQA is not to guarantee that significant impacts will not occur from a project, but rather to require an accurate and thorough assessment of potential impacts and uncertainties associated with a project so that agency decision-makers and the public can be properly informed.

In that context, PacifiCorp has taken a hard look at the Draft EIR in an effort to ensure that it is factually accurate and legally sufficient because, as noted above, any technical or legal shortcomings put KHSA implementation and ultimate dam removal at risk. PacifiCorp's concerns are informed by its long- standing involvement in the Klamath basin as the operator of the Klamath Hydroelectric Project, and reflect our long-standing understanding of the risks and uncertainties associated with dam removal. While our comments are informed by new information, they are consistent with our previous comments on the 2011 U.S. Department of the Interior and California Department of Fish and Game Klamath Facilities Removal Public Draft Environmental Statement/Environmental Impact Report. Once again, our comments have consistently focused on ensuring that the impacts of our facilities are accurately assessed, and the benefits and risks of dam removal and alternatives are accurately portrayed so that agencies can make informed decisions, the public is aware of the risks and benefits associated with a major natural resource action, and PacifiCorp can ensure that its customers are protected from risks that are transparently acknowledged.

The issues we identify in our attached comments must be addressed to ensure the final EIR and water quality certification are legally justified and defensible. As detailed in our technical and legal comments, the Draft EIR does not meet the requirements of CEQA. Critically, it relies on outdated data, inaccurately evaluates the impacts of sediment discharges and minimizes impacts to listed species while also overstating adverse impacts related to continued operation of the Klamath Hydroelectric Project. Our comments are intended to inform and improve the environmental analysis contained in a revised and recirculated Draft EIR, and further the KHSA signatories' efforts to successfully fulfill all of the conditions of the KHSA.

Sincerely,

Tim Hemstreet for

Mark Sturtevant
Managing Director, Renewable Resources

Attachment 1 - PacifiCorp Comments on DEIR

Section 1. Overview of Comment Structure

These comments summarize several important issues that are not properly addressed or where foundational data is not provided in the Draft Environmental Impact Report (DEIR) (Section 2 Major Issues). Section 3 presents a series of thematic comments. Thematic comments are issues and problems that were pervasive throughout the DEIR, which necessitate more focused general comments in addition to the specific section-by-section comments. Exhibit A presents PacifiCorp's detailed comments on the DEIR, organized to correspond with the DEIR Chapter, page, and paragraph to assist the State Water Board's review of comments. Full citations for all sources referenced in this document, other than those in direct quotes from the DEIR, are presented in Exhibit B. Exhibit C presents a set of files for the State Water Board's use (submitted electronically on DVD).

Section 2. Major Issues

The major issues discussed in this Section are areas where the DEIR fails to accurately evaluate the impacts of the Proposed Project or alternatives, or employs a flawed analytical approach.

2.1 Impacts to Coho Salmon

2.1.1 Summary

Recent field monitoring data (MKWC2016, 2017, 2018; Chesney and Knechtle 2017; Knechtle and Chesney 2017), indicates that the Coho population upstream of Portuguese Creek (including the Scott and the Shasta rivers) is extremely small; perhaps less than 1,000 adults in most years, which is well below the risk thresholds associated with abundance set by NMFS (2014) in the Recovery Plan. While adults mainly spawn in the tributaries, some do spawn in the mainstem Klamath River, and any deposited eggs in the mainstem will die as a result of sedimentation within the spawning areas (see Waters 1995; Quinn 2005) the year dams are removed (See Major Issue 2.4). Juvenile Coho use the mainstem throughout the year (Soto et al. 2016b; Manhard et al. 2018), both for rearing in cool-water and low velocity refuge habitat, and as a movement corridor from natal to non-natal habitat.

The few adult Coho that spawn in the tributaries in turn produce relatively few juveniles. In some streams and in some years, approximately 25 percent of the rearing juveniles will leave the tributary for the mainstem in the winter (Soto et al. 2016b; Manhard et al. 2018). Juvenile Coho moving into the mainstem Klamath River will be subject to increased direct mortality rates, decreased fitness and condition, and likely will be more susceptible to disease. These fish would suffer increased mortality (20-40 percent according to Appendix Table E-10 (DEIR pg. E-36) from high suspended sediment concentrations generated by reservoir drawdown. The DEIR assumes these fish will not leave the tributaries or, if they do, will find refuge in cleaner-water inflows along the mainstem; however, the DEIR does not acknowledge that these cleaner-water areas will be crowded with fish from the entire river also seeking refuge, nor does the DEIR discuss the corresponding impacts to juvenile Coho from competition or direct predation. If Coho survive to rear in these conditions, these factors could reasonably be expected combine to create juvenile Coho in relatively poor body condition (Ebersole et al. 2006; Weybright and Giannico 2018), which will in turn reduce their survival rate in the ocean (Gorman 2016).

Iron Gate Hatchery currently operates under a Hatchery and Genetics Management Plan (CDFW and PacifiCorp 2014) that supports an integrated conservation program for Coho Salmon listed as threatened under the Endangered Species Act. Dam removal and associated impacts to Iron Gate Hatchery will likely end this support of the Coho populations. While there is funding for 8 years of continued hatchery operations included in the Klamath Hydroelectric Settlement Agreement (KHSA) under Interim Measure 19, the relocation of the program from Iron Gate Hatchery to Fall Creek and lack of an identified funding source 9 years after dam removal creates uncertainty regarding the ability of hatchery releases to continue to support this population. Currently, an average of 50 percent of the Coho spawning naturally in Bogus Creek and the Shasta River are Iron Gate Hatchery fish (Chesney and Knechtle 2017; Knechtle and Giudice 2018a). When these population are no longer supported by hatchery releases they are likely to dramatically decrease in size. There is no analysis in the DEIR that evaluates the impact of the loss of this hatchery program on Coho populations.

The Proposed Project would add additional stress to outmigrating juveniles; however, the DEIR fails to indicate what this means in terms of the population. The population of Coho is small enough that even a modest increase in mortality rate (either through reduced fitness, predation, or increased susceptibility to disease) could reduce the number of returning adults. Naman and Perkins (2015) noted that on the Trinity River "...because of low population size of unmarked coho [sic] salmon, managers should take measures to limit the mortality of any new fisheries on the natural component of the run." Although this comment is focused on mortality from harvest, the rationale applies equally to the upper Klamath Coho population and mortality that will occur as a result of the Proposed Project. Because the overall Coho population in the Upper Klamath River is already very small, there is a significant and unanalyzed risk that Coho populations would not survive such a mortality event.

2.1.2 Proposed Project Impacts to Coho Salmon Upstream of Portuguese Creek

The DEIR characterizes the short-term impacts from the Proposed Project on Coho as not significant with application of mitigation. There are several issues with this conclusion. The following discussion focuses solely on the DEIR impact analysis as it relates to sediment transport and does not discuss the DEIR's chosen threshold for significance (loss of 50 percent or more of the total Klamath River Coho population) or other technical issues. The purpose of the following discussion is to provide a more comprehensive overview than is provided in the DEIR regarding the existing upper Klamath River Coho populations, address impacts to these fish from suspended sediment, and clarify the uncertainty associated with the Proposed Project's impacts to Coho Salmon.

Adult Populations. The Coho population in the upper Klamath River and its tributaries is very small (Figure 1). The CDFW has maintained counting stations on Bogus Creek, Scott River, and Shasta River consistently since 2007 (Knechtle 2019). The population trend over this period has been downward for Bogus Creek and the Shasta River. The Scott River population appears to be larger and more variable in total returns than any of the other tributaries in the upper Klamath River.

Since 2015, the Mid-Klamath Watershed Council has conducted spawning Coho surveys of tributaries from Bogus Creek downstream to Portuguese Creek (not including the Shasta and Scott rivers). Of the 15 streams surveyed annually, Coho are reliably found only in Horse Creek and Seiad Creek with the occasional fish or two in other streams. Over the 4 years these surveys have been conducted, on average there appear to be about 191 natural-origin Coho per year using these tributaries (MKWC 2016, 2017, 2018, preliminary 2019 data).

Coho return data for Iron Gate Hatchery is available since the hatchery started operating in 1962 (Figure 2). While the long-term average Coho return is 985 fish, this data also illustrates the variable nature of Coho returns over the years. Since 1962, there are only 4 years with more than 2,500 Coho returning to the hatchery, but 13 years with fewer than 250 Coho (Figure 2). Although the last 4 years have seen a gradual increase in adults (Figure 2), it is too soon to tell if this will continue, especially because a similar trend is not apparent in the downstream tributaries.

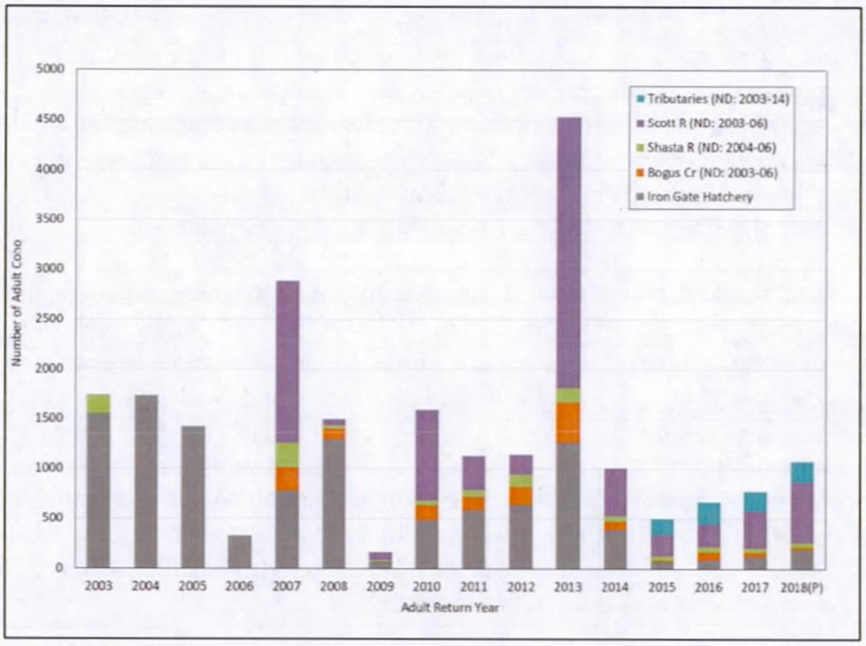

Figure 1. Adult Coho returns to the Klamath River and tributaries upstream of Portuguese Creek. (2018 data is preliminary, Data from CDFW 2018b, Knechtle 2019).

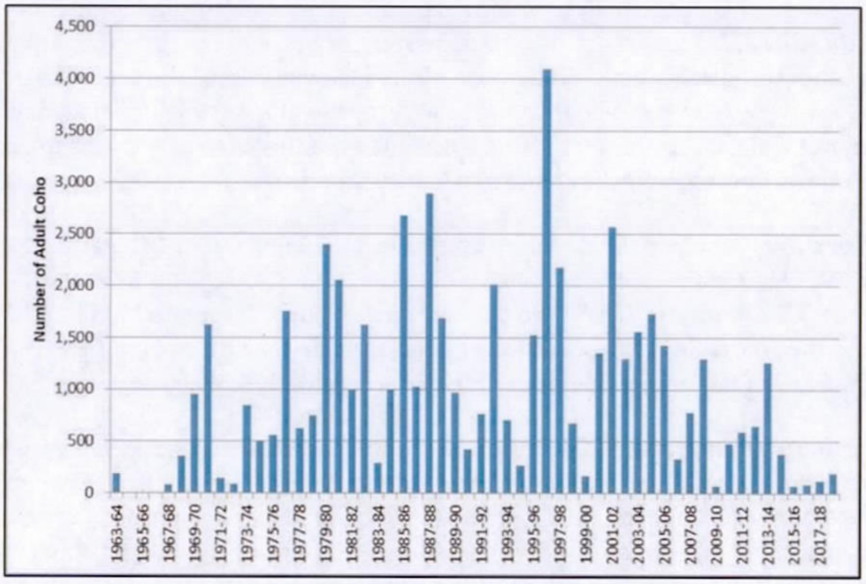

Figure 2. Adult Coho Returns to Iron Gate Hatchery on the Klamath River, 1962 through 2019 (CDFW 2018b).

Coho migrate through the mainstem Klamath River and most adults spawn in the tributaries. Mainstem spawning surveys find very few Coho redds downstream of Iron Gate Dam (MKWC 2016, 2017, 2018). This mainstem spawning population is likely limited to a couple of dozen fish in any given year (DEIR pg. 3-318).

Juvenile Populations. Juvenile Coho are found in the mainstem Klamath River and its tributaries throughout the year (Soto et al. 2016). Coho spend about a total of up to 18 months in freshwater (from emergence to outmigration) before they migrate to the ocean. During this period, they can exhibit any of several life history patterns. Some spend that entire time in one stream, others move from a creek into the mainstem Klamath River for a while sometimes moving back into the same creek or another stream as river conditions dictate. Still others move into the Klamath River, distribute downstream, and then move into non-natal rearing habitats (creeks, off-channel ponds, groundwater springs, etc.). Soto et al. (2016) indicate that the Klamath River provides important habitat for juvenile Coho throughout the year; during the summer periods this use is likely limited to refugia habitats in or adjacent to the mainstem river. Of particular note for the Proposed Project are the spring and early winter redistributions of juvenile Coho from natal streams to non-natal rearing habitat. Soto et al. (2016) hypothesized that juvenile Coho that leave rearing habitat in mid-winter are in search of higher-quality habitat, but are not prone to make long-distance movements.

2.1.3 Coho Mortality from Suspended Sediments

Mainstem Spawning Adults. Even though most Coho spawn in the tributaries, those fish that do spawn in the mainstem would suffer 60-80 percent mortality from sediments mobilized by the Proposed Project (DEIR pg. 3-318). This is up from 20-40 percent present under existing conditions—a 40 percent increase in the mortality rate that is solely attributable to the Proposed Project. Granted this is a small number of individual Coho, perhaps a couple of dozen fish, but the mainstem population could make up about 14 percent of the total population between Portuguese Creek and Iron Gate Dam assuming the average population is about 191 Coho as has been recently documented (not including Bogus Creek) (Table 1). While suspended sediment may kill an added 40 percent of the adults, it is reasonable to expect suspended sediment concentrations would kill 100 percent of the eggs and alevins (newly hatched fish) from mainstem spawning Coho. The DEIR discounts these adult Coho as hatchery fish that did not migrate all the way to the hatchery. That may be the case, but the Iron Gate Hatchery is managed as an integrated hatchery under a Hatchery Genetics Management Plan (HGMP; CDFW and PacifiCorp 2014) with the entire upper Klamath Coho population, making each of these fish of critical importance to the overall population. Currently, Coho returning to Iron Gate Hatchery make up about 65 percent of all returning spawners upstream of Portuguese Creek (including the Scott and Shasta rivers).

Tributary Spawning Adults. When populations are comprised of very few individuals, they can experience difficulties finding mates, which in turn reduces fertilization rates and limits production of young. This in turn results in increased per capita predation rates, and decreased overall survival (Williams et al. 2008). The threshold at which these effects are apparent is the depensation threshold for the population. As noted in Williams et al. (2008) failure to achieve depensation thresholds can exacerbate the rate of decline towards extirpation and extinction. This context is important for the discussion of impacts of the Proposed Project on Coho in the upper Klamath River because populations are generally smaller than these depensation thresholds and therefore, even a small change in abundance can have a substantial effect on the population.

Table 1. Annual counts of adult Coho at Iron Gate Hatchery, video weirs in Bogus Creek, Shasta River, and Scott River, and spawning survey estimates from other tributaries between Bogus Creek and Portuguese Creek from 2003-2018.

Adult Return Year	Iron Gate	Bogus Creek	Shasta River	Scott River	Other Tributaries
2003	1558	No Data	187	No Data	No Data
2004	1734	No Data	No Data	No Data	No Data
2005	1425	No Data	No Data	No Data	No Data
2006	332	No Data	No Data	No Data	No Data
2007	779	233	249	1622	No Data
2008	1296	111	30	62	No Data
2009	70	6	9	81	No Data
2010	485	154	44	911	No Data
2011	586	142	62	344	No Data
2012	644	182	115	201	No Data
2013	1268	405	134	2731	No Data
2014	384	94	46	485	No Data
2015	72	14	45	212	156
2016	86	85	52	226	222
2017	122	44	41	382	186
2018 (Preliminary)	198	24	40	614	200
Average	**690**	**125**	**81**	**656**	**191**
Sources: Knechtle 2019; MKWC 2016, 2017, 2018, and preliminary 2019 data)					

The Upper Klamath River Coho population as defined in the NMFS (2014) recovery plan, does not include the Scott and Shasta rivers populations or the Iron Gate Hatchery fish. The depensation thresholds for the Upper Klamath Coho population is 425 adult Coho, for the Shasta River it is 531 adult Coho, and for the Scott River it is 441 adult Coho (Williams et al. 2008). The Upper Klamath adult returns have been below this threshold since at least 2013 (spawning estimates for Coho in tributaries between Bogus Creek and Portuguese Creek are not available until 2015; Figure 3). The population in the Shasta River has not been above the depensation threshold for the entire period for which data is available (Figure 4). The Scott River population seems to be slightly more robust than the other two populations with 2 out of the last 5 years above the depensation threshold (Figure 5).

Coho on the Klamath River show a distinct 3-year life cycle, and adult returns are driven by the relative strength of an individual brood year with almost no overlap between years. Review of return data indicates that 2007 is the strongest of the three brood years and led to more adults returning in 2010, 2013, and so on (Table 1). This is important to consider because if an entire year-class is eliminated, that year class may not re-establish itself.

Most of the tributary spawning adults are likely to have reached their spawning grounds before suspended sediment concentrations in the mainstem become lethal. The DEIR analysis indicates that the median conditions under existing conditions could be expected to have some "moderate habitat degradation and impaired homing" (DEIR Table E-4). Under the Proposed Project, the effects of suspended sediment concentrations under the same median flow conditions are expected to result in

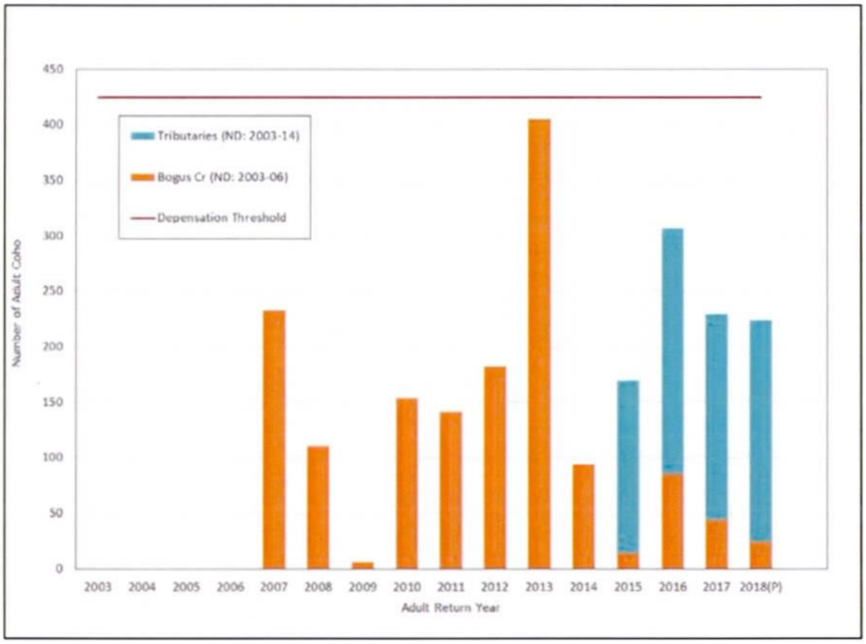

Figure 3. Adult Coho Returns to the Upper Klamath River Population - Portuguese Creek to Iron Gate Hatchery (2018 data is preliminary, Data from CDFW 2018b, Knechtle 2018, Depensation threshold from Williams et al. 2008).

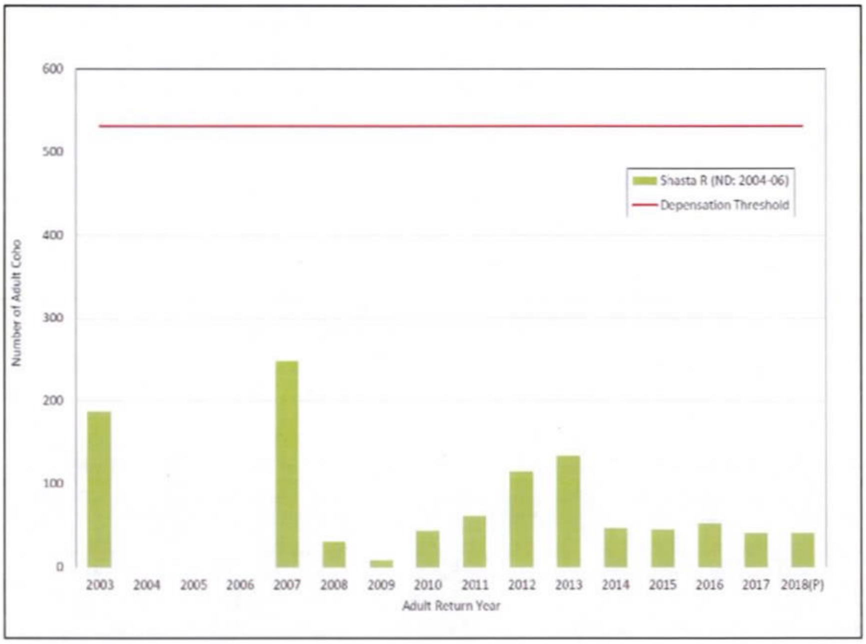

Figure 4. Adult Coho Returns to the Shasta River Population (2018 data is preliminary, Data from Knechtle 2018, Depensation threshold from Williams et al. 2008).

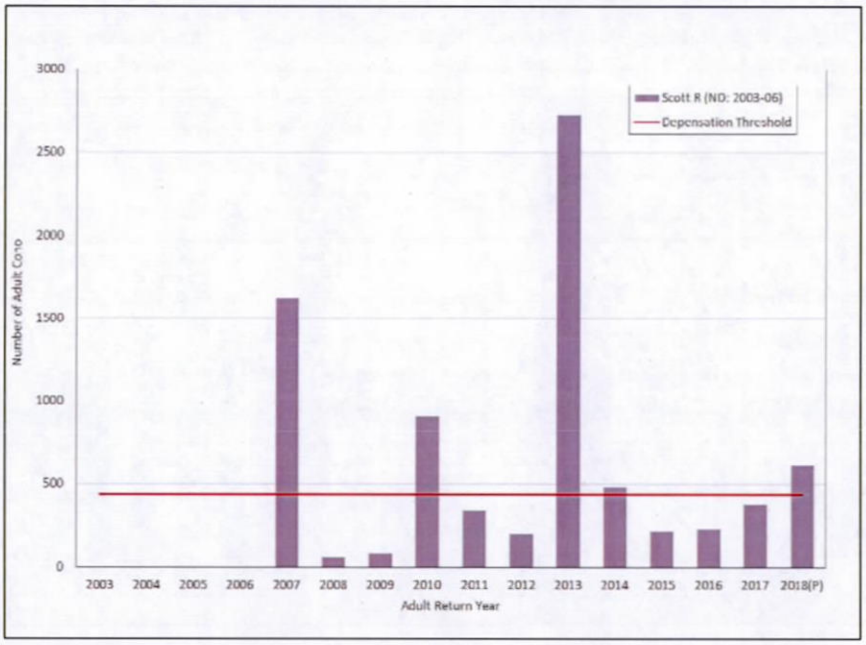

Figure 5. Adult Coho Returns to the Scott River Population (2018 data is preliminary, Data from Knechtle 2018, Depensation threshold from Williams et al. 2008).

"major physiological stress; long-term reduction in feeding; and poor condition" (DEIR Table E-10). This is an increase in adverse conditions associated with the Proposed Project for adult Coho, but still sub-lethal. The reduction in feeding rates are not important for the adults, but changes in condition as a result of physiological stress could reduce fecundity and affect the spawning success even if the adults survive their transit of the mainstem to reach tributaries.

Juvenile Coho in the Mainstem. Juvenile Coho use the mainstem Klamath River throughout the year (Soto et al. 2016), although summer-time use is probably limited to cool-water refugias. About 30 percent of the tagged juvenile Coho in Seiad Creek emigrated from the creek to the Klamath River between the beginning of November, 2010 and the end of February, 2011 (Soto et al. 2016). While Manhard et al. (2018) caution that juvenile Coho migrate in different patterns when coming from different streams, their modeling of migration patterns indicates that between 19 and 24 percent of the juvenile Coho present in a tributary population may leave that tributary during the winter months.

The DEIR assumes that those juvenile Coho that migrate early in the year (January through March) are few in number and would find refuge from elevated suspended sediment concentrations in the mainstem in off-channel habitats, tributary inflows, or tributaries themselves. While fish do actively avoid areas of high suspended sediment concentrations, naturally-generated events do not last for 6-8 weeks like under the Proposed Project. Because of the duration of the Proposed Project-generated suspended sediment concentrations, there would be little escape for Coho leaving tributaries during the winter. It is also reasonable to expect that all the fish (e.g., resident trout, Chinook, Steelhead, etc.) in the river may be trying to access those very same refuge habitats. There is some indication that there may already be density dependent interactions occurring in refuge habitats (Soto et al. 2016). Forcing more fish to use these areas would increase the risk to Coho from predation, competition for space and food, and disease exposure; this potential impact on Coho is not addressed in the DEIR. The DEIR's assumption that Coho will simply avoid periods of high turbidity does not reflect complexities of actual fish behavior or the likelihood that the Proposed Project could result in high rates of mortality of juvenile fish that originated from the tributaries. Because the overall Coho population in the Upper Klamath River is already very small, it is not clear if the populations could survive such a mortality event.

During the January-to-March drawdown period, suspended sediment concentrations are expected to result in 20-40 percent mortality for all age classes of juvenile Coho in the mainstem (DEIR Table E-10). This is higher than the sub-lethal "moderate to major stress" levels predicted for existing conditions (DEIR Table E-4). Deposition of sediment in mainstem refugia could eliminate these habitats. Similarly, deposition of sediment at the confluences of tributaries with the Klamath River could eliminate mainstem refugia and limit juvenile access to areas of higher water quality in the tributaries.

The DEIR posits that existing Coho outmigrants face high mortality under existing conditions for a variety of reasons and that the Proposed Project could result in even higher mortality in the spring of 2021 (DEIR pg. 3-319). While the DEIR does not indicate what the incremental change in juvenile mortality may be, it would appear that the upper Klamath River Coho populations are small enough that even a minor change in mortality could have dramatic results on adult escapement and the viability of these populations. Because there are so few juvenile Coho in the river, juvenile Chinook are used as a surrogate for assessing disease levels. The rate of *Ceratonova shasta* (*C. shasta*) infection in fish has ranged from about 12 to 96 percent from 2005 through 2015 (Som et al. 2016). As fish become more stressed by environmental conditions (lack of food, space, increased competition, etc.) they become more susceptible to disease. This would make them more likely to contract common fish diseases including Ich (*Ichthyophthirius multifilis*), *Columnaris*, or *Parvicapsula minibicornis*, all of which can be lethal.

2.1.4 Population Level Impact of the Proposed Project

The DEIR says that "...Coho salmon smolts outmigrating from the Upper Klamath River, Scott River, and Shasta River populations currently have high mortality rates (35 to 70 percent) presumably as a result of poor water quality and disease (Beeman et al. 2007, 2008)"[1] (Appendix E pg. E-38). The Proposed Project would add additional stress to outmigrating juveniles; however, the DEIR fails to indicate what this means in terms of the population. The population of Coho is small enough that even a modest increase in mortality rate (either through direct mortality, or indirect through reduced fitness, predation, or increased susceptibility to disease) could reduce the number of returning adults. With most of the Coho populations below depensation thresholds, it is unclear how these populations would respond to this event.

Uncertainty. The DEIR acknowledges that there is uncertainty associated with the effects of the Proposed Project on Coho. While the DEIR extensively references the Expert Panel report on Coho and Steelhead (Dunne et al. 2011), there is not an adequate discussion of the implications of this uncertainty. Dunne et al. (2011) repeatedly reinforce that what could ultimately happen to the Coho population from the Proposed Project is not clear and note that while there may be a small increase in production from newly accessible habitat, disease and low ocean survival could easily offset this gain. It is also important to recall that the determinations by the Expert Panel included the implementation of the Klamath Basin Restoration Agreement (KBRA), an element that is no longer available to, in part, provide funding and structure for restoration in the basin. If the Expert Panel thought that the outcome

[1] Contrary to the assertion in the DEIR, Beeman (2008) does not actually attribute the loss of Coho to disease. Beeman (2008) stated that overall Coho survival rate from Iron Gate Hatchery to river kilometer (km) 33 was similar to survival in other rivers. The survival rate over this 276 km distance was 0.857 per 100 km. They note that survival rates for Coho in the Yakima River for example ranged from 0.79 to 0.913 per 100 km.

was uncertain in 2011, that level of uncertainty has increased in 2019 without the elements of the KBRA that were intended to improve habitat function and result in water quality improvements in the Upper Klamath Basin that might address acknowledged fish passage impediments.

The suspended sediment modeling and the effects analysis relating to Coho attempts to address some of the uncertainty associated with the effects of the Proposed Project by using the 10th, 50th, and 90th exceedance probabilities. While helpful if properly done, the analysis in the DEIR uses the sediment transport modeling incorrectly (see Major Issue 2.4 and Brookes 2019), is incomplete, and does not help the reader understand the potential effects of the Proposed Project. The analysis fails to make the connection between the effects of increased suspended sediment concentrations on Coho and the population of Coho present that will be impacted by these changes.

Recolonization at low abundance levels. There are few Coho left in the upper Klamath River populations (Figure 1). Few Coho return to Bogus Creek and even fewer to the Shasta River, and it appears that less than 200 Coho annually spawn in the tributaries of the Upper Klamath from Iron Gate Dam to Portuguese Creek. These populations are below the abundance risk thresholds and mostly below depensation thresholds established in the recovery plan (NMFS 2014, Williams et al. 2008). Although adult straying is a natural event in salmon, it is a relatively infrequent occurrence. The main population from which recolonization could occur is adult Coho returning to Iron Gate or Fall Creek hatcheries. Although straying rates vary greatly amongst species and populations and specific rates are difficult to establish without an abundance of tagging data (see Quinn 2005), if there are only a couple hundred natural Coho in this population to start with there may not be many adults available to stray into the newly accessible habitat. Because all the Coho released from Iron Gate Hatchery are clipped, the number of Coho available to recolonize the areas upstream of Iron Gate Dam can be estimated by the number of natural-origin fish that return to Iron Gate Hatchery annually because these natural-origin fish are straying into the hatchery. The average number of natural-origin fish entering the hatchery from 1997 through 2017 was 30 adult Coho (Giudice and Knechtle 2018); there is no sex information readily available on these strays so it is impossible to evaluate the true recolonization potential. Even if females make up half of this straying population, 15 pairs of Coho on average does not seem like enough fish to effectively recolonize the area upstream of Iron Gate Dam and any straying that does occur reduces the population size in the source streams.

Hatchery Operations. The ability of Iron Gate Hatchery and the redeveloped Fall Creek Hatchery to capture fish after Iron Gate Dam is removed remains is uncertain. Coho may or may not successfully home to these facilities. The importance of hatchery production in maintaining the Upper Klamath population cannot be overemphasized. Adult Coho escapement data indicate that on average, approximately 50 percent of the Coho spawning naturally in the Shasta River and Bogus Creek were of hatchery origin (Chesney and Knechtle 2017; Knechtle and Giudice 2018). This percentage indicates that all of the natural production in these two streams may only be one generation or less removed from the hatchery. Failure of the hatchery or cessation of the hatchery program could permanently reduce these populations of Coho by 50 percent.

2.2 Klamath River Flow Modeling

In the introduction to the effects analysis in the DEIR, Section 3.1 includes a discussion regarding hydrology information, analyses, and provides a rationale to defend the use of the hydrology analysis found in the Klamath Facilities Removal Environmental Impact Statement (EIS)/EIR (2012 KHSA EIS/EIR; DOI and CDFW 2012). Section 3.1 is cross-referenced over 40 times throughout the DEIR. The hydrology and flow analysis from the 2012 KHSA EIS/EIR is outdated and inconsistent with the best representation available of existing hydrologic conditions, which is the 2013 Biological Opinion (2013 BiOp) Klamath Basin Planning Model (KBPM) hydrologic results (USBR 2012a). Throughout the DEIR, statements like the following are used to justify use of the 2012 KHSA EIS/EIR hydrology analysis (DEIR pg. 3-96):

> ...model predictions made using hydrology assumptions adopted for the Klamath Dam Removal Secretarial Determination are still appropriate for assessing Proposed Project impacts since the NMFS 2013 Biological Opinion mandatory flows are encompassed within the modeled range of flows.

In Section 3.1.6 of the DEIR, the 2012 KHSA EIS/EIR Supplemental Information Report (SIR) (USBR 2016) is cited as supporting information for these statements. Specifically, the DEIR states (DEIR pg. 3-4):

> USBR (2016) concluded that the relatively small flow differences between 2013 BiOp and KBRA Flows would not substantively alter the conclusions in the 2012 KHSA EIS/EIR for those environmental resources that would be affected by flows (i.e., water quality, aquatic resources, flood risk, recreation).

Review of U.S. Bureau of Reclamation (USBR 2016) found that it does not provide additional explanation or information to adequately support the conclusion in the DEIR that the difference from the 2013 BiOp and KBRA flows would not alter the previous conclusions. Additionally, information regarding differences in water supply diversion volumes and storage conditions throughout the basin, such as in Upper Klamath Lake, are not provided in Section 3.1.6 of the DEIR or USBR (2016). Review of the differences in KBRA versus 2013 BiOp flows (see DEIR Figure 3.1.1 and Figure 3.1.2) clearly indicates that in many months the differences are significant, not small. The use of the 2012 KHSA EIS/EIR (DOI and CDFW 2012) analyses, when more recent flow information is readily available, indicates that the DEIR does not use the best available science to inform its hydrologic analysis, which then impairs all subsequent analysis that relies upon these hydrologic inputs.

The hydrology data forms the foundation upon which analysis in the DEIR is based. Because the more representative 2013 BiOp KBPM analysis was not used to characterize existing hydrologic conditions, the representativeness and accuracy of the DEIR analyses of the Proposed Project as it relates to hydrology, water quality, and aquatic resources impacts are questionable. This includes the DEIR's conclusions regarding significance of impacts on these resources. The KBRA flows and resultant 2012 KHSA EIS/EIR analysis represents a baseline in which river flows are greater under the KBRA flow assumptions as compared to flows from the 2013 BiOp KBPM analysis, which reduces impacts on water quality and aquatic resources. Not using the updated information available from the 2013 BiOp KBPM results in an overstatement of beneficial water quality and aquatic resources effects from the Proposed Project, and an understatement of adverse impacts associated with the Proposed Project. The DEIR incorrectly and inappropriately states that it is sufficient to "bracket the range of 2013 BiOp flows" (DEIR pg. 3-9) rather than maintain more comparable and updated probability distributions of flow duration and magnitude, but the DEIR fails to provide a discussion of why this bracketing is adequate. The DEIR should include a specific analysis and examples (preferably based on formal statistical analysis) to demonstrate the appropriateness of the DEIR's use of the KBRA flows and 2012 KHSA analysis rather than the 2013 BiOp model.

The Klamath Hydroelectric Project has limited flood control capacity as it is currently operated, and storage in Upper Klamath Lake, which is managed by USBR, is relied upon to provide flood control in the Upper Klamath Basin. Flood storage in Upper Klamath Lake is important in order to reduce the potential for Upper Klamath Lake to overtop levies since hydraulic restrictions at the outlet of the lake and at Link River Dam limit the amount of water that can be released from Upper Klamath Lake. Storage in Upper Klamath Lake is also used to limiting downstream releases that can exacerbate flooding in the Keno Plain, as occurred during the 1964 flood. Thus, Upper Klamath Lake elevations impact the amount of storage available for flood control and ultimately drive the need for pre-emptive flood control releases from Link River Dam. Due to concerns over water surface levels in Upper Klamath Lake to protect endangered suckers and the desire to manage to higher lake levels to protect sucker habitat, Upper Klamath Lake levels are being managed to higher elevations under the 2013 BiOp (see Exhibit A, comment 3.3-46). The USBR changed its flood control management with the 2013 BiOp as compared to earlier flood control operations evaluated in the 2010 BiOp (and as used in the 2012 KHSA EIS/EIR analysis), resulting in less pre-release of water downstream for flood control purposes. There is no discussion in Section 3.1.6 of the DEIR comparing Upper Klamath Lake storage levels between the previous 2012 KHSA EIS/EIR analysis and the 2013 BiOp KBPM analysis, which drives changed river flows. Thus, the DEIR flood risk analysis does not recognize the changed operating conditions in Upper Klamath Lake that affect routing of the 100-year flood, which may underestimate flood risk impacts associated with the Proposed Project.

2.3 Water Quality

Upper Klamath Lake is hypereutrophic and is the source of the nutrient loading to the Klamath River. The river itself exceeds phosphorus and nitrogen loading levels typically associated with eutrophic rivers (Dodds 2006; Smith et al. 2003). The DEIR does not consistently acknowledge this or the decades-long timeframe necessary for implementation actions, which remain uncertain, to result in nutrient loading reductions necessary to achieve the Oregon TMDL's water quality goals in Upper Klamath Lake (ODEQ 2002). Because the flow regime discussed in the DEIR does not accurately represent existing conditions, the water quality modeling and effects analysis that is based on those flows also do not reflect existing conditions nor are they adequate to evaluate the impacts of the Proposed Project. The DEIR acknowledges that "multiple numeric models" (DEIR pg. 3-64) were used in the effects analysis for water quality. The DEIR however, does not use the most recent version of the Klamath Hydroelectric Project water quality model developed by PacifiCorp (2014), which includes numerous model updates and improvements from the version of the model used by ODEQ and others to develop the Klamath River TMDLs. Highlights of the more recent modeling outputs from the PacifiCorp (2014) model are presented here and included in the files that accompany PacifiCorp's comments.

Water temperatures in the 190-mile lower Klamath River downstream of Iron Gate Dam are generally at or near equilibrium water temperature conditions with the exception of immediately downstream of the dam and in the vicinity of certain tributaries (PacifiCorp 2014). Releases from Iron Gate Reservoir are generally moderated owing to the relatively large reservoir volume and a penstock intake elevation that is about 30 feet below the reservoir water surface. These attributes lead to water temperatures that may be at or slightly cooler than equilibrium water temperature during the spring period. The river is considerably smaller in terms of volume per unit length, and thus cools and heats more quickly than the reservoir in response the ambient meteorological conditions.

During the fall period, temperature of water releases from Iron Gate Dam are warmer than equilibrium water temperature due to the thermal lag caused by the reservoir's mass (PacifiCorp 2014). The effect of this seasonal lag is largest in the river just downstream of Iron Gate Dam and diminishes relatively quickly in the downstream direction as the river comes into equilibrium with the local meteorological conditions. PacifiCorp's (2014) water temperature modeling indicates that by the time flows reach the

Shasta River (RM 177), the impact of the lag is diminished by approximately 50 percent and continues to diminish in the downstream direction (Figure 6).

Water temperatures are generally at or near equilibrium water temperature conditions over the rest of the lower Klamath River below the Shasta River (RM 177) (PacifiCorp 2014). The major tributaries generally enter the Klamath River at similar temperatures to the river. The overall state of temperature equilibrium may not hold during periods when cold tributary runoff during spring snowmelt runoff or rain on snow events enter the mainstem Klamath River. During warmer periods of the year there are isolated regions at the confluence of many tributaries where inflow water temperatures are markedly colder than the mainstem. These thermal refugia areas may range from a few square yards to several hundred square yards in size depending on the flow and temperature in the tributary, flow conditions in the mainstem Klamath River, and local geomorphology (Sutton et al. 2002). By the time waters reach the Scott River (RM 143), water temperatures indicate minimal seasonal thermal lag and variability in mean daily water temperatures are largely absent, but results may vary among months (Perry et al. 2011). Such results are consistent with PacifiCorp (2014) water quality modeling results (Figure 6). The DEIR repeatedly incorrectly asserts that the temperature effects of releases from Iron Gate Dam are apparent downstream of or to the confluence of the Salmon River (RM 66) (e.g., DEIR pg. 3-78), and that dam removal will provide benefits to outmigrating fish. Such an example is found on pg. 3-277 of the DEIR, where it states (emphasis added), "FERC (2007) concluded that dam removal would enhance water quality and reduce the cumulative effects on water quality and habitat that contribute to disease-induced salmon die-offs in the Klamath River downstream from Iron Gate Dam. *In turn, this would benefit salmon outmigrants from tributaries downstream from Iron Gate Dam, such as the Shasta and Scott rivers."* This statement is contrary to the best available water quality modeling results, which indicate temperature differences hardly discernible at the Scott River confluence and mean daily temperatures at Iron Gate Dam that are cooler during the juvenile outmigration period as compared to locations further downriver (Figure 7).

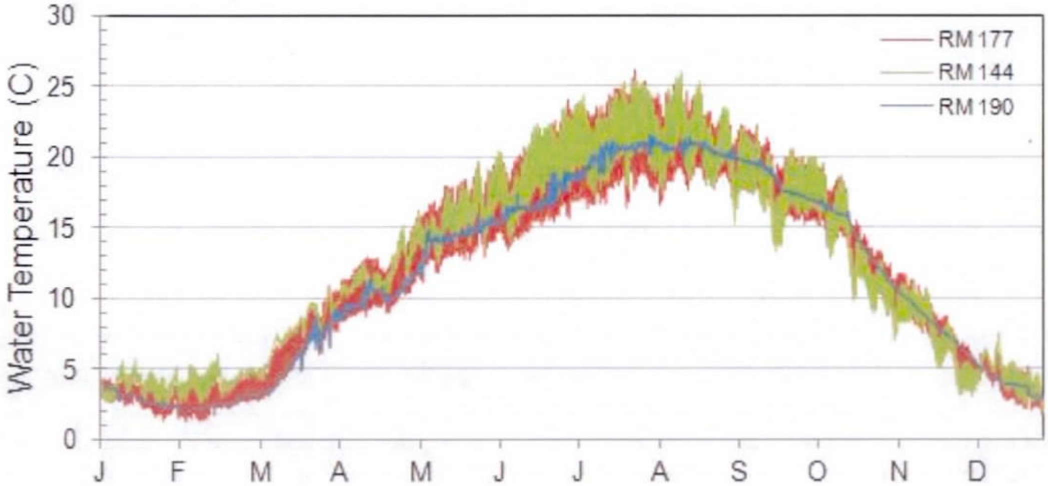

Figure 6. Water temperatures from hourly model simulations (PacifiCorp 2014) for example year 2004 for the Klamath River downstream of Iron Gate Dam (RM 190), upstream of the Shasta River (RM 177), and upstream of the Scott River (RM 144).

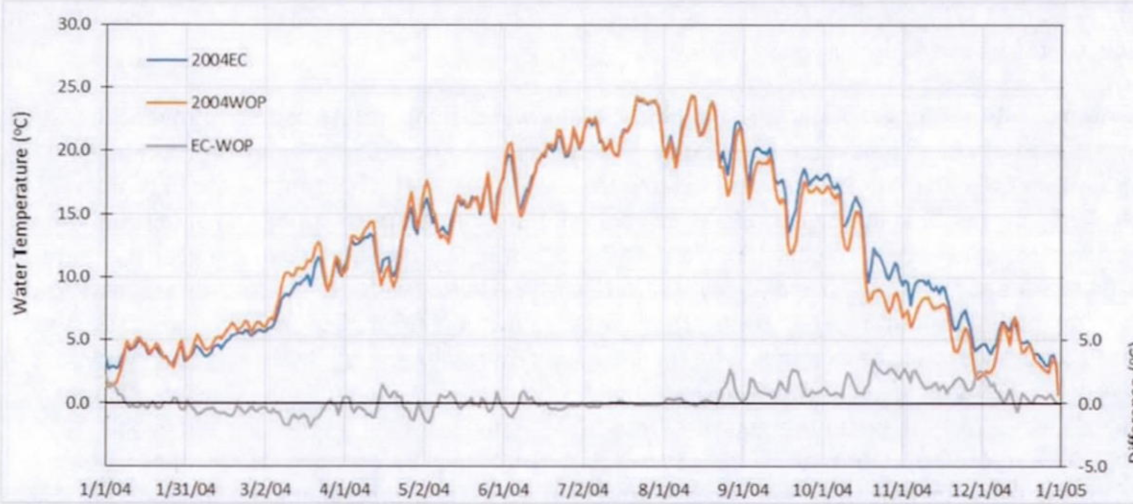

Figure 7. Simulated water temperatures for the Klamath River at the confluence with the Scott River under Existing conditions (2004EC), hypothetical without-Project conditions (2004WOP), and difference between Existing Conditions and hypothetical without-Project conditions (EC-WOP).

PacifiCorp (2014) modeling simulations indicate that the consistently warmest reach of the Klamath River under existing conditions is the reach between approximately Seiad Valley (RM 129) and Clear Creek (RM 98.8). Maximum daily temperatures can reach 30°C and daily minimum temperatures in the 20 to 25°C range are common in this reach during summer (Figure 8). Downstream of this reach, the river experiences considerable accretion and the aspect ratio of the channel changes from a broad shallow stream to a deeper river. As the river approaches the coast, marine influences can moderate river temperatures, but when clear warm conditions prevail, water temperatures respond accordingly. For example, water temperatures at Turwar (RM 6) are cooler overall during spring and summer periods than upriver at Orleans (RM 57) or Seiad Valley (RM 129), with the diurnal range in temperature also more moderated at Turwar (Figure 8). During winter, water temperatures at Turwar are generally warmer overall than at upriver locations (Figure 8) due to milder meteorological conditions at lower elevations.

Because of specific shortcomings created by inappropriate flow data, the complicated interrelated nature of water quality, and the matrix of outdated or flawed water quality models that the DEIR analysis is based upon, it is difficult to discern the actual shortcomings in the water quality discussion in the DEIR. At the most basic level flow rates affect water temperatures which in turn affect dissolved oxygen concentrations, hydraulic retention times, growth of cyanobacteria, nutrient cycling, pH, and so on. Because short-duration adverse water quality events (on the scale of hours to days) can have significant effects on aquatic species, correctly representing the flow regime is critical when assessing potential impacts of a proposed action on water quality. Many of those water quality analysis influence the evaluation of Proposed Project's effects on aquatic species.

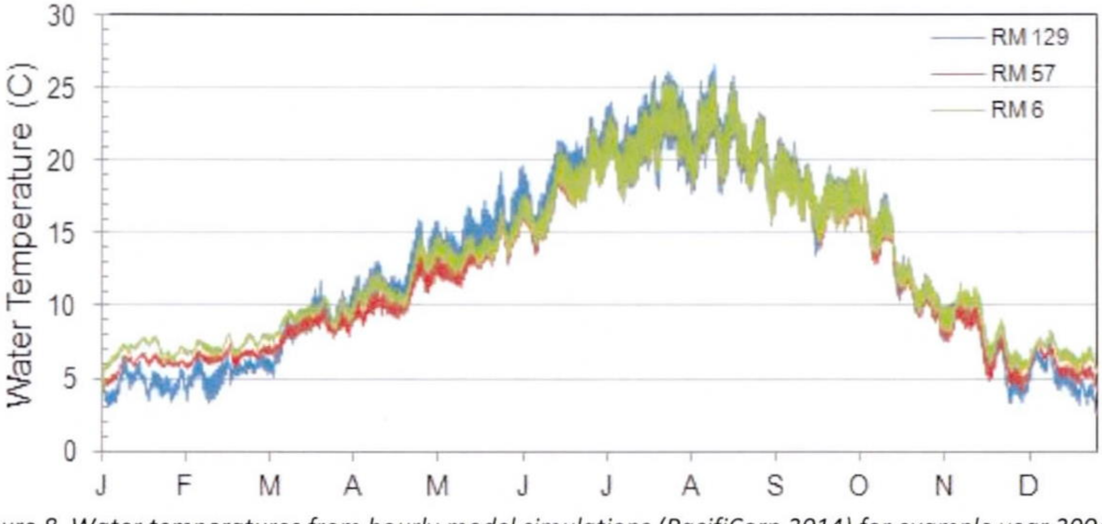

Figure 8. Water temperatures from hourly model simulations (PacifiCorp 2014) for example year 2004 for the Klamath River at Seiad Valley (RM 129), at Orleans (RM 57), and at Turwar (RM 6).

2.4 Sediment Transport Modeling

The fate and transport of the fine sediment predicted to be released under the Proposed Project is critically important to understanding a wide-range of both short- and long-term environmental impacts. Therefore, the DEIR must include a detailed discussion and supporting numerical or quantitative analysis to document the expected impacts of the Proposed Project. Because this is a critical area for the effects analysis, PacifiCorp had an independent expert review the sediment transport models and the DEIR's use of the modeling information (see Brookes 2019 which is included in Exhibit C materials).

In numerous locations throughout the DEIR, there is a repeated conclusion that the fine sediment will be transported the length of the Klamath River and enter the Pacific Ocean. For example, the DEIR states that:

- "Most of the fine sediment is expected to be transported in suspension to the ocean shortly after being eroded. Fine sediment erosion would result in elevated suspended sediment concentrations downstream of Iron Gate Dam in the short term (Stillwater Sciences 2010, USBR 2012)." (DEIR pg. ES-6)
- "Over 80 percent of the reservoir sediments are fine sediment (organics, silts, and clays), which are expected to remain suspended in the Klamath River flow as it moves downstream and out into the Pacific Ocean." (DEIR pg. 2-60)
- "Because the trapped sediments consist primarily of organic material (e.g., dead algae), silts, and clays, they would be easily eroded and flushed out of the reservoirs into the Klamath River, and would continue to be suspended in the river downstream to the Pacific Ocean." (DEIR pg. 2-68)
- "The amount of sediment deposition in the estuary as a result of dam removal is anticipated to be small..." (DEIR pg. 3-83).

These conclusions represent highly simplified opinions that are not supported by the cited numerical analysis (i.e., Stillwater Sciences 2010; USBR 2012c). The Stillwater Sciences (2010) and USBR (2012c) models both assume that fine sediment behaves as wash load, which by definition does not deposit. The DEIR makes a fundamental error by presenting this assumption as a conclusion of the modeling.

It is reasonable to assume that some proportion of the fine sediment load would behave as wash load (sediment that remains in suspension throughout the river system). However, in the absence of a specific numerical analysis, such an assumption is a broad generalization that only holds true under specific circumstances, presenting significant risk that the wash load flushing would not persist for the duration of the drawdown or the 190 miles of river downstream of Iron Gate Dam. Fine sediment can, and does, settle-out in riverine systems. This is likely to happen in the Klamath River in areas such as backwaters, pools, eddies, slack water, side channels, the estuary, and any floodplains accessed by high flows. Deposition will also occur at the heads of riffles where downwelling will move sediment-laden water into the gravels resulting in deposition of those fine silts and clays into the interstitial spaces of the riffles; these areas are important spawning habitat for salmon. Deposition of fine sediments into these areas would adversely affect aquatic and riparian biota and important habitat.

Despite the potential significance of the issue to aquatic and fishery resources, analysis of fine sediment transport downstream of Iron Gate was included in a very simple manner in the DEIR's cited references. While the modeling in these cited source materials appears generally technically sound, the models are limited and the DEIR fails to present these model limitations or the uncertainties that remain. Specifically, these areas of uncertainty could substantively affect the analysis in the DEIR include:

- Errors in estimating the amount and type of stored sediment.
- Lack of high flow suspended sediment data.
- Definition of the mobilization flow without direct field measurements of sediment movement.
- Unknown bed material and channel dimensions that will prevail after dam removal.
- Incision and erosion of deposits accumulated behind the dams (e.g. Copco and Iron Gate reservoirs).
- Effect of climate change on geomorphology.
- Angle of repose of material upstream of dam, which impacts sediment volumes that may be eroded from the reservoirs due to bank failures during drawdown.
- The impact of proposed sediment jetting, which is included in the Proposed Action as part of the Definite Plan, but was not included in prior modeling related to sediment volume and transport relied upon in the DEIR.
- Cohesive materials (fine silts and clays) that are not addressed in the modeling and this material would behave differently than how it is modeled because of cohesion (the USBR 2012 model is capable of modeling cohesive and non-cohesive sediment transport).

Because the DEIR does not discuss the uncertainties associated with the numeric modeling, the reader is erroneously led to believe that these models accurately represent conditions likely to occur under dam removal. However, other large-scale dam removal projects, such as on the Elwha River, have had sediment impacts that were not consistent with expectations. The limitations and uncertainties associated with the modeling present significant residual and unaddressed risks that need to be described in the DEIR. Specific areas that need to be addressed include:

- The DEIR states that a faster drawdown would reduce the time of interaction between flow and reservoir sediment deposits. While this may be true, there are processes involved other than the duration of exposure to erosive forces. The DEIR needs to discuss the rate of erosion because of exposure to higher water velocities generated by a faster drawdown could also produce more slumping and bank failures along reservoir margins because of the pore pressure of water remaining in the sediments and over-steepened banks.
- The DEIR should analyze the effects of erosion processes operating both upstream and downstream of the dams and within the reservoir footprints (such as lateral channel adjustment following reservoir drawdown), which could extend the duration of downstream sediment effects.
- The DEIR should identify key sensitive habitat locations downstream of Iron Gate Dam, discuss how susceptible these areas are to deposition, evaluate rates at which deposition could occur, and provide an analysis of effects of deposition on the habitat and resources in those sensitive locations. Some of the key habitats that should be addressed include known Chinook spawning areas and refugia that are important to Coho rearing throughout the year.
- Spawning sites at the head of riffles where downwelling currents carry oxygenated water into the interstices of salmon spawning sites may be especially vulnerable to deposition (Tompkins and Kondolf 2009). As water is pulled into the gravels, the fine sediment that is suspended moves into the interstices where it is deposited thereby clogging gravel, interrupting important intergravel flow, and reducing survival of deposited eggs or newly hatched fish.
- The impacts of proposed sediment jetting to remove additional sediments during reservoir drawdown. Sediment jetting as proposed in the Definite Plan was not considered in the modeling work conducted by Stillwater Sciences (2010) and USBR (2012a), and would be expected to increase the amount of sediment discharged from the reservoirs, impacting modeling results.

In summary, while the modeling that was conducted by Stillwater Sciences (2010) and USBR (2012c) may be technically sound, the models are inherently limited. Moreover, the DEIR fails to use these models properly, interprets a basic modeling assumption as a result, does not discuss impacts resulting from deposition of fine sediment downstream of Iron Gate dam that would result from implementation of the Proposed Project, and does not consider changes in the approach to reservoir drawdown (sediment jetting) that may impact model results.

2.5 Greenhouse Gas

The impacts to greenhouse gas emissions resulting from removal of a non-emitting power source and its relation to California climate change policies are inadequately addressed in the DEIR. The qualitative analysis identifies the replacement of hydroelectric power with possible non-renewable energy sources as an indirect impact. This is not an indirect impact but rather a direct consequence of removing a stable and reliable non-emitting generation source from PacifiCorp's resource portfolio that can meet the energy needs of approximately 69,000 homes.

The analysis repeatedly refers to PacifiCorp's 2017 integrated resource plan (IRP; PacifiCorp 2017) and associated plans to increase renewable energy resources on its system over time. While it is the case that PacifiCorp is in the process of decarbonizing its generating resource portfolio, the analysis in the DEIR is inadequate in that what is required is an assessment of PacifiCorp's system emissions if the Klamath Hydroelectric Project is *not* removed, or if specific elements of the project are not removed as considered in the Two Dam Removal and Three Dam Removal alternatives. Since PacifiCorp's (2017) IRP assumes the Klamath Hydroelectric Project is removed, it already represents the scenario where the energy and capacity from the Klamath Hydroelectric Project are replaced with existing or incremental resources. Though future capacity resources may be non-emitting, from an operational perspective low-cost energy from a hydroelectric resource displaces a combination of energy resources and wholesale market purchases on PacifiCorp's system that provide similar capacity and dispatch flexibility as the hydroelectric facilities and that do have an emissions profile that is not accounted for in the DEIR. To continue to balance fluctuating loads and resources in real-time, while providing local voltage and frequency support to the transmission system, PacifiCorp will need to call upon non-renewable resources if the Klamath Hydroelectric Project is removed. While PacifiCorp's continued expansion of renewable resources in its generation portfolio can replace zero-emission energy lost as a result of dam removal, the expansion of non-carbon resources that can provide capacity (e.g. storage) will be needed to reduce these impacts over time. For these reasons, these emissions impacts should be acknowledged in the DEIR.

As calculated pursuant to the California Air Resources Board Mandatory Greenhouse Gas Reporting Rule, PacifiCorp's 2017 system emission factor was 0.6844 metric tons of carbon dioxide equivalent ($MTCO_2e$) per megawatt-hour (MWh). Using this factor, the Klamath Hydroelectric Project developments proposed to be removed, which produce 686,000 MWh of generation per year, displace approximately 469,500 $MTCO_2e$ *per year*. As a point of reference, PacifiCorp's total obligation for emissions reductions under California's cap-and-trade program in 2017 was 756,736 $MTCO_2e$. Thus, removal of the Klamath project dams will set back PacifiCorp's compliance with mandated emissions reductions and increase its required emissions reductions to achieve California's climate change policy mandates.

The threshold for a potentially significant impact related to greenhouse gas emissions in the DEIR is set at 10,000 $MTCO_2e$ (DEIR pg. 3-719). Though avoided emissions will go down over time as PacifiCorp decarbonizes its system, the DEIR entirely fails to consider the emissions impacts related to removal of hydroelectric facilities that are qualified generation resources under California's renewable portfolio standard. In a single year, the increased emissions resulting from removal of the Klamath Hydroelectric Project will exceed the DEIR's significance criteria by a factor of nearly 47. Over the expected life of a new potential FERC license – 40 years – the increased system emissions would be on the order of 18 *million* $MTCO_2e$ at PacifiCorp's current system emission factor. Granted, revised instream flow requirements under a new license would reduce the generation output of the Klamath Hydroelectric Project, but the failure of the DEIR to consider the potential impact on greenhouse gas emissions due to dam removal reflects a lack of balance in the document that results in adverse environmental impacts of potential dam removal being downplayed. Millions of tons of avoided greenhouse emissions is not an insignificant environmental impact, particularly in the near-term when reducing emissions to avoid the worst impacts of climate change is critical.

Indeed, prior environmental analysis of Klamath relicensing and dam removal alternatives (FERC 2007; DOI and CDFW 2012) have considered greenhouse gas emissions impacts to be a direct consequence of Klamath dam removal. In its Final EIS, FERC (2007) estimated the greenhouse gas emissions impacts of removing the four Klamath dams proposed for removal to range between 68,600 to 106,330 metric tons of carbon per year, or 251,500 to 389,900 $MTCO_2e$ per year (see Table 4-8 in FERC 2007). Similarly, the 2012 KHSA EIS/EIR (DOI and CDFW 2012) documented emissions impacts from potential dam removal ranging between 341,539 to 396,575 $MTCO_2e$ per year (see Tables 3.10-6 and 3.10-7 in DOI and CDFW 2012). The DEIR considers the emissions impacts of removing non-emitting generating resources as an indirect impact of the Proposed Project, and then only qualitatively discusses those impacts as being not significant given PacifiCorp's plans to continue to add renewable resources. However, robust and readily available quantitative analysis has been conducted on these greenhouse gas emissions impacts but this information is not incorporated into the DEIR.

The DEIR's lack of balance is also reflected in that its greenhouse gas evaluation considers potential emissions of methane from the hydroelectric reservoirs that would presumably be removed as part of the Proposed Project, even though there has been no thorough assessment of methane production at the Klamath Hydroelectric Project. As FERC (2007) stated, "Given the lack of any site specific data concerning methane production at the Klamath Hydroelectric Project, any attempt to estimate net bio-production of greenhouse gases would be speculative, at best." This remains the case, yet the DEIR assessed reduced methane emissions as a potential benefit of the Proposed Project, but completely fails to assess the greenhouse gas emissions impacts of removing qualified, non-emitting renewable resources.

The DEIR's analysis also does not address California's policies in Senate Bill (SB) 100 (De León). Senate Bill 100 increases California's renewable portfolio standard (RPS) to 60 percent by 2030 and establishes a state policy whereby renewable and zero-carbon resources are to supply 100 percent of retail sales to California end-use customers by December 31, 2045. Any loss of a zero-carbon resource will make this standard more costly and difficult to meet. While removal of the Klamath Hydroelectric Project may not endanger PacifiCorp's ultimate compliance with California's RPS, it will make such compliance more costly. The intent of California's RPS and its cap-and-trade program is to reduce greenhouse gas emissions and ultimately the impacts of climate change. The removal of an existing non-emitting resource that could continue to serve customers directly contradicts the purpose of these policies and thus should be more fully evaluated in the DEIR.

Additionally, both Oregon and Washington are considering sweeping climate change bills impacting the electric sector in 2019 legislative sessions. Oregon is considering adopting a cap-and-trade program that will link with California's program, while Washington is considering both a cap-and-trade program and a proposal that would require utilities in Washington to achieve 100 percent carbon neutral energy portfolios by 2030. While not certain to pass this year, it is likely that additional policies targeting emissions from the electric sector will be enacted in the near-term. Hydroelectric generation, which is more predictable and reliable than intermittent resources such as wind and solar, will be a critical component of the shift to a low-cost, reliable carbon-free future. In failing to even acknowledge the benefit of the non-emitting nature of the Klamath Hydroelectric Project and its relation to California's extensive climate change policies, the DEIR conflicts with the California RPS goals by not addressing the increase in carbon emissions resulting from implementation of the Proposed Project.

2.6 Uncertainty in Salmon Production and Recolonization

The DEIR does adequately address the uncertainty associated with salmon production and recolonization and presents an unbalanced view of potential outcomes. The DEIR states that the Proposed Project will increase fall-run Chinook Salmon abundance based solely on Hendrix (2011) modeling analysis. To be precise, the Hendrix (2011) analysis uses average habitat productivity data from Pacific Northwest streams to forecast that natural fall-run Chinook Salmon production will increase in the absence of harvest. That is, natural production of the important harvest species in the Klamath Basin will increase *if there is no fishing for that species*. The Hendrix (2011) analysis has significant limitations and does not present data for hatchery fish returning to Iron Gate Hatchery or Trinity River Hatchery. This distinction is important because as the DEIR states, Iron Gate Hatchery produces about

50,000 adult fall-run Chinook annually (DEIR pg. 3-248). This rate of supplementation by Iron Gate Hatchery supports a long-term average harvest rate of about 28,000 fall-run Chinook (CAHSRG 2012). Hendrix (2011) estimates that the Iron Gate Dam to Keno Dam reach of the Klamath River would produce 23,000 adult natural origin fall-run Chinook if there was no harvest of those adults. Even using this flawed no harvest assumption, this is approximately 50 percent fewer fall-run Chinook than the corresponding number currently produced by Iron Gate Hatchery. The DEIR fails to recognize the inherent contradiction in these modeling results: namely, that under the most optimum outcomes, implementation of the Proposed Project would result in the production of substantially fewer fish than under existing conditions without allowing any harvest of those fall-run Chinook. If harvest were to occur at close to the historically average rate, even fewer fall-run Chinook would be available to return to the upper Klamath River.

This discussion illustrates how the DEIR underestimates the importance of fall-run Chinook produced at Iron Gate Hatchery. While the DEIR acknowledges that production targets at the hatchery will be changing under the Proposed Project, it does not accurately address the impacts that will occur from the proposed substantial reduction in Chinook production on fish populations or tribal, recreational, or commercial fisheries. The Proposed Project would reduce the yearling Chinook production by 87 percent and the smolt production by 33 percent. Yearling fall-run Chinook have better survival rates, contribute to the fisheries at a higher rate than Chinook released as smolts, and return to Iron Gate Hatchery at a long-term average rate that is about twice that of smolts (Giudice and Knechtle 2018). This makes the proposed 87 percent reduction in yearling production a much larger proportional impact on fall-run Chinook populations and fisheries. Coupled with this shortcoming, the DEIR does not adequately address the long-term impacts arising from the eventual elimination of Iron Gate Hatchery production 8 years after dam removal.

The DEIR fails to discuss the results from habitat modeling conducted during FERC relicensing (Oosterhout 2005; PacifiCorp 2005) that compared natural production to current hatchery production of adults. These results should be described in the DEIR to adequately inform the public and decision-makers about the potential impacts of the Proposed Project. The analyses by PacifiCorp (2005) and Oosterhout (2005) should be described, because these two analyses are thorough, incorporate habitat and water quality data specific to the Klamath River, and include potential dam removal scenarios. Unlike the Hendrix (2011) model, these two analyses incorporated actual measurements of stream habitat, water quality, and disease for virtually every river mile from Iron Gate Dam upstream. The data for the two analyses were collected by agencies and PacifiCorp as part of FERC relicensing process and data inputs to the models were reviewed and agreed to by the agencies. In contrast, the Hendrix (2011) model used the more simplified assumption that habitat quality is similar to other streams up and down the West Coast (even though the Klamath River is like no other stream on the West Coast). Thus, the analyses of PacifiCorp (2005) and Oosterhout (2005) are based on basin-specific scientific information in contrast to Hendrix (2011) that uses generic data.

The DEIR acknowledges that there is uncertainty associated with the effects of the Proposed Project on Coho and Chinook. The DEIR notes that one of the reasons that Hendrix (2011) model results are used in the analysis is that it provided variance estimates of uncertainty, yet the results of this uncertainty analysis are not discussed in the DEIR. This uncertainly analysis needs to be described in the DEIR to fully inform decision-makers and public about the range of potential outcomes of the Proposed Project. The DEIR extensively references the Expert Panel report on Coho and Steelhead where Dunne et al. (2011) repeatedly reinforce the uncertainty around how the Proposed Project could affect the Coho population. Dunne et al. (2011) note that there may be a small increase in Coho production from newly accessible habitat, but also that disease and low ocean survival could easily offset this gain. Dunne et al. (2011) state that any increases in Coho populations are expected to be small through the first 10 years following the Proposed Project. This uncertainty was again voiced by the Expert Panel on Chinook where Goodman et al. (2011) stated that "...achieving substantial gains in Chinook salmon abundance and distribution in the Klamath Basin is contingent upon successfully resolving the following nine factors:"

1. Resolve water quality issues in Upper Klamath Lake and Keno Reservoir
2. Address fish disease
3. Salmon successfully colonization of the upper basin
4. Harvest is managed to support adequate escapement
5. Hatchery straying does not adversely impact natural reproduction
6. Predation does not impact salmon populations
7. Climate change does not overwhelm production
8. Fall flows are adequate to minimize impacts to Chinook
9. Dam removal impacts do not have multi-year adverse effects

While these nine items were written for the report on Chinook, they apply to Coho and the overall success of the Proposed Project as a whole. Because of unknown habitat quality upstream of Iron Gate Dam, the small population of Coho from which recolonization could occur (on average Iron Gate Hatchery annually receives 30 stray natural-origin adult Coho), and the fact that most of those fish are not adapted to habitat upstream of Iron Gate Dam, the DEIR conclusions regarding the success and speed of recolonization are overly optimistic. It is also important to recall that the determinations by both of these Expert Panels included the implementation of the KBRA. The KBRA in part provided funding and structure for basin-wide restoration which could address some of the nine factors listed above. The KBRA expired at the end of 2015 and has not been resuscitated. In Dunne et al. (2011) possible larger gains in Coho production were reported as being contingent on successful implementation of the KBRA. Given that this is no longer available, the level of uncertainty surrounding the successful outcome of the Proposed Project is even higher than it was 2011. Additionally, the DEIR presents no analysis about potential harvest restrictions that could be necessary to support reintroduction and recolonization of Chinook into habitat areas upstream of Iron Gate Dam. Restrictions on harvest are often necessary to support reintroduction efforts to reduce pressure on populations that are attempting to recolonize formerly inaccessible or inadequate habitat areas. The DEIR provides no analysis of these potential impacts, or the duration of these impacts. Similarly, the Hendrix (2011) model provides no time-scale for natural production sufficient to replace hatchery production to occur and simply assumes that peak natural production occurs immediately after dam removal. There is great uncertainty about impacts to harvest from the Proposed Project which is not portrayed in the DEIR.

2.7 Undisclosed Potentially Significant Impacts

The DEIR concludes that various resource impacts would be less than significant or not impacted at all when many of those impacts should be considered significant. These include:

- **The DEIR does not accurately assess the magnitude of impacts from the Proposed Project on Coho.** The DEIR identifies a threshold for a potentially significant impact to Coho Salmon as being a change in "...the abundance (greater than 50 percent reduction) of a year class for aquatic species." (DEIR pg. 3-258.) This definition ignores the fact that over 50 percent of the

Coho population returns to the Trinity River (Naman and Perkins 2015; Kier et al. 2018) and would be substantially unaffected by the project. Under this questionable approach, even the extirpation of all Coho from the Klamath River upstream of the Trinity River would not be considered significant because it would affect less than 50 percent of a year class of the population. Even though impacts to Coho Salmon may not exceed the significance threshold established by the DEIR, the small population of Coho in the mainstem Klamath River (see Major Issue 2.1) would still be substantially impacted, and should be considered a significant impact. See *Communities for a Better Environment v. California Resources Agency* (supra, 103 Cal. App. 4th 98).

- ***The DEIR does not clearly and accurately assess the impacts of the Proposed Project from loss of reservoir storage***. The DEIR asserts that because evaporation losses from Copco and Iron Gate reservoirs would be removed under the Proposed Project, more water would be available to the USBR for diversion. However, the loss of reservoir storage and downstream release facilities (namely Iron Gate Dam) would require USBR to release correspondingly larger volumes of water at Keno Dam to achieve required flows downstream to support aquatic and cultural river uses, which would result in flow demands significantly greater than the reduction in evaporative losses.
- ***The DEIR inadequately addresses the impacts of sedimentation on Waters of the U.S***. The Klamath River downstream of Iron Gate Dam is a jurisdictional Water of the U.S. and subject to regulation by Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. The release of sediment (bedload movement and suspended sediments) from the Proposed Project will result in fill of these jurisdictional waters. The DEIR analysis does not evaluate or quantify the amount of fill to Waters of the U.S. that would occur downstream of Iron Gate Dam as a result of the Proposed Project.
- ***The DEIR's assessment of reservoir drawdown does not address the effects to downstream fish communities of releasing the entire population of Yellow Perch (or any other reservoir fish) from Copco and Iron Gate reservoirs.*** Hundreds of thousands of Yellow Perch from the reservoirs would be released into the lower river during and after drawdown of the reservoirs. The DEIR does not address the effect of Yellow Perch competing for the same habitat types used by Chinook, federally-threatened Coho, or Steelhead.
- ***A critical effect of the Proposed Project on the river's periphyton community is absent from the DEIR's analysis and discussion***. Under the Proposed Project, the existing periphyton community downstream of Iron Gate Dam will shift upstream. Aquatic vegetation, currently absent under the reservoirs and in the J.C. Boyle Peaking Reach, will colonize the newly exposed stream reaches. Periphyton-related nitrogen fixation in the river would further increase the nutrient loading in the river, exacerbating nutrient impacts to the river and estuary. While the DEIR mentions the extension of periphyton upstream of Iron Gate Dam in the discussion of fish disease (DEIR pg. 3-278), this is not discussed in Section 3.4 Phytoplankton and Periphyton.
- ***The DEIR fails to assess the greenhouse gas emissions impacts of removing renewable generation facilities.*** Removing non-emitting hydroelectric generation facilities under the Proposed Project will result in millions of tons of additional greenhouse gas emissions, contrary to California climate change policies, and these significant impacts are not disclosed.

2.8 *Ceratonova shasta* Fish Disease Discussion

The DEIR's assertion that dam removal will lead to reductions in fish disease is based almost entirely on speculation and is unlikely to be realized. Fish disease hosts, triggers, and virulence are unlikely to be substantively changed with the Proposed Project. Recolonization of the project reach by infected salmon will spread the parasite *C. shasta* upstream of Iron Gate Dam where they will infect the highly abundant population of the polychaete host *Manayunkia speciosa*. In turn, the infected polychaetes will release the *C. shasta* actinospore that infects juvenile and adult salmon, which will cause infected salmon to contract the disease ceratomyxosis. The duration of actinospore exposure of juvenile salmon originating from upstream of Iron Gate Dam would be longer than for salmon populations downstream of this point as they must migrate farther to reach the estuary. Additionally, increased spring-time river temperatures following dam removal may increase the prevalence of infection among outmigrating juveniles.

In the analysis of the Proposed Project impacts on fish disease (Section 3.3.5.5), the DEIR indicates that existing conditions contributing to disease in salmonids include (DEIR pg. 3-276):

- The availability of habitat for the polychaete hosts
- Static flows and low velocities that create appropriate microhabitats for polychaete hosts
- Congregations of spawned adult salmon with high actinospore loads
- Polychaete populations in proximity to spawning salmon
- Planktonic food sources for the polychaete hosts from Copco and Iron Gate reservoirs
- Water temperatures over 59°F (15°C)

PacifiCorp agrees that these factors influence infection and mortality rates; however, the DEIR does not accurately represent the possible outcomes of the Proposed Project, or the alternatives, as it relates to disease, specifically ceratomyxosis.

Disease dynamics in the Klamath River from *C. shasta* infection are incredibly complex and the scientific understanding of them continues to evolve at a rapid pace. The DEIR (in Section 3.3.2.3) does an insufficient job of presenting an up-to-date discussion of *C. shasta* effects on salmonids. While *C. shasta* infection rates have been high at times, the most recent highest levels (2014 and 2015) occurred during extreme drought conditions. The infection rates have declined dramatically since then (Voss et al. 2018), likely for a combination of reasons related to flow, temperature, and fish abundance.

The polychaete host for *C. shasta*, *Manayunkia speciosa*, is native to the Klamath River and found throughout the basin. While the densities of this polychaete vary within the basin in response to a variety of factors, they are abundant in the reach downstream of J.C. Boyle Dam, in the Williamson River, and at various locations in the mainstem lower Klamath River from the mouth upstream to Iron Gate Dam.

In Section 3.3 the DEIR recognizes that under the Proposed Project the expected increase in periphytic growth could provide habitat for the polychaetes (DEIR pg. 3-278). However, the DEIR then assumes other factors such as the restoration of bedload sediment transport would offset increases in periphyton-related habitat by enhancing potential scour of polychaetes. The DEIR does not inform the reader that there is very little bedload sediment supply for inducing scour in the Keno Reach, J. C. Boyle Reservoir, J.C. Boyle Bypass Reach, or J.C. Boyle Peaking Reach. The substrate in these reaches is large and the stream beds are stable because: (a) the flows are moderated by upstream dams and storage reservoirs; (b) no tributaries of any consequence enter the system (Spencer and Shovel creeks are not appreciable inputs of sediment); and (c) flows are notably lower here than in downstream reaches where active sediment transport occurs (especially downstream of the Scott River). In sum, these upper reaches will be prime polychaete habitat, with conditions well-suited for abundant polychaete densities, including appreciable organic matter, stable flows, stable stream bed, and stable substrate for polychaetes to colonize. Add to this the DEIR's expectation of producing tens of thousands of Chinook Salmon in this reach which would provide the myxospores needed to infect polychaetes and expansion of *C. shasta* throughout the upper Klamath River would result.

Further, the DEIR does not make use of recent studies that have evaluated the effectiveness of scour as a mechanism for reducing polychaete concentrations. Recent research indicates that while polychaetes may respond to flow changes and be removed from substrates by increasing flows (with specific dislodgment flows that varied depending on the substrate), polychaetes also exhibited a variety of behavioral reactions to flow changes and proved to have relatively high survival rates (Malakauskas et al. 2013). Generally, this research suggests that polychaete populations likely exhibit high resilience to flow-mediated disturbances.

Additionally, the DEIR fails to acknowledge that recent research indicates that the magnitude of high flows that may be necessary to induce scour that could disrupt polychaete habitat (see Shea et al. 2016) are above the thresholds of flows that are expected to be achieved from the Proposed Project. That is, removal of the Klamath Hydroelectric Project is not anticipated to increase peak flows, that result in significant scour events, above conditions that are currently experienced with the hydroelectric dams in place. Thus, recent research indicates that scour may be ineffective at solely combating polychaete densities that contribute to high infectious rates in the Klamath River, and that the expected hydrologic changes from the Proposed Project are unlikely to result in flows that could accomplish scour anyway.

Research by Foott et al. (2016) has shown that relatively few very highly infected adult Chinook carcasses are capable of fully seeding the polychaete populations in the river reaches. This information indicates that *C. shasta* disease transmission will occur whether salmon spawner density increases of decreases. Reintroduction of Chinook and Coho spawners infected with *C. shasta* would infect the polychaete hosts through the release of myxospores from fish carcasses. As a result, the Chinook and Coho-specific genotypes of *C. shasta* would become established in the existing polychaete population and release spores in densities that result in infection of juvenile Chinook and Coho. Based on this information, the DEIR is incorrect to indicate that spreading out the salmon populations would reduce their proximity to polychaete populations and therefore reduce disease effects. In sum, the DEIR's assumption that the Proposed Project would reduce disease effects is not supported by the current understanding of fish disease dynamics in the Klamath River.

The DEIR makes reference to the planktonic algae released from Copco and Iron Gate reservoirs as an important polychaete food source that is partially responsible for the abundance of the polychaete host of *C. shasta* downstream of Iron Gate Dam. While these food sources would no longer be present if the Proposed Project were implemented, the DEIR acknowledges that Keno Reservoir would remain in place and continue to release large amounts of algae into the Klamath River. Based on KHSA Interim Measure 15 monitoring data and using chlorophyll-*a* as a surrogate for planktonic algae, it is apparent that Keno Dam would remain a source of planktonic algae for the polychaetes, producing more planktonic algae than is released from Iron Gate Dam (Figure 9). Further, researchers from Oregon State University have routinely harvested polychaetes from the J.C. Boyle Bypass Reach because these populations are some of the densest anywhere in the river (Alexander et al. 2016b). The high densities in this reach are at least partially due to the food supplied from Keno Reservoir and Upper Klamath Lake.

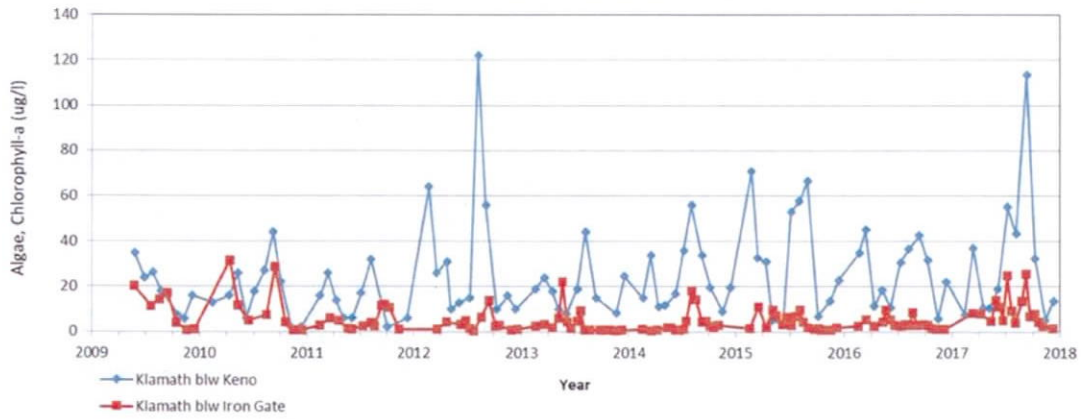

Figure 9. Chlorophyll-a concentrations downstream of Keno Dam and downstream of Iron Gate Dam collected as part of the Klamath Hydroelectric Settlement Agreement Interim Measure 15 monitoring program from 2009 through 2017.

The DEIR asserts that "Dam removal would mean cooler temperatures in the late summer and fall, but slightly warmer temperatures in the spring and early summer" (DEIR pg. 3-277). The Klamath Hydroelectric Project dams serve to cool water temperatures during the spring months, which may reduce *C. shasta* severity in the reach of the river downstream of Iron Gate Dam where the temperature signature from the Klamath Hydroelectric Project is greatest. The DEIR states, and PacifiCorp's prior water quality modeling (PacifiCorp 2006, 2014) confirms, that the spring water temperatures are higher under the Proposed Project. In fact, Figure 3.3-5 (DEIR pg. 3-275) is based on PacifiCorp's water quality modeling for 2002 and is used to describe temperature effects to salmon (Figure 10). The data show that water temperatures would exceed 15°C approximately 2 to 4 weeks earlier with implementation of the Proposed Project (Figure 10). This in turn could increase *C. shasta* disease rates because polychaete hosts develop spores more quickly under warmer water conditions (Ray et al. 2012). The DEIR spends a great deal of time noting the severity of *C. shasta* for Klamath River salmonid populations but fails to acknowledge that dam removal has the potential to also exacerbate *C. shasta* infection prevalence. The DEIR is required to present both possible positive and negative effects of the Proposed Project.

According to Bartholomew and Foott (2010 as cited in the DEIR), the 59°F (15°C) water temperature criterion that is referenced in the DEIR applies when the infectious dose of *C. shasta* is low. However, DEIR fails to present the complete finding of Bartholomew and Foott (2010, page 38) that water temperature is not a strong predictor of survival when infectious dose is high. Specifically, Bartholomew and Foott (2010) show substantial effects on salmonids at temperatures ranging from about 55°F to almost 70°F (13°C to 21°C). Simulated water temperature information presented in the DEIR indicates that water temperatures would reach 13°C in early April for the Proposed Project compared to early May for existing conditions (Figure 10). While the DEIR claims that warmer water temperatures in spring under the Proposed Project would result in earlier fry emergence for mainstem Chinook spawners, this would not be the case for tributary populations. Juvenile migration timing for tributary populations would remain unchanged and the majority of these fish would enter a warmer Klamath River under the Proposed Project, with all of its implications for disease.

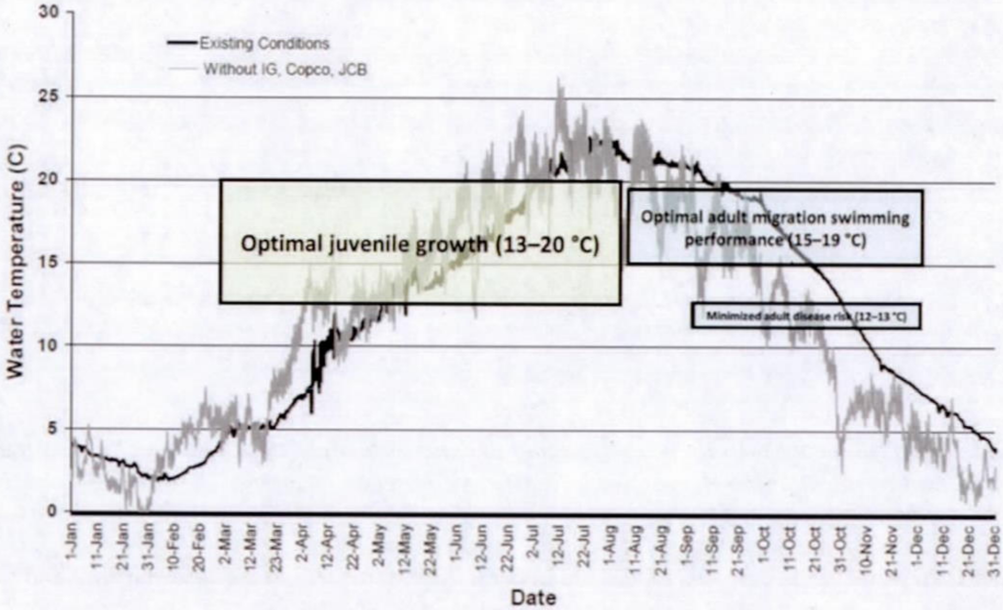

Figure 10. PacifiCorp (2005) simulated hourly water temperatures below Iron Gate Dam based on a dry water year (WY 2002) for existing conditions compared to the Proposed Project (without Lower Klamath Project dams), and USEPA (2003) water temperature criteria for salmonid growth and migration (Reproduction of DEIR Figure 3.3-5, DEIR pg. 3-275).

Routine monitoring of juvenile Chinook outmigration has indicated that water temperature may not be as important as flow in resulting disease infection rates and mortality (see True et al. 2017; Voss et al. 2018). In the discussion of disease, the DEIR should provide a more detailed and accurate summary of the differences in river flow between alternatives so that possible flow effects on disease are clarified (see Major Issue 2.2).

The DEIR indicates that high rates of *C. shasta* infection downstream of Iron Gate Dam are a function of the concentration of returning salmon spawners at Iron Gate Dam and the hatchery . The DEIR assumes that because the Proposed Project would allow access to new habitat, fish would no longer be concentrated and therefore the rates of *C. shasta* infection would be reduced. However, as noted by Som et al. (2016), the *C. shasta* infectious zone has shifted over the years. In the past, samples from Beaver Creek (RM 161) often had the highest actinospore concentrations, but peak concentrations have since moved downstream in some years and in 2016 peak spore counts were obtained near Orleans (RM 58) and Tully Creek (RM 38.5) (Bartholomew et al. 2017). Given that Chinook spawner density in these areas is substantially less than areas closer to Iron Gate Dam, large concentrations of nearby mainstem spawners are not required to produce areas with high *C. shasta* infection potential. The risk of *C. shasta* infection is based partially on the number of actinospores per liter of water because as this number increases, so does the dose for each exposed fish. Because flows upstream of Iron Gate Dam steadily decrease to Keno Dam (as fewer tributaries enter the reach), the shifting of adult spawners to upstream areas could result in a higher actinospore densities per liter of water and thus higher exposure rates and corresponding *C. shasta* disease risk. Thus, the DEIR's assumption that the Proposed Project would spread the spawning adults over a wider area, and that this would in turn reduce *C. shasta* infection rates and resultant salmonid mortality, is not supported by recent analyses.

The DEIR also does not acknowledge that because water quality conditions in Keno Reservoir could constitute a water quality barrier to adult salmon migration, returning spawners may congregate downstream of Keno Dam. Using the DEIR's logic, a concentration of Chinook in this area would form a new *C. shasta* infectious hot-spot as this area is just upstream of the J.C. Boyle Bypass Reach, which has some of the largest densities of polychaetes measured in the basin (Alexander et al. 2016b; Bartholomew and Hallett 2017).

The DEIR fails to accurately address the specific Proposed Project objective to "Ameliorate conditions underlying high disease rates among Klamath River salmonids" (DEIR pg. 2-1). The DEIR needs to update the discussion in Section 3.3 to reflect the current understanding of *C. shasta* on the Klamath River as it relates to Chinook and Coho and then conduct an analysis of potential impacts of the Proposed Project and the alternatives on fish disease. The DEIR should specifically evaluate potential impacts the Proposed Project and the alternatives could have in relation to fish disease. This includes an evaluation of:

- The impact of a wider range of water temperatures including a complete and accurate analysis of water temperatures as they relate to the different life stages of *C. shasta* and the susceptible salmonids.
- Evaluate the potential for a *C. shasta* infectious zone to develop downstream of Keno Dam and the impact this would have on salmon recolonization and production.
- Evaluate the potential of the river reach extending from Keno Dam to Iron Gam to Dam support polychaete populations and implications for salmon production.
- Revisit assumptions regarding salmon spawner density effects, spawner location, and salmon *C. shasta* infection rates on corresponding polychaete *C. shasta* infection.
- Accurately describe and compare changes in flow between alternatives and how these changes may affect *C. shasta* infection rates on salmonids.

2.9 Salmonid Migration, Spawning, and Rearing Water Temperature Analysis

This section describes information pertaining to the effects of water temperature conditions on anadromous fish species downstream of Iron Gate Dam. The focus here is to present an evaluation of the effects of water temperature conditions on anadromous salmonid migration, spawning, and rearing in the Klamath River downstream of Iron Gate Dam. This is necessary because the DEIR simply reports conditions as being warmer, or cooler, or more "natural" under the Proposed Project, existing conditions, or an alternative but does not discuss the biological significance, if any, of these changes or differences in temperature. In the following discussion the existing conditions are essentially analogous to the existing conditions within the DEIR, and the without-Project discussion approximates the Proposed Project in the DEIR.

This information and analysis was previously included in PacifiCorp's (2014) application to the State Water Resources Control Board for water quality certification of the Klamath Hydroelectric Project under Section 401 of the federal Clean Water Act. The PacifiCorp (2014) application analyzes water quality conditions within the Klamath Hydroelectric Project area in California, and the controllable water quality factors reasonably available to address the Klamath Hydroelectric Project's contribution to compliance with water quality objectives and protection of beneficial uses as designated in the Water Quality Control Plan for the North Coast Region (Basin Plan). The DEIR does not reference this available and relatively recent analysis in any way. Current distributions of anadromous species in the lower Klamath River Basin are discussed in the DEIR Section 3.3 and the current population status for Coho Salmon is discussed in Section 2.1 of PacifiCorp's comments.

2.9.1 Methods and Criteria

The extent to which the Klamath Hydroelectric Project contributes to current water temperature conditions in the Klamath River downstream of Iron Gate Dam are described in PacifiCorp (2014) based on field observations and supported by water temperature modeling of existing conditions for years 2000 through 2004 at several locations in the Klamath Hydroelectric Project reaches in California. Detailed discussions of water temperature modeling methods and results for the Klamath Hydroelectric Project are provided in PacifiCorp 2004a, 2004b, 2005a, 2005b, and 2014.

The potential effects of the Klamath Hydroelectric Project on water temperatures released downstream of Iron Gate Dam were evaluated specifically for fall-run Chinook Salmon, Coho Salmon, and Steelhead (PacifiCorp 2014). Average daily water temperature ranges were used to define suitable, low-to-moderate stress, and high stress/lethal effects for these species (Table 2). Suitable conditions reflect a water temperature range behaviorally selected by a species within which growth and survival are high, and susceptibility to other stressors (e.g., disease) is reduced. Low to moderate stressful conditions reflect water temperatures where growth rates are reduced, behavioral avoidance may occur, and susceptibility to other stressors is increased. High stress/lethal temperatures result in severe physiological impairment, loss of equilibrium, and/or direct mortality (e.g., incipient lethal threshold LT10). The temperature ranges have been synthesized from information available in the scientific literature on the biological response of salmonid life-history stages to water temperature conditions including, but not limited to, McCullough (1999), Sullivan et al. (2000), McCullough et al. (2001), Myrick and Cech (2001), and USEPA (2003).

These analyses were performed using the average daily water temperatures derived from modeling for 2000 and 2001 existing conditions (with the Klamath Hydroelectric dams present) and without-Project (with dams removed akin to the Proposed Project) scenarios. Three metrics were used for this analysis: annual exposure, degree-day exposure, and habitat suitability. These are the same metric previously used by Bartholow et al. (2005) to evaluate the effects of dam removal on water temperature conditions and habitat suitability for Chinook in the Klamath River.

- Annual exposure equals the number of days during the year that water temperatures exceed the literature-based criteria for suitable habitat conditions (referred to as index of annual exposure).
- Degree-day exposure equals the sum of the differences between mean daily water temperatures above and below a range of suitable temperatures during the appropriate time periods and locations within the river.
- Habitat suitability equals the linear distance within a river reach that average daily water temperatures were within the range identified as suitable habitat conditions. Habitat suitability was also evaluated based on average weekly water temperatures at various locations downstream of Iron Gate Dam (running average).

Table 2. Literature-based Ranges of Average Daily Water Temperature for Designation of Suitable and Stressful to Lethal Effects for Target Salmon Species in the Klamath River

Species	Life-History Stage	Suitable	Low to Moderate Stress	High Stress
Fall-run Chinook Salmon	Adult migration, pre-spawning, spawning	<17	18-21	>21
	Egg to emergence	<12	13-14	>14
	Juvenile rearing and emigration	<15	16-23	>23
Coho Salmon	Adult migration, pre-spawning, spawning	<17	18-21	>21
	Egg to emergence	<12	13-14	>14
	Juvenile rearing and emigration	<15	16-23	>23
Steelhead	Adult migration, pre-spawning, spawning	<17	18-21	>21
	Egg to emergence	<12	13-14	>14
	Juvenile rearing and emigration	<15	16-23	>23
	Steelhead smoltification	<12	13-18	>18

The seasonal distribution of the various salmonid life-history stages in the Klamath River assumed in the assessment (Table 3) are somewhat different than those presented in the DEIR (see Table 3.3-5 for example), but the overall range of life stages is roughly analogous. The seasonal periodicity assumptions reflect when various life stages of a target species will occur in the river and when life stage-specific water temperature criteria apply.

Table 3. Estimated Fish Periodicity—Klamath River, updated to include stakeholder comments to PacifiCorp. Current and potential life history strategies from Iron Gate to Link River dams.

Species/Life stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fall Chinook-Type II (fall juvenile migrant)												
Adult migration												
Adult spawning												
Incubation												
Fry emergence												
Rearing												
Juvenile Outmigration												
Fall Chinook-Type I (ocean type)												
Adult migration												
Adult spawning												
Incubation												
Fry emergence												
Rearing												
Juvenile Outmigration												
Coho												
Adult migration												
Adult spawning												
Incubation												
Fry emergence												
Rearing												
Juvenile Outmigration												
Steelhead-Fall/Winter												
Adult migration												
Adult spawning												
Incubation												
Fry emergence												
Rearing												
Juvenile Outmigration												

Note: For anadromous juvenile emigration, timing reflects fish migration from Klamath Hydroelectric Project area, not when they reach the estuary. Anadromous salmonid life histories represent stocks currently in the Klamath Basin from Iron Gate Dam to Salmon River. Dark shading equals peak use period.

In addition to the application of the criteria listed previously (Table 2), there is also the California water temperature objective applicable to the Klamath Hydroelectric Project as set forth in Section 3 of the Basin Plan. The state water temperature objective is:

> *Temperature objectives for COLD interstate waters, WARM interstate waters, and Enclosed Bays and Estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California" including any revisions thereto.*
>
> *In addition, the following temperature objectives apply to surface waters:*
>
> > *The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses.*
> >
> > *At no time or place shall the temperature of any COLD water be increased by more than 5°F above natural receiving water temperature.*
> >
> > *At no time or place shall the temperature of WARM intrastate waters be increased more than 5°F above natural receiving water temperature.*

2.9.3 Water Temperature Effects on Anadromous Fish Downstream of Iron Gate Dam

The following discussion summarizes the potential effects of water temperature under existing conditions and a without-Project conditions (analogous to the Proposed Project analyzed in the DEIR) on Chinook, Coho, and Steelhead.

<u>Chinook Salmon</u>

Fall-run Chinook Salmon use the Klamath River downstream of Iron Gate Dam for adult migration, spawning and egg incubation, juvenile rearing, and juvenile emigration. Although fall-run Chinook respond to both high and low water temperatures, the primary focus of concern regarding Klamath Hydroelectric Project operations on habitat suitability has been on seasonally elevated temperatures. As a result, the following analyses emphasize the occurrence of elevated water temperatures (e.g., seasonally low temperatures have been included within the thermal zone identified, for purposes of the analysis of suitable habitat conditions for a given life stage of fall-run Chinook Salmon and other salmonids).

Adult fall-run Chinook Salmon migrate upstream within the Klamath River during the seasonal period from August to October (Table 3). Results of water temperature modeling show a general seasonal pattern with elevated temperatures occurring during August and declining during September and October. Results of the water temperature modeling showed a consistent pattern of diminishing differences in water temperatures between existing and hypothetical without-Project conditions as a function of distance downstream from Iron Gate Dam (RM 190).

Results of the temperature modeling also show that during the fall migration period water temperatures under both existing and without-Project conditions reach a thermal equilibrium where water temperatures are virtually identical under existing and without-Project conditions in the lower reaches of the river below Seiad Valley (RM 129). Klamath Hydroelectric Project operations at Iron Gate Dam, therefore, have no effect on water temperature conditions in these reaches and would not affect water temperature conditions, thermal exposure, or behavioral response of adult fall-run Chinook Salmon entering the Klamath River.

Water temperatures within the Klamath River show a consistent pattern of temperatures considered to be unsuitable for adult upstream migration throughout the entire reach from Iron Gate Dam to Turwar

(RM 6) during August under both existing and without-Project conditions with temperatures decreasing seasonally during September into the range considered to be low to moderately stressful throughout the mainstem river (Table 4). Water temperatures generally decreased and remained within a range considered to be suitable for adult upstream migration beginning in early October and continuing through the end of the migration period. The seasonal pattern in water temperatures was generally similar between 2000 and 2001.

Results of the comparison of the average weekly temperatures (Table 5) showed temperatures above a 16°C average weekly average during approximately 75 to 80 percent of the days within the migration period. The frequency of these average weekly temperatures was similar at mainstem locations extending from Iron Gate Dam downstream to Turwar. This pattern was similar under both existing and without-Project conditions based on analyses of average weekly temperature (Table 5).

The biological significance of the incremental temperature exposure in the reach just downstream of Iron Gate Dam under existing conditions was evaluated to assess potential effects of temperature exposure to pre-spawning adults on subsequent egg viability and hatching success. An investigation of the relationship between temperature exposure for pre-spawning fall-run Chinook Salmon and egg viability was conducted by Mann and Peery (2005). The observed relationship between pre-spawning adult temperature exposure, expressed as degree days above 18 and 20°C and corresponding estimates of percent mortality for incubating eggs from each female, show that the incremental increase in egg mortality over a range of pre-spawning adult temperature exposures is typically less than approximately 5 percent.

Table 4. Habitat suitability based on average daily water temperatures for adult fall-run Chinook Salmon migration at locations downstream from Iron Gate Dam based on 2000 and 2001 water temperature modeling results for existing conditions (EC) and hypothetical without-Project (WOP) scenarios.

Date	Scenario	Iron Gate Dam RM 190.5	Above Shasta River RM 177.5	At Walker Bridge RM 156.8	Above Scott River RM 143.9	At Seiad Valley RM 129.0	Above Clear Creek RM 99.0	Above Salmon River RM 66.9	At Orleans RM 57.6	Above Bluff Creek RM 49.0	Above Trinity River RM 43.3	At Martins Ferry RM 39.5	At Blue Creek RM 15.9	At Turwar RM 5.3
8/15/2001	EC	21.9	23.1	23.8	23.8	23.7	23.5	23.5	23.5	23.1	22.9	22.6	22.6	22.8
	WOP	21.3	22.3	22.8	23.2	23.5	23.5	23.5	23.5	23.1	22.9	22.6	22.5	22.8
8/29/2001	EC	21.4	22.7	23.5	23.7	23.8	23.9	23.9	23.8	23.2	22.8	21.0	22.2	22.7
	WOP	19.6	21.2	23.0	23.6	23.9	23.8	23.9	23.7	23.2	22.9	21.1	22.2	22.7
9/12/2001	EC	20.4	20.3	19.8	19.7	20.0	20.1	20.0	19.9	19.6	19.4	18.9	19.1	19.4
	WOP	16.5	17.5	18.2	18.7	19.4	19.7	19.8	19.7	19.4	19.3	18.8	19.2	19.5
9/26/2001	EC	18.9	18.1	17.6	17.6	18.0	18.8	19.0	18.9	18.5	18.3	17.9	18.0	18.2
	WOP	14.3	15.0	15.8	16.2	17.3	18.4	18.8	18.8	18.5	18.5	18.0	18.1	18.2
10/10/2001	EC	17.2	16.4	15.3	14.9	14.5	14.9	15.2	15.2	15.0	14.9	14.9	14.8	14.8
	WOP	10.1	10.4	11.2	11.7	12.6	14.2	14.6	14.8	14.8	14.8	14.8	14.9	14.9
10/24/2001	EC	14.1	13.1	11.8	11.4	11.7	12.4	12.2	12.2	12.2	12.3	12.5	12.5	12.4
	WOP	7.2	8.0	9.1	9.7	10.6	11.8	11.7	11.8	12.0	12.1	12.5	12.5	12.4
11/7/2001	EC	11.0	10.3	9.5	9.4	9.5	9.6	9.3	9.6	9.9	10.0	10.5	10.5	10.4
	WOP	6.0	6.7	7.5	8.0	8.4	9.0	8.9	9.4	9.9	10.1	10.6	10.6	10.6
11/21/2001	EC	8.6	8.4	8.2	8.1	8.4	8.3	7.7	8.3	8.4	8.5	9.0	9.1	9.2
	WOP	6.5	6.6	7.1	7.3	7.9	7.9	7.3	8.1	8.2	8.3	9.0	9.1	9.2
12/5/2001	EC	5.5	5.2	5.1	4.9	5.0	5.4	5.4	5.8	6.1	6.4	6.9	7.0	7.1
	WOP	1.4	1.8	2.9	3.0	3.6	4.7	5.0	5.5	5.9	6.1	6.8	6.9	7.0
*12/19/2001	EC	3.1	2.9	3.3	3.3	4.1	4.7	4.7	5.5	5.7	5.9	6.7	6.8	6.7
	WOP	2.4	2.3	2.9	3.0	3.8	4.4	4.6	5.4	5.6	5.8	6.7	6.7	6.7

*Life stage ends 12/15/2001, but for the sake of including the period from 12/19/2001 through the end of the life stage, this date is also shown

suitable: <17°C	low to moderate stress: 17-21 °C	high stress: >21 °C

Table 5. Number of days during life stages that running average weekly temperature is above the threshold, based on 2000 and 2001 water temperature modeling results for existing conditions (EC) and hypothetical without-Project (WOP) scenarios.

	Life Stage Period			Temp. Threshold	Number of Days Temperature Above Threshold							
					Blw Iron Gate Dam		At Seiad Valley		Abv Trinity River		At Turwar	
Species/Life Stage	Start	End	No. Days	(C)	EC	WOP	EC	WOP	EC	WOP	EC	WOP
Chinook Salmon												
Adult Migration	Aug 1	Oct 31	92	16	73	49	70	60	69	68	69	69
Egg to emergence	Oct 1	Mar 31	182	12	28	18	27	21	23	27	31	32
Juvenile Rearing	Feb 1	Jun 30	150	15	45	55	58	64	49	50	46	48
Juvenile Emigration	Apr 1	Jul 31	122	15	76	86	89	93	80	81	77	79
Coho Salmon												
Adult Migration	Sep 15	Jan 31	139	16	28	11	25	17	24	23	24	24
Egg to emergence	Nov 1	Apr 15	166	12	0	8	0	11	0	11	9	12
Juvenile Rearing	Jan 1	Dec 31	365	15	157	147	166	165	157	153	154	155
Juvenile Emigration	Feb 1	Jul 31	181	15	76	86	89	95	80	81	77	79
Steelhead												
Adult Migration	Sep 1	Nov 30	91	16	42	18	39	29	38	37	38	38
Egg to emergence	Dec 1	Jun 30	212	12	55	74	59	77	66	81	78	84
Juvenile Rearing	Jan 1	Dec 31	365	15	157	147	166	165	157	153	154	155
Smoltification	Mar 1	Jul 15	137	12	70	89	92	100	92	96	93	94

Assuming that a female adult Chinook Salmon entered the Klamath River on September 15 and migrated upstream to spawn in the reach downstream of Iron Gate Dam (equal duration of exposure to temperatures within each reach) the degree-day exposure to water temperatures above 18 and 20°C was estimated to be 14.5 and 59.2 degree-days, respectively under existing conditions and 13.2 and 46.4 degree days under hypothetical without-Project conditions. Under these simulated conditions, temperature exposure under existing conditions would be similar to without-Project conditions and would be expected to contribute to an incremental increase in egg mortality of less than 5 percent. Results of these analyses are consistent with observations for fall-run Chinook Salmon spawned at the Iron Gate Hatchery, which show high egg viability under existing conditions (Kim Rushton, former Iron Gate Hatchery Manager, CDFW).

Fall-run Chinook Salmon egg incubation occurs between October and March (Table 3). Water temperatures show a typical seasonally declining trend during the early portion of egg incubation followed by a seasonal increase in water temperatures during the later period of incubation prior to fry emergence in the spring. Examination of the average weekly temperatures during the egg incubation period (Table 6) showed a similar pattern with approximately 21 percent of the observations exceeding 10°C within the reach immediately downstream of Iron Gate Dam, 20 percent within reach upstream of Shasta River, 25 percent upstream of the Scott River, and 28 percent upstream of Clear Creek under existing project operations. Under the without-Project conditions average weekly water temperatures exceeded 10°C in 17 percent of the observations within the reach immediately downstream of Iron Gate Dam, 18 percent within reach upstream of Shasta River, 20 percent upstream of the Scott River, and 24 percent upstream of Clear Creek.

Results of a comparison of habitat suitability conditions for egg incubation (using criteria in Table 2) under existing and without-Project conditions show a consistent pattern of exposure to elevated water temperatures under both existing and without-Project conditions in early October (Table 6). Water temperature exposure under existing project operations, although declining seasonally, are within the range during early October that would contribute to reduced egg viability. The significance of egg exposure to elevated temperatures during early October under existing project operations is reduced, in part, as a result of fewer salmon spawning during the early portion of the spawning period. The peak of Chinook Salmon spawning occurs during the latter portion of October when seasonally declining water temperatures have less effect on the viability and successful hatching of incubating eggs.

Habitat conditions for egg incubation in the reach downstream of Iron Gate Dam potentially could be improved if water temperatures released from the dam during early to mid-October could be reduced under existing conditions. Reducing early to mid-October water temperatures would be expected to improve potential egg viability for those adult Chinook Salmon spawning early while continuing to provide water temperatures during the late fall that would be warmer when compared to hypothetical without-Project conditions. Continuing to provide warmer water temperatures under existing conditions that are suitable for egg incubation would accelerate embryonic development and early fry emergence (see Section 2.9.4 below).

Juvenile Chinook Salmon (ocean type migrants) rearing and emigration occurs between February and July (Table 3). Results of water temperature modeling during the juvenile rearing period has shown that water temperatures are cooler under existing conditions when compared to hypothetical without-Project conditions in the reach immediately downstream of Iron Gate Dam. Temperature modeling has shown that differences in water temperature between existing and without-Project conditions diminish as a function of distance downstream from the dam as water temperatures reach thermal equilibrium within the river.

Table 6. Habitat suitability based on average daily water temperatures for fall-run Chinook Salmon egg incubation at locations downstream from Iron Gate Dam based on 2000 and 2001 water temperature modeling results for existing conditions (EC) and hypothetical without-Project (WOP) scenarios.

Date	Scenario	Iron Gate Dam RM 190.5	Above Shasta River RM 177.5	At Walker Bridge RM 156.8	Above Scott River RM 143.9	At Seiad Valley RM 129.0	Above Clear Creek RM 99.0	Above Salmon River RM 66.9	At Orleans RM 57.6	Above Bluff Creek RM 49.0	Above Trinity River RM 43.3	At Martins Ferry RM 39.5	At Blue Creek RM 15.9	At Turwar RM 5.3
10/1/2000	EC	18.0	18.6	19.1	19.3	19.6	19.7	19.8	19.7	19.4	19.3	18.8	19.0	19.2
	WOP	16.6	17.7	18.4	18.6	19.0	19.5	19.6	19.6	19.3	19.2	18.7	18.9	19.2
10/15/2000	EC	15.5	15.2	15.0	15.0	15.0	14.9	14.7	14.6	14.5	14.4	14.4	14.5	14.6
	WOP	11.2	11.7	12.3	12.5	12.9	13.3	13.3	13.4	13.5	13.6	13.8	14.1	14.2
10/29/2000	EC	11.9	11.3	10.8	10.6	10.6	11.0	11.1	11.0	11.1	11.1	11.3	11.3	11.4
	WOP	6.8	7.4	8.4	8.8	9.3	10.0	10.1	10.3	10.4	10.5	10.9	11.2	11.3
11/12/2000	EC	8.8	8.0	7.5	7.0	6.5	6.1	6.0	5.9	6.3	6.4	7.0	7.1	7.1
	WOP	2.6	2.7	3.6	3.7	3.9	4.4	4.9	5.2	5.6	5.9	6.7	6.9	6.9
11/26/2000	EC	5.5	5.3	5.1	5.0	5.3	5.7	6.0	6.4	6.7	6.8	7.1	7.4	7.5
	WOP	2.5	2.3	2.8	2.9	3.6	4.4	5.1	5.5	5.9	6.1	6.5	7.0	7.1
12/10/2000	EC	3.9	4.1	4.5	4.7	5.1	5.5	5.6	6.0	6.3	6.5	7.1	7.3	7.3
	WOP	4.2	4.3	4.4	4.6	5.0	5.5	5.7	6.1	6.4	6.6	7.2	7.4	7.4
12/24/2000	EC	2.4	2.6	3.1	3.3	3.9	4.8	5.1	5.4	5.5	5.6	6.1	6.1	6.1
	WOP	3.0	3.3	3.7	3.9	4.5	5.0	5.2	5.5	5.6	5.6	6.1	6.1	6.1
1/7/2001	EC	3.9	4.2	4.5	4.5	4.4	4.6	4.6	4.7	4.9	5.1	5.3	5.5	5.5
	WOP	3.3	3.9	4.3	4.3	4.3	4.5	4.5	4.6	4.9	5.1	5.3	5.5	5.5
*1/21/2001	EC	3.0	3.8	4.1	4.0	4.0	3.9	4.1	4.1	4.4	4.6	4.9	5.1	5.1
	WOP	3.3	3.5	3.9	3.9	3.7	3.2	3.4	3.5	3.8	4.0	4.5	4.7	4.8

*Life stage ends 1/15/2001, but for the sake of including the period from 1/7/2001 through the end of the life stage, this date is also shown.

suitable: <12°C	low to moderate stress: 13-14°C	high stress: >14°C

For example, for juvenile rearing, the running average weekly temperatures exceeded temperature criterion on 45 days (30 percent) under existing conditions within the Iron Gate Dam reach when compared with 55 days (37 percent) under hypothetical without-Project conditions. In contrast, there was no difference in the frequency of exceeding the temperature criterion between existing and without-Project conditions in the lower reaches of the river upstream of the confluence with the Trinity River or at Turwar (Table 4).

Results of a comparison of habitat suitability at various locations within the river for juvenile rearing and emigration show that water temperature conditions under both existing and without-Project conditions are within the range considered to be suitable for juvenile rearing and emigration throughout the river through approximately late April (Table 7). Beginning in May and continuing through June, water temperatures throughout the river under both existing and without-Project conditions were within the range considered to reflect low to moderate stress. Temperature conditions, particularly within the lower reaches of the river in July were within the range characterized by high stress/lethal under both existing and without-Project conditions.

Exposure of juvenile Chinook Salmon to seasonally cooler water temperatures under existing project operations, primarily within the reach downstream of Iron Gate Dam, would be expected to benefit the overall health and condition of juvenile rearing salmon. Exposure to reduced water temperatures within the Iron Gate Dam reach during the spring and early summer juvenile rearing period would contribute to reduced vulnerability of juveniles to disease and infection. Operation of Iron Gate Dam also serves to substantially reduce daily variation in water temperatures during the spring and early summer, which would contribute to a reduction in variation in metabolic demands on rearing juveniles and improve growth, when compared to more highly variable temperature conditions that would occur under without-Project conditions.

Although exposure of juvenile salmon to seasonally reduced water temperatures during the spring and early summer rearing period offers benefits in terms of a reduced risk of disease and infection, it was also determined that exposure to cooler water temperatures under existing project operations would not result in reduced juvenile growth rates. Results of studies by Marine and Cech (2004) show that juvenile Chinook growth rates are virtually identical over a temperature ranges from 13-16°C and 17-20°C reflecting the general range of seasonal temperatures expected to occur during the juvenile rearing period under existing conditions in the reach downstream of Iron Gate Dam. Results of these growth studies show no evidence that lower spring and early summer water temperatures under existing project operations would adversely impact juvenile salmon growth rates.

These analyses demonstrate that existing conditions within the Klamath River reach downstream of Iron Gate Dam provide better rearing conditions for juvenile fall-run Chinook Salmon when compared to water temperature conditions occurring under hypothetical without-Project conditions. As a result of thermal warming within the river, the benefits of project operations on juvenile rearing habitat diminish with distance downstream of the dam. Within the lower reaches of the river, project operations have no effect on water temperature conditions affecting habitat suitability for juvenile rearing period.

PacifiCorp's conclusions with regard to Project-related water temperature effects on fall-run Chinook Salmon are supported by other recent independent analyses. In an analysis of the effects on fall Chinook of hypothetical temperature conditions with and without Klamath Hydroelectric Project dams and reservoirs, Bartholow et al. (2005) concluded that water temperature conditions for juvenile rearing life stages are better with Klamath Hydroelectric Project dams and reservoirs than without, especially immediately downstream of Iron Gate Dam. In a subsequent analysis of factors limiting fall Chinook production potential, Bartholow and Henriksen (2006) concluded that water temperature during

Table 7. Habitat suitability based on average daily water temperatures for juvenile fall-run Chinook Salmon rearing at locations downstream from Iron Gate Dam based on 2000 and 2001 water temperature modeling results for existing conditions (EC) and hypothetical without-Project scenarios.

Date	Scenario	Iron Gate Dam RM 190.5	Above Shasta River RM 177.5	At Walker Bridge RM 156.8	Above Scott River RM 143.9	At Seiad Valley RM 129.0	Above Clear Creek RM 99.0	Above Salmon River RM 66.9	At Orleans RM 57.6	Above Bluff Creek RM 49.0	Above Trinity River RM 43.3	At Martins Ferry RM 39.5	At Blue Creek RM 15.9	At Turwar RM 5.3
2/1/2001	EC	2.1	2.3	2.6	2.6	2.9	3.3	3.8	4.1	4.5	4.7	5.1	5.3	5.4
	WOP	2.1	1.9	2.1	2.2	2.5	3.2	3.8	4.0	4.4	4.6	5.0	5.3	5.3
2/15/2001	EC	2.1	2.5	3.1	3.3	3.7	4.2	4.6	4.8	5.1	5.3	5.5	5.9	6.0
	WOP	3.3	3.4	3.6	3.6	3.9	4.2	4.6	4.7	5.0	5.2	5.5	5.9	6.0
3/1/2001	EC	2.6	3.1	4.3	4.7	5.5	6.5	7.0	7.1	7.2	7.3	7.1	7.4	7.5
	WOP	4.5	5.0	5.7	6.0	6.4	7.1	7.5	7.4	7.5	7.6	7.2	7.4	7.5
3/15/2001	EC	4.1	4.8	6.2	6.8	8.0	9.0	9.3	9.3	9.2	9.2	8.9	9.2	9.3
	WOP	7.5	8.0	8.8	9.1	9.7	10.0	9.9	9.8	9.6	9.6	9.1	9.4	9.5
3/29/2001	EC	7.3	8.9	10.7	11.6	12.7	12.5	12.1	12.0	11.8	11.7	11.7	11.6	11.7
	WOP	12.1	12.7	13.0	13.0	13.4	12.9	12.5	12.3	12.1	12.0	11.8	11.7	11.8
4/12/2001	EC	7.9	8.6	9.0	9.3	9.8	10.5	10.6	10.6	10.6	10.6	10.4	10.6	10.8
	WOP	7.7	8.4	9.1	9.4	9.9	10.3	10.5	10.5	10.4	10.4	10.3	10.5	10.6
4/26/2001	EC	9.1	11.0	13.4	14.6	16.0	15.8	15.6	15.6	15.2	15.0	14.7	14.8	15.0
	WOP	17.1	17.5	18.1	18.2	18.5	17.4	16.6	16.2	15.7	15.5	15.0	14.9	15.0
5/10/2001	EC	12.4	13.8	15.4	15.9	17.1	16.2	15.8	16.0	15.4	15.2	14.9	14.8	15.0
	WOP	16.2	17.3	18.0	18.3	18.7	17.5	16.4	16.4	15.6	15.3	14.9	14.8	15.0
5/24/2001	EC	16.3	17.7	19.2	19.8	20.4	19.2	18.5	18.9	17.8	17.6	17.3	17.0	17.3
	WOP	21.2	21.6	22.0	21.8	21.7	19.6	18.8	19.1	18.1	17.7	17.4	17.1	17.4
6/7/2001	EC	18.2	18.8	19.2	19.2	19.4	18.7	18.4	18.4	17.8	17.6	17.3	17.2	17.4
	WOP	17.3	17.5	17.7	17.8	18.1	17.7	17.6	17.8	17.3	17.1	17.0	16.9	17.1
6/21/2001	EC	18.5	20.0	21.4	22.0	22.5	22.8	23.1	22.9	22.3	22.0	21.2	21.3	21.7
	WOP	20.5	21.4	22.2	22.5	22.8	22.7	22.9	22.8	22.1	21.9	21.1	21.2	21.5
*7/5/2001	EC	19.0	22.1	24.6	25.3	25.7	25.9	26.3	26.0	25.1	24.8	24.0	24.1	24.5
	WOP	23.0	24.6	25.5	25.8	26.0	26.1	26.3	26.0	25.2	24.9	24.1	24.2	24.6

* Life stage ends 7/01/2001, but for the sake of including the period from 7/05/2001 through the end of the life stage, this date is also shown

suitable: <15°C	low to moderate stress: 16-23 °C	high stress: >23 °C

spawning and egg incubation is not a significant factor affecting fall-run Chinook freshwater production in the Klamath River.

Coho Salmon

Coho Salmon use the mainstem Klamath River primarily as a migration corridor for the upstream movement of adults and downstream movement of juveniles. Although the majority of Coho spawning, egg incubation, and a substantial portion of juvenile rearing occurs within the tributaries that are not affected by existing Klamath Hydroelectric Project operations, this analysis assumed all life stages of Coho inhabit the Klamath River, and the analysis is useful for those Coho that do spawn in the mainstem. Coho juveniles are known to use the Klamath River throughout the year (Soto et al. 2016; Manhard et al. 2018)

Coho are sensitive to seasonal water temperature conditions that affect quality and availability of habitat for various life stages, growth and survival, behavior, vulnerability to disease, and other biological responses. Although the seasonal time periods of occurrence of Coho vary from those described for Chinook Salmon temperature criteria used in this analysis are similar for the two species (Table 2).

Adult Coho Salmon upstream migration within the Klamath River occurs from approximately mid-September through January (Table 3). Results of temperature analyses show that water temperatures are cooling during the fall and winter Coho adult migration period. As a result of the seasonally cooling temperature conditions, habitat is generally suitable throughout the river under both existing conditions and hypothetical without-Project conditions beginning in approximately October and extending through January (Table 8). In general, there is very little difference in the suitability of river temperature conditions for adult Coho migration under existing and without-Project conditions (Table 8).

Coho Salmon egg incubation occurs from November through April (Table 3). Water temperature conditions during the winter and early spring are naturally low and are generally within the range considered to be suitable for Coho egg incubation. Habitat suitability criteria (Table 9) consistently show that water temperatures are typically within the range considered to be suitable for Coho egg incubation. A comparison of water temperature conditions within the Iron Gate reach show the frequency of occurrence of elevated water temperatures during the Coho egg incubation period is less under existing project operations when compared to hypothetical without-Project conditions (Table 5).

Juvenile Coho Salmon rear within freshwater rivers and tributaries throughout the year (Table 3). Klamath Hydroelectric Project operations result in cooler water temperatures during the spring and early summer months within the reach immediately downstream of Iron Gate Dam when compared to without-Project conditions. Cooler water temperatures during the spring and early summer months within the Iron Gate reach under existing project operations would improve opportunities and conditions for juvenile Coho rearing and emigration. During the spring and summer months, water temperatures increase within the river, and differences in water temperature conditions between existing conditions and hypothetical without-Project conditions become less as a function of distance downstream from the dam (Table 10). During the mid-summer water temperatures, particularly in the lower reaches of the river, may reach levels under both existing and without-Project conditions that are considered to be highly stressful for juvenile Coho rearing (Table 10).

Although juvenile Coho may use the mainstem Klamath River throughout the year, this analysis focuses on those fish that use the mainstem Klamath River as a migratory corridor from February through July (Table 3). Water temperature conditions throughout the Klamath River are within the range considered to be suitable for juvenile Coho Salmon emigration during the period from February through approximately mid-May (Table 10). Water temperatures during the spring and early summer months are

Table 8. Habitat suitability based on average daily water temperatures for adult Coho Salmon migration at locations downstream from Iron Gate Dam based on 2000 and 2001 water temperature modeling results for existing conditions (EC) and hypothetical without-Project scenarios.

		Iron Gate Dam	Above Shasta River	At Walker Bridge	Above Scott River	At Seiad Valley	Above Clear Creek	Above Salmon River	At Orleans	Above Bluff Creek	Above Trinity River	At Martins Ferry	At Blue Creek	At Turwar
Date	Scenario	RM 190.54	RM 177.52	RM 156.79	RM 143.86	RM 129.04	RM 99.04	RM 66.91	RM 57.58	RM 49.03	RM 43.33	RM 39.5	RM 15.95	RM 5.28
9/15/2000	EC	19.2	19.3	19.7	20.1	20.3	20.3	20.5	20.5	20.2	20.2	20.0	20.0	20.1
	WOP	18.3	19.1	20.1	20.3	20.4	20.3	20.5	20.4	20.2	20.1	19.9	19.9	20.1
9/29/2000	EC	18.1	18.4	18.5	18.6	18.7	18.3	18.1	18.1	17.9	17.8	17.5	17.7	17.8
	WOP	16.1	17.0	17.6	17.9	18.1	17.9	17.8	17.9	17.7	17.6	17.4	17.6	17.8
10/13/2000	EC	15.9	15.7	15.1	14.8	14.6	14.3	14.1	14.1	14.1	14.1	14.1	14.2	14.3
	WOP	10.6	10.8	10.9	11.0	11.5	12.4	13.0	13.3	13.4	13.5	13.8	14.1	14.2
10/27/2000	EC	12.6	12.3	11.9	11.8	11.6	11.4	11.7	11.8	11.9	11.9	12.0	12.0	12.0
	WOP	8.5	9.0	9.3	9.3	9.8	10.7	11.1	11.1	11.1	11.2	11.5	11.6	11.6
11/10/2000	EC	9.3	8.6	7.9	7.7	7.6	7.6	7.8	7.9	8.1	8.2	8.7	8.8	8.8
	WOP	3.9	4.1	4.8	5.1	5.7	6.4	6.9	7.2	7.5	7.7	8.3	8.5	8.5
11/24/2000	EC	6.0	5.7	5.6	5.5	5.8	5.9	5.9	6.1	6.4	6.5	6.9	7.0	6.9
	WOP	3.8	3.6	3.8	3.6	4.0	4.9	5.5	6.0	6.4	6.6	7.3	7.5	7.5
12/8/2000	EC	4.1	4.1	4.3	4.3	4.5	4.8	4.9	5.2	5.6	5.8	6.5	6.6	6.6
	WOP	3.3	3.4	3.9	3.9	4.3	4.6	4.9	5.2	5.6	5.8	6.5	6.6	6.6
12/22/2000	EC	2.9	3.8	4.6	4.7	4.7	4.4	4.5	4.8	5.1	5.3	5.7	5.8	5.9
	WOP	3.8	4.3	4.8	4.8	4.7	4.3	4.3	4.7	5.0	5.1	5.6	5.8	5.9
1/5/2001	EC	3.9	4.1	4.3	4.4	4.3	4.3	4.4	4.4	4.7	4.9	5.2	5.4	5.4
	WOP	3.6	3.8	4.0	4.0	4.2	4.3	4.1	4.2	4.5	4.7	5.1	5.4	5.4
1/19/2001	EC	2.8	3.1	3.1	2.9	3.1	3.1	3.2	3.3	3.8	3.9	4.3	4.5	4.6
	WOP	1.7	1.4	1.5	1.5	1.6	2.0	2.6	2.9	3.4	3.6	4.1	4.4	4.4
2/2/2001	EC	2.1	3.0	3.7	3.7	3.9	4.2	4.4	4.6	4.9	5.1	5.5	5.7	5.8
	WOP	3.7	3.7	3.7	3.5	3.7	3.9	4.3	4.5	4.8	4.9	5.4	5.6	5.7

*Life stage ends 1/31/2001, but for the sake of including the period from 2/2/2001 through the end of the life stage, this date is also shown.

suitable: <17°C	low to moderate stress: 18-21 °C

Table 9. Habitat suitability based on average daily water temperatures for Coho Salmon egg incubation at locations downstream from Iron Gate Dam based on 2000 and 2001 water temperature modeling results for existing conditions (EC) and hypothetical without-Project (WOP) scenarios.

		Iron Gate Dam	Above Shasta River	At Walker Bridge	Above Scott River	At Seiad Valley	Above Clear Creek	Above Salmon River	At Orleans	Above Bluff Creek	Above Trinity River	At Martins Ferry	At Blue Creek	At Turwar
Date	**Scenario**	**RM 190.54**	**RM 177.52**	**RM 156.79**	**RM 143.86**	**RM 129.04**	**RM 99.04**	**RM 66.91**	**RM 57.58**	**RM 49.03**	**RM 43.33**	**RM 39.5**	**RM 15.95**	**RM 5.28**
11/1/2000	EC	11.4	11.0	10.8	10.7	10.5	10.3	9.9	10.0	10.1	10.2	10.6	10.7	10.7
	WOP	6.8	7.2	8.0	8.2	8.3	8.5	9.0	9.2	9.4	9.5	10.1	10.3	10.4
11/15/2000	EC	8.0	7.4	7.0	6.6	6.5	5.8	5.4	5.5	5.7	5.9	6.3	6.3	6.2
	WOP	2.5	2.5	3.1	3.0	3.4	3.8	3.9	4.2	4.7	5.0	5.7	5.8	5.8
11/29/2000	EC	4.4	5.2	5.9	6.0	6.1	6.6	6.7	7.2	7.3	7.5	8.0	8.1	8.2
	WOP	5.3	5.7	5.8	5.9	5.8	6.0	6.1	6.7	6.9	7.1	7.7	7.9	8.0
12/13/2000	EC	3.6	3.5	3.6	3.5	3.5	3.8	4.0	4.5	4.9	5.2	5.9	6.1	6.2
	WOP	2.3	2.2	2.4	2.2	2.6	3.6	4.1	4.6	5.0	5.2	5.9	6.2	6.2
12/27/2000	EC	2.3	2.3	2.5	2.6	2.8	3.2	3.6	4.1	4.4	4.7	5.3	5.5	5.5
	WOP	1.7	1.8	2.1	2.2	2.5	3.2	3.8	4.2	4.6	4.8	5.4	5.6	5.7
1/10/2001	EC	3.7	3.3	3.3	3.2	3.6	4.2	4.8	4.9	5.2	5.3	5.6	5.6	5.6
	WOP	1.8	2.0	2.6	2.8	3.2	4.0	4.7	4.9	5.1	5.2	5.6	5.7	5.7
1/24/2001	EC	2.7	2.9	3.9	4.3	5.1	5.3	5.5	5.7	5.9	6.0	6.2	6.3	6.3
	WOP	3.6	3.8	4.7	4.9	5.4	5.5	5.4	5.6	5.7	5.8	6.1	6.1	6.1
2/7/2001	EC	2.1	1.8	2.0	2.1	3.0	4.7	5.4	5.6	5.8	6.0	6.1	6.5	6.6
	WOP	1.6	1.9	3.0	3.6	4.5	5.7	6.2	6.2	6.5	6.6	6.5	7.0	7.1
2/21/2001	EC	2.3	3.8	5.5	6.0	6.7	6.9	7.1	7.2	7.3	7.4	7.4	7.6	7.7
	WOP	5.2	5.8	6.4	6.7	7.2	7.3	7.4	7.5	7.5	7.6	7.5	7.7	7.8
3/7/2001	EC	3.1	4.7	6.6	7.3	8.1	8.6	8.6	8.6	8.6	8.5	8.4	8.5	8.5
	WOP	9.0	9.1	9.2	9.2	9.3	8.8	8.5	8.5	8.5	8.4	8.4	8.3	8.3
3/21/2001	EC	5.0	7.2	9.1	9.9	11.4	11.9	12.2	12.1	11.8	11.7	11.3	11.4	11.6
	WOP	13.1	13.4	13.8	14.0	14.2	13.6	13.2	12.8	12.4	12.3	11.6	11.6	11.7
4/4/2001	EC	8.5	8.7	8.7	8.7	9.0	9.0	9.3	9.4	9.5	9.5	9.5	9.7	9.8
	WOP	6.5	6.9	7.3	7.5	8.2	9.0	9.7	9.7	9.8	9.9	9.7	10.0	10.1
4/18/2001	EC	7.9	8.1	9.3	9.9	11.1	11.9	12.2	12.3	12.2	12.1	12.0	12.2	12.3
	WOP	10.3	10.6	11.2	11.5	12.3	12.7	12.6	12.6	12.4	12.3	12.1	12.2	12.3
5/2/2001	EC	11.3	11.5	11.4	11.5	12.5	12.9	12.9	13.1	12.8	12.7	12.7	12.6	12.7
	WOP	9.9	10.9	12.0	12.5	13.3	13.3	13.0	13.2	12.9	12.8	12.7	12.7	12.7

*Life stage ends 4/30/2001, but for the sake of including the period from 5/2/2001 through the end of the life stage, this date is also shown.

suitable: <12°C	low to moderate stress: 13-14 °C	high stress: >14 °C

Table 10. Habitat suitability based on average daily water temperatures for juvenile Coho Salmon rearing at locations downstream from Iron Gate Dam based on 2000 and 2001 water temperature modeling results for existing conditions (EC) and hypothetical without-Project (WOP) scenarios.

		Iron Gate Dam	Above Shasta River	At Walker Bridge	Above Scott River	At Seiad Valley	Above Clear Creek	Above Salmon River	At Orleans	Above Bluff Creek	Above Trinity River	At Martins Ferry	At Blue Creek	At Turwar
Date	Scenario	RM 190.54	RM 177.52	RM 156.79	RM 143.86	RM 129.04	RM 99.04	RM 66.91	RM 57.58	RM 49.03	RM 43.33	RM 39.5	RM 15.95	RM 5.28
1/1/2001	EC	4.0	4.1	3.8	3.9	4.0	4.1	4.1	4.2	4.5	4.5	4.9	4.8	4.6
	WOP	2.2	3.0	3.8	3.9	4.1	4.1	4.1	4.2	4.4	4.5	4.9	4.7	4.4
1/15/2001	EC	3.1	2.8	2.7	2.6	2.9	3.6	4.0	4.3	4.6	4.8	5.4	5.5	5.5
	WOP	1.0	1.1	1.6	1.7	2.5	3.4	3.7	4.0	4.3	4.5	5.2	5.3	5.2
1/29/2001	EC	2.3	2.7	3.2	3.1	3.6	4.1	4.5	4.7	4.9	5.1	5.6	5.7	5.7
	WOP	2.4	2.6	3.0	3.1	3.5	3.9	4.2	4.4	4.7	4.9	5.4	5.6	5.6
2/12/2001	EC	1.9	2.1	2.5	2.7	3.3	4.1	4.4	4.5	4.8	5.0	5.4	5.6	5.6
	WOP	1.9	2.1	2.5	2.6	3.4	4.1	4.1	4.3	4.5	4.7	5.2	5.4	5.5
2/26/2001	EC	2.5	3.5	4.7	5.2	5.6	6.2	6.6	6.7	6.8	6.9	7.1	7.3	7.4
	WOP	5.4	5.5	5.5	5.5	5.6	6.2	6.7	6.8	7.0	7.0	7.2	7.4	7.5
3/12/2001	EC	3.5	4.7	6.0	6.5	7.6	8.2	8.6	8.7	8.7	8.7	8.6	8.8	9.0
	WOP	7.8	7.7	7.7	7.8	8.3	8.6	9.1	9.2	9.2	9.2	8.9	9.1	9.2
3/26/2001	EC	6.9	7.6	8.9	9.4	10.9	11.6	12.0	11.6	11.4	11.3	10.7	10.8	10.9
	WOP	9.5	10.0	11.3	11.9	12.5	12.8	13.0	12.3	12.1	12.1	11.1	11.3	11.4
4/9/2001	EC	8.0	8.3	8.5	8.7	9.1	9.2	9.4	9.4	9.5	9.5	9.5	9.6	9.7
	WOP	6.7	6.8	7.0	7.4	8.3	8.9	9.4	9.5	9.5	9.6	9.5	9.6	9.7
4/23/2001	EC	8.3	9.8	11.0	11.4	12.3	12.4	12.5	12.6	12.4	12.4	12.2	12.2	12.4
	WOP	13.4	13.3	13.0	12.8	13.1	12.9	12.8	12.8	12.5	12.4	12.3	12.2	12.3
5/7/2001	EC	12.1	13.7	15.0	15.5	16.4	15.4	15.0	15.1	14.5	14.4	14.1	14.0	14.3
	WOP	15.6	15.9	16.1	16.2	17.0	15.8	15.2	15.2	14.6	14.4	14.1	14.0	14.3
5/21/2001	EC	15.8	17.3	18.5	18.9	19.5	18.3	17.8	18.2	17.2	16.9	16.6	16.4	16.7
	WOP	18.1	18.9	19.8	20.0	20.2	18.4	17.9	18.2	17.3	17.0	16.7	16.4	16.6
6/4/2001	EC	18.4	18.1	17.7	17.4	17.1	16.5	16.4	16.6	16.2	16.1	15.9	15.8	15.9
	WOP	13.6	14.0	14.6	14.8	15.5	16.0	16.5	16.7	16.3	16.2	15.9	15.8	16.0
6/18/2001	EC	18.2	18.6	18.8	19.0	19.6	20.4	20.7	20.7	20.2	20.0	19.5	19.5	19.7
	WOP	16.6	17.5	18.3	18.8	19.5	20.3	20.6	20.6	20.1	20.0	19.4	19.4	19.6
7/2/2001	EC	18.5	21.0	22.4	22.7	22.9	22.7	22.7	22.5	22.1	21.8	21.2	21.3	21.6
	WOP	21.0	22.0	22.1	22.2	22.3	22.4	22.4	22.3	21.8	21.6	21.1	21.1	21.4
7/16/2001	EC	20.1	20.5	21.0	21.2	21.3	21.3	21.4	21.5	21.2	21.0	21.0	20.7	20.8
	WOP	19.0	20.1	21.0	21.3	21.4	21.4	21.4	21.5	21.3	21.2	21.1	21.0	21.2

Date	Scenario	Iron Gate Dam RM 190.54	Above Shasta River RM 177.52	At Walker Bridge RM 156.79	Above Scott River RM 143.86	At Seiad Valley RM 129.04	Above Clear Creek RM 99.04	Above Salmon River RM 66.91	At Orleans RM 57.58	Above Bluff Creek RM 49.03	Above Trinity River RM 43.33	At Martins Ferry RM 39.5	At Blue Creek RM 15.95	At Turwar RM 5.28
7/30/2001	EC	20.9	21.0	21.0	21.3	22.0	22.2	22.3	22.4	22.0	21.8	21.7	21.6	21.8
	WOP	17.8	19.5	20.5	21.1	22.0	22.0	22.3	22.4	21.9	21.7	21.7	21.6	21.9
8/13/2001	EC	21.6	22.1	22.6	22.8	22.9	23.3	23.3	23.3	22.8	22.7	22.4	22.3	22.5
	WOP	20.0	21.4	22.6	22.9	23.0	23.4	23.3	23.2	22.8	22.6	22.4	22.5	22.8
8/27/2001	EC	21.5	22.5	23.5	23.7	23.5	23.0	22.8	22.7	22.2	22.0	21.6	21.7	22.0
	WOP	20.0	21.5	22.6	23.0	23.0	22.8	22.7	22.6	22.2	22.0	21.5	21.7	22.1
9/10/2001	EC	20.6	20.8	21.0	20.9	20.6	20.2	20.4	20.4	20.1	19.9	19.7	19.7	19.9
	WOP	16.8	18.3	19.3	19.7	19.7	19.7	20.1	20.2	20.0	20.0	19.7	19.8	20.1
9/24/2001	EC	19.1	18.8	18.8	18.9	19.3	19.6	19.5	19.4	19.0	18.8	18.3	18.5	18.7
	WOP	15.5	16.8	17.9	18.3	18.7	19.2	19.4	19.3	18.9	18.8	18.3	18.5	18.8
10/8/2001	EC	17.7	17.3	17.2	17.2	17.3	17.5	17.5	17.4	16.9	16.8	16.5	16.5	16.6
	WOP	12.8	14.8	15.6	16.1	16.5	17.1	17.3	17.2	16.7	16.6	16.3	16.5	16.7
10/22/2001	EC	14.6	14.7	14.6	14.5	14.4	14.1	13.9	13.9	13.6	13.6	13.5	13.6	13.7
	WOP	10.8	11.9	12.7	12.9	13.0	13.1	13.1	13.3	13.3	13.3	13.4	13.6	13.7
11/5/2001	EC	11.4	11.5	11.4	11.4	11.5	10.8	10.6	10.9	11.0	11.1	11.4	11.6	11.7
	WOP	8.6	9.4	9.8	9.9	10.3	10.1	10.3	10.7	10.8	10.9	11.3	11.6	11.7
11/19/2001	EC	8.6	9.2	9.1	8.8	8.4	7.7	7.6	8.3	8.6	8.8	9.4	9.5	9.5
	WOP	6.4	7.0	7.4	7.3	7.3	7.4	7.6	8.2	8.5	8.7	9.4	9.5	9.5
12/3/2001	EC	5.9	5.3	5.0	4.9	5.3	5.7	5.8	6.1	6.4	6.6	7.2	7.2	7.2
	WOP	2.3	2.5	3.1	3.2	3.8	4.8	5.2	5.7	6.0	6.2	6.9	7.0	7.0
12/17/2001	EC	3.7	3.6	4.3	4.4	5.0	5.0	4.9	5.6	5.8	6.1	6.8	6.9	6.9
	WOP	2.5	2.5	3.6	3.8	4.6	4.7	4.6	5.4	5.6	5.8	6.7	6.8	6.8
12/31/2001	EC	1.9	2.0	2.8	2.9	3.9	4.5	4.7	5.8	5.8	6.1	7.5	7.3	7.2
	WOP	4.1	3.7	3.9	3.8	4.4	4.7	4.8	5.8	5.8	6.0	7.4	7.3	7.2

*Life stage ends 4/30/2001, but for the sake of including the period from 5/2/2001 through the end of the life stage, this date is also shown.

suitable: <15°C	low to moderate stress: 16-23 °C	high stress: >23 °C

colder within the reach immediately downstream of Iron Gate Dam under existing Klamath Hydroelectric Project operations. Water temperatures within the lower reaches of the river that serve as the migratory corridor for Coho Salmon are not affected by Klamath Hydroelectric Project operations.

Steelhead

Steelhead are sensitive to exposure to elevated water temperatures. Like Coho Salmon, Steelhead primarily use the mainstem Klamath River as a migratory corridor for upstream adult and downstream juvenile movement. Spawning, egg incubation, and juvenile rearing primarily occur within the tributaries.

Adult Steelhead upstream migration within the Klamath River occurs from approximately September through November (Table 3). Results of temperature analyses show that during the adult Steelhead migration period, water temperatures are cooling during the fall and winter months. As a result of the seasonally cooling temperatures, conditions are generally suitable throughout the river under both existing and without-Project conditions beginning in approximately October and extending through January. In general, there is very little difference in the suitability of river temperature conditions for adult Steelhead migration under existing and without-Project conditions at locations in the lower reaches of the river (Table 11). As a result of the elevated water temperatures within the lower reaches of the river under both existing and without-Project conditions during September, behavior response and entry of adult Steelhead into the river would be independent of Klamath Hydroelectric Project operations.

Steelhead egg incubation occurs from December through April with fry emergence between March and June (Table 3). Water temperature conditions during the winter and early spring are naturally cool and are generally within the range considered to be suitable for Steelhead egg incubation and fry emergence (Table 12). Analysis of average weekly temperatures show that the frequency of temperatures above 12°C is greater under hypothetical without Project conditions within the Iron Gate reach when compared to existing project operations with the differences declining with distance downstream of the dam (Table 5).

During the latter part of the egg incubation period, water temperatures under existing conditions are colder than spring temperatures predicted under the without-Project scenario. Therefore, existing operations would provide better habitat conditions for Steelhead egg incubation and fry emergence within the reach immediately downstream of Iron Gate Dam (both egg viability and rate of embryonic development) when compared to without-Project conditions. Warming within the river during the spring months reduces the temperature difference between existing operations and without-Project conditions as a function of distance downstream from the dam.

Juvenile Steelhead rear within freshwater rivers and tributaries throughout the year (Table 3). As discussed above, seasonal water temperature conditions significantly affect habitat quality and availability for juvenile rearing within the mainstem Klamath River. Klamath Hydroelectric Project operations result in cooler water temperatures during the spring and early summer months within the reach immediately downstream of Iron Gate Dam under existing operations when compared to hypothetical without-Project conditions (Table 13). Cooler water temperatures during the spring and early summer months within the Iron Gate reach under existing project operations would improve opportunities and conditions for juvenile Steelhead rearing. During the spring and summer months water temperatures increase within the river and differences in water temperature conditions between existing and without-Project conditions become less as a function of distance downstream from Iron Gate Dam.

Table 11. Habitat suitability based on average daily water temperatures for adult Steelhead migration at locations downstream from Iron Gate Dam based on 2000 and 2001 water temperature modeling results for existing conditions (EC) and hypothetical without-Project scenarios.

Date	Scenario	Iron Gate Dam RM 190.54	Above Shasta River RM 177.52	At Walker Bridge RM 156.79	Above Scott River RM 143.86	At Seiad Valley RM 129.04	Above Clear Creek RM 99.04	Above Salmon River RM 66.91	At Orleans RM 57.58	Above Bluff Creek RM 49.03	Above Trinity River RM 43.33	At Martins Ferry RM 39.5	At Blue Creek RM 15.95	At Turwar RM 5.28
9/1/2000	EC	21.2	18.9	18.4	18.4	18.9	18.8	18.6	18.6	18.5	18.5	18.6	18.4	18.4
	WOP	15.2	16.2	17.3	17.8	18.4	18.5	18.4	18.5	18.4	18.3	18.6	18.3	18.4
9/15/2000	EC	19.2	19.3	19.7	20.1	20.3	20.3	20.5	20.5	20.2	20.2	20.0	20.0	20.1
	WOP	18.3	19.1	20.1	20.3	20.4	20.3	20.5	20.4	20.2	20.1	19.9	19.9	20.1
9/29/2000	EC	18.1	18.4	18.5	18.6	18.7	18.3	18.1	18.1	17.9	17.8	17.5	17.7	17.8
	WOP	16.1	17.0	17.6	17.9	18.1	17.9	17.8	17.9	17.7	17.6	17.4	17.6	17.8
10/13/2000	EC	15.9	15.7	15.1	14.8	14.6	14.3	14.1	14.1	14.1	14.1	14.1	14.2	14.3
	WOP	10.6	10.8	10.9	11.0	11.5	12.4	13.0	13.3	13.4	13.5	13.8	14.1	14.2
10/27/2000	EC	12.6	12.3	11.9	11.8	11.6	11.4	11.7	11.8	11.9	11.9	12.0	12.0	12.0
	WOP	8.5	9.0	9.3	9.3	9.8	10.7	11.1	11.1	11.1	11.2	11.5	11.6	11.6
11/10/2000	EC	9.3	8.6	7.9	7.7	7.6	7.6	7.8	7.9	8.1	8.2	8.7	8.8	8.8
	WOP	3.9	4.1	4.8	5.1	5.7	6.4	6.9	7.2	7.5	7.7	8.3	8.5	8.5
11/24/2000	EC	6.0	5.7	5.6	5.5	5.8	5.9	5.9	6.1	6.4	6.5	6.9	7.0	6.9
	WOP	2.5	2.5	3.0	3.2	3.8	4.5	4.8	5.1	5.5	5.6	6.3	6.5	6.5
12/8/2000	EC	4.1	4.1	4.3	4.3	4.5	4.8	4.9	5.2	5.6	5.8	6.5	6.6	6.6
	WOP	3.3	3.4	3.9	3.9	4.3	4.6	4.9	5.2	5.6	5.8	6.5	6.6	6.6

*Life stage ends 11/30/2000, but for the sake of including the period from 11/24/2001 through the end of the life stage, this date is also shown.

suitable: <17°C	low to moderate stress: 18-21 °C	high stress: >21 °C

Table 12. Habitat suitability based on average daily water temperatures for Steelhead egg incubation and fry emergence at locations downstream from Iron Gate Dam based on 2000 and 2001 water temperature modeling results for existing conditions (EC) and hypothetical without-Project (WOP) scenarios.

		Iron Gate Dam	Above Shasta River	At Walker Bridge	Above Scott River	At Seiad Valley	Above Clear Creek	Above Salmon River	At Orleans	Above Bluff Creek	Above Trinity River	At Martins Ferry	At Blue Creek	At Turwar
Date	Scenario	RM 190.54	RM 177.52	RM 156.79	RM 143.86	RM 129.04	RM 99.04	RM 66.91	RM 57.58	RM 49.03	RM 43.33	RM 39.5	RM 15.95	RM 5.28
12/1/2000	EC	4.7	4.5	4.5	4.5	4.9	5.7	6.1	6.5	6.7	6.8	7.5	7.7	7.7
	WOP	3.7	3.9	4.5	4.7	5.3	5.9	6.0	6.4	6.6	6.7	7.5	7.6	7.6
12/15/2000	EC	3.4	4.3	4.8	4.8	4.7	4.8	4.8	5.2	5.4	5.5	6.2	6.2	6.2
	WOP	3.3	4.1	4.3	4.3	4.2	4.2	4.3	4.7	4.9	5.0	5.8	5.9	6.0
12/29/2000	EC	2.3	2.3	2.4	2.4	2.5	2.9	3.3	3.6	4.1	4.3	4.8	5.1	5.1
	WOP	2.1	2.2	2.3	2.1	2.2	2.8	3.2	3.5	4.0	4.2	4.8	5.1	5.1
1/12/2001	EC	3.5	3.4	3.7	3.6	3.8	3.9	4.0	4.3	4.6	4.8	5.3	5.5	5.6
	WOP	2.3	2.3	2.5	2.5	2.9	3.4	3.8	4.1	4.4	4.6	5.2	5.4	5.5
1/26/2001	EC	2.6	2.6	2.7	2.7	3.2	3.8	4.5	4.8	5.1	5.3	5.7	5.8	5.8
	WOP	1.6	1.7	2.4	2.7	3.3	4.1	4.8	5.0	5.3	5.4	5.7	5.9	5.9
2/9/2001	EC	2.2	1.9	2.0	1.9	2.2	2.7	3.1	3.3	3.8	4.1	4.5	4.9	4.9
	WOP	1.1	0.7	0.9	1.1	1.8	2.6	3.5	3.8	4.3	4.5	4.8	5.2	5.3
2/23/2001	EC	2.4	2.7	3.4	3.8	4.9	6.0	6.6	6.7	6.9	6.9	7.0	7.1	7.2
	WOP	4.1	4.2	4.7	5.0	5.8	6.4	6.8	6.9	7.0	7.1	7.0	7.2	7.3
3/9/2001	EC	3.2	4.0	5.7	6.5	7.9	8.6	8.8	8.9	8.8	8.8	8.6	8.7	8.8
	WOP	7.3	8.1	9.3	9.7	10.2	10.0	9.7	9.5	9.4	9.3	8.8	8.9	8.9
3/23/2001	EC	5.2	7.9	10.3	11.3	12.9	13.2	13.2	13.0	12.8	12.6	12.2	12.4	12.5
	WOP	14.0	14.7	15.1	15.2	15.4	14.8	14.5	13.9	13.6	13.5	12.6	12.7	12.8
4/6/2001	EC	8.6	8.4	8.9	9.1	9.9	10.0	10.0	10.0	9.9	9.9	9.8	9.9	9.9
	WOP	7.6	8.2	8.7	8.8	9.6	9.5	9.6	9.7	9.7	9.7	9.7	9.8	9.9
4/20/2001	EC	7.9	8.6	9.3	9.6	10.1	10.5	11.1	11.2	11.3	11.3	11.1	11.5	11.7
	WOP	10.2	10.3	10.5	10.7	10.9	11.2	11.7	11.7	11.8	11.9	11.4	11.7	11.9
5/4/2001	EC	11.3	12.4	13.5	13.9	14.7	13.9	13.6	13.9	13.5	13.4	13.3	13.3	13.5
	WOP	13.2	13.5	13.7	13.7	14.4	13.7	13.8	14.0	13.6	13.5	13.3	13.3	13.5
5/18/2001	EC	15.5	16.4	16.9	17.0	16.9	15.8	15.4	15.5	15.0	14.8	14.5	14.3	14.5
	WOP	16.3	16.8	17.6	17.7	17.2	16.0	15.4	15.5	15.0	14.7	14.5	14.3	14.4
6/1/2001	EC	17.8	18.5	19.8	20.3	20.7	20.0	19.4	19.7	18.6	18.3	17.9	17.7	18.0
	WOP	19.6	20.5	21.1	21.0	21.0	19.6	19.2	19.5	18.6	18.3	17.9	17.7	18.0

Date	Scenario	Iron Gate Dam RM 190.54	Above Shasta River RM 177.52	At Walker Bridge RM 156.79	Above Scott River RM 143.86	At Seiad Valley RM 129.04	Above Clear Creek RM 99.04	Above Salmon River RM 66.91	At Orleans RM 57.58	Above Bluff Creek RM 49.03	Above Trinity River RM 43.33	At Martins Ferry RM 39.5	At Blue Creek RM 15.95	At Turwar RM 5.28
6/15/2001	EC	18.0	18.6	19.1	19.4	19.8	20.0	20.0	19.9	19.5	19.3	18.9	18.9	19.0
	WOP	17.2	18.0	18.3	18.4	18.7	18.9	19.4	19.5	19.2	19.1	18.7	18.7	18.9
6/29/2001	EC	18.6	19.8	20.7	21.1	21.3	21.2	21.3	20.9	20.6	20.4	19.8	19.8	20.0
	WOP	18.4	19.1	19.5	19.7	20.2	20.9	21.1	20.7	20.3	20.1	19.6	19.5	19.7
7/13/2001	EC	20.0	21.7	22.9	23.2	23.6	24.0	24.5	24.4	23.9	23.6	23.1	23.1	23.5
	WOP	21.1	22.5	23.1	23.3	23.8	24.1	24.5	24.4	23.9	23.6	23.1	23.1	23.5

* Life stage ends 6/30/2000, but for the sake of including the period from 6/29/2001 through the end of the life stage, this date is also shown

suitable: <12°C	low to moderate stress: 13-14°C	high stress: >14°C

Table 13. Habitat suitability based on average daily water temperatures for juvenile Steelhead rearing at locations downstream from Iron Gate Dam based on 2000 and 2001 water temperature modeling results for existing conditions (EC) and hypothetical without-Project (WOP) scenarios.

Date	Scenario	Iron Gate Dam RM 190.54	Above Shasta River RM 177.52	At Walker Bridge RM 156.79	Above Scott River RM 143.86	At Seiad Valley RM 129.04	Above Clear Creek RM 99.04	Above Salmon River RM 66.91	At Orleans RM 57.58	Above Bluff Creek RM 49.03	Above Trinity River RM 43.33	At Martins Ferry RM 39.5	At Blue Creek RM 15.95	At Turwar RM 5.28
1/1/2001	EC	4.0	4.1	3.8	3.9	4.0	4.1	4.1	4.2	4.5	4.5	4.9	4.8	4.6
	WOP	2.2	3.0	3.8	3.9	4.1	4.1	4.1	4.2	4.4	4.5	4.9	4.7	4.4
1/15/2001	EC	3.1	2.8	2.7	2.6	2.9	3.6	4.0	4.3	4.6	4.8	5.4	5.5	5.5
	WOP	1.0	1.1	1.6	1.7	2.5	3.4	3.7	4.0	4.3	4.5	5.2	5.3	5.2
1/29/2001	EC	2.3	2.7	3.2	3.1	3.6	4.1	4.5	4.7	4.9	5.1	5.6	5.7	5.7
	WOP	2.4	2.6	3.0	3.1	3.5	3.9	4.2	4.4	4.7	4.9	5.4	5.6	5.6
2/12/2001	EC	1.9	2.1	2.5	2.7	3.3	4.1	4.4	4.5	4.8	5.0	5.4	5.6	5.6
	WOP	1.9	2.1	2.5	2.6	3.4	4.1	4.1	4.3	4.5	4.7	5.2	5.4	5.5
2/26/2001	EC	2.5	3.5	4.7	5.2	5.6	6.2	6.6	6.7	6.8	6.9	7.1	7.3	7.4
	WOP	5.4	5.5	5.5	5.5	5.6	6.2	6.7	6.8	7.0	7.0	7.2	7.4	7.5
3/12/2001	EC	3.5	4.7	6.0	6.5	7.6	8.2	8.6	8.7	8.7	8.7	8.6	8.8	9.0
	WOP	7.8	7.7	7.7	7.8	8.3	8.6	9.1	9.2	9.2	9.2	8.9	9.1	9.2
3/26/2001	EC	6.9	7.6	8.9	9.4	10.9	11.6	12.0	11.6	11.4	11.3	10.7	10.8	10.9
	WOP	9.5	10.0	11.3	11.9	12.5	12.8	13.0	12.3	12.1	12.1	11.1	11.3	11.4
4/9/2001	EC	8.0	8.3	8.5	8.7	9.1	9.2	9.4	9.4	9.5	9.5	9.5	9.6	9.7
	WOP	6.7	6.8	7.0	7.4	8.3	8.9	9.4	9.5	9.5	9.6	9.5	9.6	9.7
4/23/2001	EC	8.3	9.8	11.0	11.4	12.3	12.4	12.5	12.6	12.4	12.4	12.2	12.2	12.4
	WOP	13.4	13.3	13.0	12.8	13.1	12.9	12.8	12.8	12.5	12.4	12.3	12.2	12.3
5/7/2001	EC	12.1	13.7	15.0	15.5	16.4	15.4	15.0	15.1	14.5	14.4	14.1	14.0	14.3
	WOP	15.6	15.9	16.1	16.2	17.0	15.8	15.2	15.2	14.6	14.4	14.1	14.0	14.3
5/21/2001	EC	15.8	17.3	18.5	18.9	19.5	18.3	17.8	18.2	17.2	16.9	16.6	16.4	16.7
	WOP	18.1	18.9	19.8	20.0	20.2	18.4	17.9	18.2	17.3	17.0	16.7	16.4	16.6
6/4/2001	EC	18.4	18.1	17.7	17.4	17.1	16.5	16.4	16.6	16.2	16.1	15.9	15.8	15.9
	WOP	13.6	14.0	14.6	14.8	15.5	16.0	16.5	16.7	16.3	16.2	15.9	15.8	16.0
6/18/2001	EC	18.2	18.6	18.8	19.0	19.6	20.4	20.7	20.7	20.2	20.0	19.5	19.5	19.7
	WOP	16.6	17.5	18.3	18.8	19.5	20.3	20.6	20.6	20.1	20.0	19.4	19.4	19.6
7/2/2001	EC	18.5	21.0	22.4	22.7	22.9	22.7	22.7	22.5	22.1	21.8	21.2	21.3	21.6
	WOP	21.0	22.0	22.1	22.2	22.3	22.4	22.4	22.3	21.8	21.6	21.1	21.1	21.4

Date	Scenario	Iron Gate Dam RM 190.54	Above Shasta River RM 177.52	At Walker Bridge RM 156.79	Above Scott River RM 143.86	At Seiad Valley RM 129.04	Above Clear Creek RM 99.04	Above Salmon River RM 66.91	At Orleans RM 57.58	Above Bluff Creek RM 49.03	Above Trinity River RM 43.33	At Martins Ferry RM 39.5	At Blue Creek RM 15.95	At Turwar RM 5.28
7/16/2001	EC	20.1	20.5	21.0	21.2	21.3	21.3	21.4	21.5	21.2	21.0	21.0	20.7	20.8
	WOP	19.0	20.1	21.0	21.3	21.4	21.4	21.4	21.5	21.3	21.2	21.1	21.0	21.2
7/30/2001	EC	20.9	21.0	21.0	21.3	22.0	22.2	22.3	22.4	22.0	21.8	21.7	21.6	21.8
	WOP	17.8	19.5	20.5	21.1	22.0	22.0	22.3	22.4	21.9	21.7	21.7	21.6	21.9
8/13/2001	EC	21.6	22.1	22.6	22.8	22.9	23.3	23.3	23.3	22.8	22.7	22.4	22.3	22.5
	WOP	20.0	21.4	22.6	22.9	23.0	23.4	23.3	23.2	22.8	22.6	22.4	22.5	22.8
8/27/2001	EC	21.5	22.5	23.5	23.7	23.5	23.0	22.8	22.7	22.2	22.0	21.6	21.7	22.0
	WOP	20.0	21.5	22.6	23.0	23.0	22.8	22.7	22.6	22.2	22.0	21.5	21.7	22.1
9/10/2001	EC	20.6	20.8	21.0	20.9	20.6	20.2	20.4	20.4	20.1	19.9	19.7	19.7	19.9
	WOP	16.8	18.3	19.3	19.7	19.7	19.7	20.1	20.2	20.0	20.0	19.7	19.8	20.1
9/24/2001	EC	19.1	18.8	18.8	18.9	19.3	19.6	19.5	19.4	19.0	18.8	18.3	18.5	18.7
	WOP	15.5	16.8	17.9	18.3	18.7	19.2	19.4	19.3	18.9	18.8	18.3	18.5	18.8
10/8/2001	EC	17.7	17.3	17.2	17.2	17.3	17.5	17.5	17.4	16.9	16.8	16.5	16.5	16.6
	WOP	12.8	14.8	15.6	16.1	16.5	17.1	17.3	17.2	16.7	16.6	16.3	16.5	16.7
10/22/2001	EC	14.6	14.7	14.6	14.5	14.4	14.1	13.9	13.9	13.6	13.6	13.5	13.6	13.7
	WOP	10.8	11.9	12.7	12.9	13.0	13.1	13.1	13.3	13.3	13.3	13.4	13.6	13.7
11/5/2001	EC	11.4	11.5	11.4	11.4	11.5	10.8	10.6	10.9	11.0	11.1	11.4	11.6	11.7
	WOP	8.6	9.4	9.8	9.9	10.3	10.1	10.3	10.7	10.8	10.9	11.3	11.6	11.7
11/19/2001	EC	8.6	9.2	9.1	8.8	8.4	7.7	7.6	8.3	8.6	8.8	9.4	9.5	9.5
	WOP	6.4	7.0	7.4	7.3	7.3	7.4	7.6	8.2	8.5	8.7	9.4	9.5	9.5
12/3/2001	EC	5.9	5.3	5.0	4.9	5.3	5.7	5.8	6.1	6.4	6.6	7.2	7.2	7.2
	WOP	2.3	2.5	3.1	3.2	3.8	4.8	5.2	5.7	6.0	6.2	6.9	7.0	7.0
12/17/2001	EC	3.7	3.6	4.3	4.4	5.0	5.0	4.9	5.6	5.8	6.1	6.8	6.9	6.9
	WOP	2.5	2.5	3.6	3.8	4.6	4.7	4.6	5.4	5.6	5.8	6.7	6.8	6.8
12/31/2001	EC	1.9	2.0	2.8	2.9	3.9	4.5	4.7	5.8	5.8	6.1	7.5	7.3	7.2
	WOP	4.1	3.7	3.9	3.8	4.4	4.7	4.8	5.8	5.8	6.0	7.4	7.3	7.2

Life stage ends 6/30/2000, but for the sake of including the period from 6/29/2001 through the end of the life stage, this date is also shown

suitable: <15°C | low to moderate stress: 16-23°C | high stress: >23°C

During the summer and early fall months, water temperatures throughout the river increase to a range considered a low to moderately stressful for juvenile Steelhead rearing. During the mid-summer, water temperatures may reach levels under both existing and without-Project conditions that are considered to be highly stressful for juvenile Steelhead rearing, particularly in the lower reaches of the river (Table 13). The occurrence of these high temperatures, under both existing and without-Project conditions, limits year-round Steelhead rearing within the mainstem Klamath River (perhaps with the exception of limited microhabitat areas providing coldwater refuges).

Juvenile Steelhead outmigration using the mainstem Klamath River as a migratory corridor occurs primarily during the period from March through June and potentially early July (Table 3). Water temperature conditions throughout the Klamath River are within the range considered be suitable for juvenile Steelhead emigration during the period from March through approximately mid-May (Table 13). Water temperatures during the spring and early summer months are colder within the reach immediately downstream of Iron Gate Dam under existing project operations, however temperatures within the lower reaches of the river that serve as the migratory corridor for Steelhead are independent of project operations. Under existing conditions and without-Project conditions seasonal water temperatures increase during the summer, particularly in the lower reaches of the river, where temperatures are typically within the range considered to be low to moderately stressful during June and high stress/lethal during July.

Summary

As discussed in PacifiCorp (2014), Klamath Hydroelectric Project operations and the presence of Copco and Iron Gate reservoirs do not affect temperature in the Klamath River to an extent that causes biologically significant adverse effects to anadromous fish species that use the reach downstream of Iron Gate Dam at the time of migration, spawning, and egg incubation. Copco and Iron Gate reservoirs create a thermal lag that causes Iron Gate Dam release temperature to be slightly cooler in the spring and slightly warmer during the fall than would theoretically occur in the absence of the reservoirs. However, the thermal lag effect is not detrimental, and may be beneficial, to certain life stages of Chinook, Coho, and Steelhead that use the river downstream of Iron Gate Dam. In addition, as a result of basin climatological conditions and tributary inflows in the lower basin, Klamath Hydroelectric Project operations have no effect on water temperature conditions for Chinook, Coho, and Steelhead within the lower reaches of the Klamath River. The DEIR should incorporate a similar evaluation of the Proposed Project and alternatives to allow for an accurate understanding of the Proposed Project's potential effects on salmonid use of the Klamath River.

PacifiCorp's conclusions in this regard are supported by other recent independent analyses. In an analysis of the effects on fall-run Chinook of hypothetical temperature conditions with and without Klamath Hydroelectric Project facilities, Bartholow et al. (2005) concluded that water temperature conditions for juvenile rearing life stages are better with the Klamath Hydroelectric Project dams and reservoirs in place than without, especially immediately downstream of Iron Gate Dam. In a subsequent analysis of factors limiting fall-run Chinook production potential, Bartholow and Henriksen (2006) concluded that water temperature during spawning and egg incubation is not a significant factor affecting fall-run Chinook freshwater production in the Klamath River. In the 2006 EPAct trial-type proceeding, the presiding administrative judge ruled, based on the testimony of agency fisheries experts, that existing temperatures conditions will not preclude the various life stages of anadromous fish from successfully utilizing habitat either below or above Iron Gate Dam (McKenna 2007).

2.9.4 Fall-run Chinook Fry Emergence Timing and Juvenile Growth

The DEIR puts forth a hypothesis regarding the effect that changes in river temperature from the Proposed Project would have on fall-run Chinook fry emergence timing and implications regarding juvenile growth, migration timing, and stress and disease (DEIR pg. 3-272).

The DEIR analysis claims that fall-run Chinook emergence timing would be earlier with the Proposed Project compared to existing conditions. This difference in emergence timing is theorized to result because of warmer water temperatures in the spring under the Proposed Project (Figure 11). However, an inspection of the temperature data in the DEIR (see bottom panel in Figure 11 below) shows that fall water temperatures are about 2 to 5°C cooler and spring temperatures 1 to 2°C warmer for the Proposed Project compared to existing conditions. In short, the degree days lost in the fall are about 2 to 5 times higher than the degree days gained in the spring. A total of 889 degree days are required for fry emergence and is calculated from the day the fish spawned. Thus, it is a combination of fall, winter, and spring water temperature that determines fry emergence date. The DEIR incorrectly looks only at the spring degree-days to conclude that emergence timing is delayed under existing conditions as compared to the Proposed Project.

Review of DEIR Analysis

While text presented throughout the DEIR claims an earlier fry emergence timing for fall-run Chinook under the Proposed Project, the data (Figure 11) do not support such an assertion. In fact, the data indicate emergence timing is later for fish spawning on similar dates for the Proposed Project compared to existing conditions. For example, a dotted line in the middle panel of Figure 11 shows that under the Proposed Project there are about 120 days to emergence, compared to 60 days for existing conditions for fish spawning mid-September. This results in fry emergence dates of January (Proposed Project) and November (existing conditions) (Figure 11, top panel). This relationship (i.e., later emergence date for Proposed Project) holds for fish spawning until about late November, when emergence date becomes similar for the two alternatives, with emergence timing being marginally earlier for the Proposed Project.

What is unclear in the DEIR, is the meaning of the solid lines in the days to emergence and emergence date panels (Figure 11 middle and top panels). No explanation is provided in the DEIR text as to what the lines denote. Perry et al. (2011), the reference to which this figure is linked, has temperature data but nothing on emergence timing. It is unclear from the DEIR how this figure was actually derived or if Perry et al. (2011) is even the correct source.

Emergence Timing Analysis

Because data from graphs are difficult to precisely interpret and the source material does not contain an adequate explanation, water temperature data for 2004 (an average water year) were used to perform a similar emergence timing analysis in order to verify the conclusions made from interpreting Figure 11. The results of this analysis show fall-run Chinook fry emergence timing is earlier under existing conditions for spawn dates between September 1 and December 1. After this date, emergence timing is predicted to be earlier for the Proposed Project (Table 14). Using data from 2004 and 2006 water years and the same type of analysis generates similar results.

For emergence timing under the Proposed Project to be similar to existing conditions, fall-run Chinook spawning must be approximately 2 to 3 weeks earlier for the Proposed Project. For example, fish spawning on September 29 in the Proposed Project would have about the same fry emergence timing as fish spawning between October 13 and 20 under existing conditions (Table 14). Even with similar fry emergence timing, river temperatures would be warmer at emergence for the Proposed Project.

Whether fall-run Chinook migration or spawn-timing changes under the Proposed Project would be highly dependent on resulting fall stream temperatures. Cooler stream temperatures in the fall should equate to earlier adult migration timing as conditions become more favorable for earlier arriving fish.

However, while the DEIR indicates that stream temperatures in the fall at Iron Gate Dam for the Proposed Project would be cooler, water temperatures would remain largely unchanged downstream of the Scott River (RM 143) through the Klamath Estuary and into the marine near shore environment. Because stream temperatures in the lower river are not affected by the Proposed Project, it is highly uncertain that adult run-timing would change dramatically for fall-run Chinook because they would still encounter warm water temperatures in the lower Klamath River as they do currently. These conditions, which currently limit upstream migration timing and cause fish to hold in the lower river, would persist under the Proposed Project.

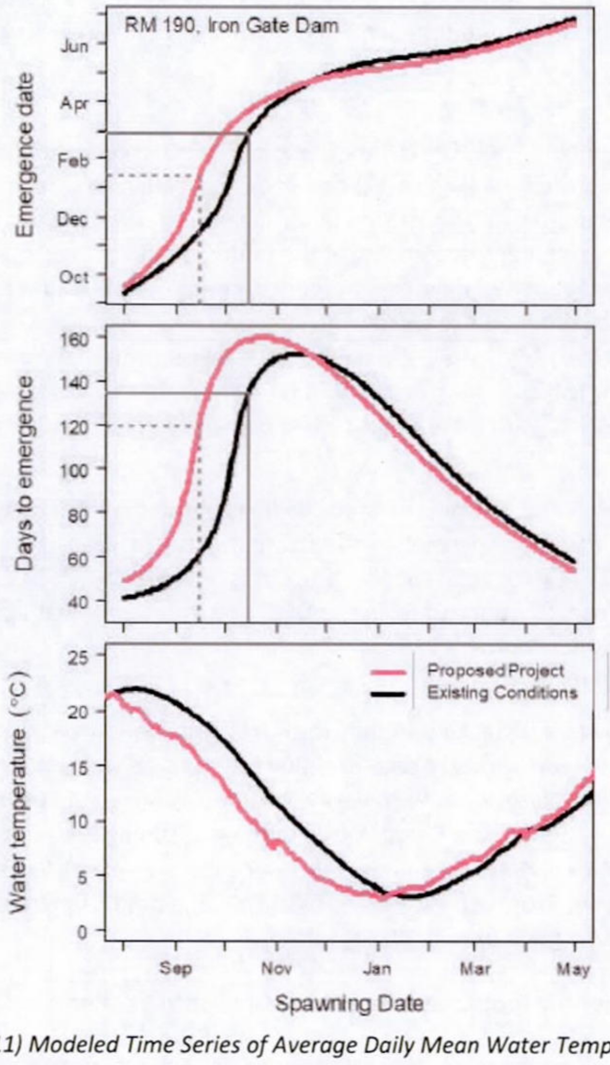

Figure 11. Perry et al. (2011) Modeled Time Series of Average Daily Mean Water Temperature (lower panel) Predicted at Iron Gate Dam (RM 193.1) Under the Proposed Project and existing conditions. Days to emergence (middle panel) and date of emergence (upper panel) for fall-run Chinook Salmon was estimated as a function of spawning date assuming that emergence would occur at 889 degree days (accumulated heat related to development) after spawning (Perry et al. 2011). (Reproduction of DEIR Figure 3.3-4, pg. 3-274).

*Table 14. Spawning date versus emergence timing for the existing conditions and Without Dams (represents Proposed Project alternative) where green cells indicate the alternative with earlier emergence timing.**

	Existing Conditions		Without-Project	
Spawning Date	Emergence Date	#Days	Emergence Date	#Days
1-Sep	19-Oct	49	11-Nov	72
8-Sep	30-Oct	53	13-Dec	97
15-Sep	12-Nov	59	28-Jan	136
22-Sep	28-Nov	68	21-Feb	153
29-Sep	24-Dec	87	11-Mar	164
6-Oct	2-Feb	120	23-Mar	169
13-Oct	13-Mar	152	3-Apr	173
20-Oct	28-Mar	160	10-Apr	173
27-Oct	8-Apr	164	14-Apr	170
3-Nov	16-Apr	165	19-Apr	168
10-Nov	24-Apr	166	23-Apr	165
17-Nov	30-Apr	165	27-Apr	162
24-Nov	4-May	162	29-Apr	157
1-Dec	8-May	159	1-May	152
8-Dec	11-May	155	1-May	145
15-Dec	14-May	151	3-May	140
22-Dec	16-May	146	5-May	135
29-Dec	17-May	140	6-May	129

*Analysis assumes 889-degree days from spawning to emergence. The without-Project data set is from PacifiCorp's (2014) Without Project (WOP) 2004 temperature data.

Disease

Assuming the fry emergence timing analysis above is correct, the statements in the DEIR regarding temperature effects of fish disease on juvenile salmon need to be revisited. For example, water temperatures for the Proposed Project are warmer in the spring than for existing conditions which means losses resulting from *C. shasta* may also be higher for the Proposed Project as compared to existing conditions simply because of the difference in water temperature (See Major Issue 2.8)

Juvenile Growth

The DEIR (pg. 3-272) states that juvenile Chinook growth rates would be higher for the Proposed Project and this would encourage earlier juvenile outmigration compared to existing conditions. This statement is correct only when Chinook fry emergence timing is the same; as was discussed above, fry emergence timing is not the same for the Proposed Project as compared to existing conditions (Table 14). Fall-run Chinook fry emergence is earlier for existing conditions for the same spawn date through December 1. Thus, although spring water temperatures are warmer for the Proposed Project, Chinook fry may have up to 30 more days to grow under existing conditions.

Conclusion

The analysis of fall-run Chinook fry emergence timing and growth for the Proposed Project, existing conditions, and all alternatives to the Proposed Project should be rerun. Once this analysis is complete, the discussion and conclusions in the DEIR need to be reevaluated to accurately present the potential impacts of the Proposed Project and the alternatives in relation to existing conditions. As it stands, the DEIR analysis is incorrect and does not support the conclusions in the DEIR that water temperature changes as a result of the Proposed Project will benefit Coho, Chinook, and Steelhead.

Section 3. Thematic Comments

The comments in Section 3 are common across multiple DEIR sections and resources categories. These thematic comments are summarized here to inform the public and State Water Board of the significance of these issues with the DEIR, and to inform major revisions that should be addressed in a recirculated DEIR. These comments should be addressed in a comprehensive manner when the document is revised.

- **The DEIR Lacks Overall Clarity.** The DEIR does not comply with CEQA's requirements that Environmental Impact Reports (EIRs) be organized and written in a manner that will make them "meaningful and useful to decision makers and to the public," (Pub. Res. Code § 21003 (b)) and that EIRs be written in plain language and drafted to be understandable to decision-makers and the public (14 Cal. Code Regs. § 15140; 15147). Throughout the DEIR, the data and information is not presented in a manner designed to adequately inform the public and decision-makers.

  A non-exhaustive list of examples of this problem include:

  - In Section 2 of the DEIR, the project description presents 'dam removal year 1' as being up through December 2020 and 'dam removal year 2' starts in January 2021. Actual removal of facilities is currently scheduled to take place in 2021. As the DEIR discusses impacts in terms of 'dam removal year 1' or 'dam removal year 2', it is easy to get confused about when an event might actually happen. This confusion is compounded in the effects analysis for example, where the DEIR discusses the end of hatchery supplementation in 'post dam removal' year 7, which is presumably 'dam removal year 2' plus 7 years (DEIR pg. 3-315). Another example of this can be found in Section 3.4.3 (DEIR pg. 3-422) where "short-term" and "long-term" are defined as: "This period [short-term] corresponds to pre-dam removal years 1 and 2, dam removal year 1, dam removal year 2, and post-dam removal year 1 (Table 2.7-1). Long-term is defined as occurring after post-dam removal year 1 (i.e., greater than three years after dam removal begins)." Terminology such as this will confuse the public and decision-makers and should be clarified in the recirculated DEIR; it would be much clearer to use calendar years.

  - The discussion of cultural resources is so vague and non-specific that it is impossible to tell if the resources potentially affected by the Proposed Project are accurately described. PacifiCorp recognizes the extremely sensitive nature of these resources. There are, however, ways to present information in such a manner that readers understand that the impact analysis was performed correctly and understand the magnitude of the impact.

- The analysis of impacts to Chinook and Coho are presented in terms of percent increased mortality with no discussion of population sizes (Appendix Tables E-8 and E-10). The impacts to Steelhead however, are presented in actual numbers of fish (Appendix Table E-12). There is an abundance of population data for Chinook and Coho that is not included or considered in the DEIR, which when added in a recirculated DEIR, would allow an analysis to be done in a manner similar to that for Steelhead. By failing to do this analysis, the DEIR disguises the actual effects of the Proposed Project in percentages that the reader is not able to connect to actual populations—particularly populations of Coho that are exceptionally small.

- The definition of "short-term impacts" in Section 3.3 Aquatic Resources, is 5 years. In Appendix F, which discusses potential impacts of bedload transport of sediment to aquatic resources, the short-term period is 2 years. Similarly, Section 3.2 Water Quality uses a 2-year period as short term. The disparity in these timeframes makes the connection between the analysis in one section of the DEIR and the analysis in another extremely difficult to follow. For example, the effects analysis in Section 3.3 discusses short-term impacts to fish from bedload transport and references Appendix F which covers two of these years. The DEIR does not explain what happens in the three extra short-term years necessary to meet the definition of short term in Section 3.3. As a result, the reader's ability to understand short-term impacts (i.e., Proposed Project impacts occurring over a consistently defined period of years) is compromised.

- **The DEIR Relies on Out of Date Information.** The Klamath Basin is a data rich environment. The DEIR background and analyses, however, does not rely on recent data; instead, it relies on older information prepared in the FERC (2007) EIS and the KHSA 2012 EIR/EIS (DOI and CDFW 2012) that was developed in connection with the Secretarial Determination. There has not been a consistent effort made to present an up-to-date analysis of potential impacts based on the best available data and information. CEQA requires adequate information to ensure that "decisions be informed, and therefore balanced" (*Association of Irritated Residents v. County of Madera* (2003) 107 Cal. App. 4th 1383, 1398; see also *North Coast Rivers Alliance v. Marin Municipal Water Dist. Bd. of Directors* (2013) 216 Cal. App. 4th 614, 642-643).

  A non-exhaustive list of examples of this issue include:

  - The stream flow data relies on KBRA flow data and does not take into account mandatory flows being implemented by the USBR under its 2013 BiOp (NMFS and USFWS 2013). Even the information in the DEIR shows that these flows are quite different in some months (see DEIR Figures 3.1-1 and 3.1-2) (See Major Issue 2.2). Data reflecting actual mandatory flows should be used.
  - The DEIR does not reference any of the information and extensive analysis presented in PacifiCorp's (2014) Section 401 Water Quality Certification application for the Klamath Hydroelectric Project. The State Water Board should focus on incorporation of the up-to-date water quality modeling which includes results for water temperatures, dissolved oxygen, nutrients, pH, and other constituents, for Existing Conditions and without-

Project conditions as presented in PacifiCorp (2014). PacifiCorp's application is being provided electronically to the State Water Board with these comments.

- The DEIR only includes selective elements from the water quality analysis and data collected under the comprehensive water quality monitoring effort conducted under the KHSA Interim Measure 15 program. The Interim Measure 15 program was developed specifically to inform water quality analysis related to dam removal, is readily available on PacifiCorp's Klamath Hydroelectric Project website[2], and is annually updated. All of the Interim Measure 15 data is being provided electronically to the State Water Board with these comments.
- The aquatic resources section does not include up-to-date information relating to the status of the Coho Salmon population in the upper Klamath River. Specifically, there is no mention of the annual reports prepared for Iron Gate Hatchery, the Scott River, Shasta River, or Bogus Creek, or the results of Coho spawning surveys on the tributaries between Iron Gate dam and Portuguese Creek which PacifiCorp has been conducting annually since 2015 (see CDFW 2018a, 2018b; Knechtle and Giudice 2018b; MKWC 2016, 2017, 2018; Chesney and Knechtle 2017; Knechtle and Chesney 2017).
- It is not clear if the data regarding cultural resources potentially affected by the Proposed Project was updated to reflect the field work conducted by the KRRC over the last 2years.
- The recreational use data cited in the DEIR is from 2007, while the Definite Plan provided by the KRRC (see DEIR Appendix B) provides data from 2015. Similarly, use data for whitewater boating used in the DEIR is from 2011 or 2007 when annual data is readily available from the Bureau of Land Management.

- **Modifying Language Contained Throughout the DEIR May be Interpreted as Bias towards Certain Outcomes and Conclusions.** The DEIR presents information that is misleading, based on opinion without adequate factual or technical support, may be interpreted as suggesting a bias towards certain outcomes and conclusions, and fails to adequately inform the public and decision-makers about the environmental consequences of the Proposed Project. This conflicts with CEQA's policy that EIRs "provide decision makers with information that enables them to make a decision which intelligently takes account of environmental consequences" (14 Cal. Code Regs. § 15151). CEQA requires that an EIR contain facts and analysis, not just an agency's bare conclusions or opinions (*Citizens of Goleta Valley v. Board of Supervisors* (1990) 52 Cal. 3d 553, 568), and should, when looked at as a whole, provide a reasonable, good faith disclosure and analysis of potential environmental impacts (*Laurel Heights Improvement Ass'n v. Regents of Univ. of Cal.* (1988) 47 Cal. 3d 376; *California Oak Found. V. Regents of Univ. of Cal. (2010)* 188 Cal. App. 4th 227, 269)). An EIR must state the bases for its findings; a bare conclusion regarding an environmental impact without an explanation of its factual and analytical basis is not sufficient (*Laurel Heights, supra* at 404; *Whitman v. Board of Supervisors* (1979) 88 Cal. App. 3d 397; *People v. County of Kern* (1974) 39 Cal. App. 3d. 830, 841; *see also* 14 Cal. Code Regs. § 15151).

[2] http://www.pacificorp.com/es/hydro/hl/kr.html.

A non-exhaustive list of examples of this problem include:

- In the discussion of screening criteria for chemical contamination, the ecological and human health-based screening levels are intermingled, and it is impossible to tell which is being discussed (DEIR pg. 3-42).
- The DEIR references the "current degraded condition" without specifically defining what degraded means or analyzing the meaning or significance of the term (DEIR pg. ES-24).
- The DEIR dismissively states that "...some commenters indicated their belief that the Lower Klamath Project reservoirs improve water quality by serving as a sink for phosphorus..." (DEIR pg. 3-14). The fact that Copco and Iron Gate reservoirs are nutrient sinks is not a belief; but rather a fact that the DEIR acknowledges on page 3-27 (*See also* Kann and Asarian 2007; Asarian and Kann 2005; Asarian et al. 2009). The DEIR provides no analysis of the potential impact of increased nutrient delivery to the Klamath River downstream of Iron Gate Dam, or, importantly, to the estuary after the reservoirs are drawn down.
- The DEIR states that "[o]n an annual basis, the majority of nutrients entering a reservoir from a watershed are eventually discharged downstream, with only a small fraction being retained in the reservoir sediments" (DEIR pg. 3-20). The "only a small" modifier is unsubstantiated and unexplained, and should be replaced with the actual quantity of retention in both the percent of annual loading and mass (in tons).
- The DEIR states that "[s]tress associated with high water temperatures can make cold water species more vulnerable to disease and parasites, and have been associated with fish kills in the Klamath River downstream of Iron Gate Dam during low flow periods in late summer..." (DEIR pg. 3-236). This sentence misconstrues the effects of Iron Gate Dam on water temperature and incorrectly relates the existence of Iron Gate Dam to fish kills in the Klamath River. Taken individually, the various components of this sentence are true: warmer water does make fish more susceptible to disease, disease and parasites have been associated with fish kills in the Klamath River, and the fish kills have occurred downstream of Iron Gate Dam. However, this information is presented in a way to lead the reader to believe that Iron Gate Dam has resulted in fish kills, which is incorrect. Analysis of the 2002 fish kill does not specifically attribute effects from Klamath Hydroelectric Project facilities on the key factors considered to have caused the fish kill (i.e., large returns of Chinook, low flows, warm water temperatures, the pathogens *Ichthyophthirius* and *Columnaris*) over 150 miles downstream of Iron Gate Dam (CDFG 2004).
- Regarding gravel augmentation downstream of Iron Gate Dam per the Coho Habitat Conservation Plan, the DEIR (pg. 3-235) states that "...details on the extent of downstream movement have not been reported." This statement implies monitoring of gravel placed into the Klamath River was a requirement of the project that was not met. However, downstream movement monitoring was not a requirement of the project, although mobilization of the gravel from its placement site has been reported consistent with the project objectives and gravel monitoring plan established for this work.
- Regarding populations of polychaetes, the DEIR (pg. 3-242) states that "abundant polychaete populations that are found in atypically stable habitats." Polychaetes are

found in stable and unstable stream habitat and there is nothing atypical about either of these habitat types.

- **The DEIR Should Propose Enforceable Mitigation for Significant Environmental Effects.** The DEIR states that some mitigation measures are outside the State Water Board's regulatory reach but that they expect "…that the KRRC may agree to implement certain mitigation measures through good neighbor agreements or other legally enforceable mechanisms…" (DEIR pg. 3-2). An EIR must "propose and describe mitigation measures to minimize the significant environmental effects identified" (Pub. Res. Code §§ 21002.1(a), 21100(b)(3); 14 Cal. Code Regs § 15126.4), and mitigation measures adopted by the agency must be fully enforceable through permit conditions, legally enforceable agreements, or other measures (Pub. Res. Code § 21081.6; 14 Cal. Code Regs. § 15126.4(a)(2); see also Pub. Res. Code §§ 21002.1(a), 21100(b)(3); 14 Cal. Code Regs § 15126.4; …" *Tracy First v. City of Tracy* (2009) 177 Cal. App. 4th 912, 937).

  Additionally, the DEIR concludes that numerous impacts of the Proposed Project are significant and unavoidable, but lacks a consistent discussion regarding why mitigation is not feasible or why an impact is considered unavoidable. The DEIR should set forth the bases for its findings on a project's environmental impacts, and contain an explanation of the reasoning and evidence supporting the DEIR's impact findings (*Association of Irritated Residents v. County of Madera* (2003) 107 Cal. App. 4th 1383; *Napa Citizens for Honest Gov't v. Napa County Bd. of Supervisors* (2001) 91 Cal. App. 4th 342, 359).

  A non-exhaustive list of examples of the problems presented above include:

  - Recommended, but non-enforceable, mitigation measures are explicitly called out in Section 3.5 Terrestrial Resources in Recommended Measures TER-1 through TER-12; Section 3.17 Public Services in Recommended Measure PS-1; Section 3.22 Transportation and Traffic in Recommended Measure TR-1.
  - Mitigation Measure WSWR-2, which requires the KRRC to relocate the City of Yreka's water supply pipeline, may have environmental effects of its own that are not analyzed in the DEIR (beyond a brief discussion of construction-generated noise and vibration) per the requirements of Pub. Res. Code Regs. § 15126.4(a)(1)(D).
  - In Section 3.11 Geology, Soils, and Mineral Resources, Mitigation Measure GEO-1, requires the KRRC to monitor slopes and implement any necessary slope stabilization measures (including roads, structures, etc.). Slope stability for water quality protection may be within the State Water Board's jurisdiction, but roads, structures, and other infrastructure are clearly outside the State Water Board's jurisdiction.
  - In Section 3.12 Historical Resources and Tribal Cultural Resources, Mitigation Measures TCR-6, TCR-7, and TCR-8 are clearly beyond the State Water Board's ability to enforce.
  - In Section 3.17 Public Services, Potential Impact 3.17-1 is listed as being potentially significant and unavoidable with mitigation, yet no mitigation is included in the DEIR (DEIR pg. 3-913 to 3-915).
  - Examples of significant and unavoidable impacts that do not include a discussion of potential mitigation measures or any reasoning as to why that mitigation is not feasible include but are not limited to:

- Impacts 3.23-1, 2, 4, 5, and 6 which all relate to noise levels associated with working two shifts during facilities removal. Mitigation would appear to be feasible by simply scheduling work to occur during normal daytime hours, but the DEIR simply calls the impact significant and unavoidable without any reasoning.

- Impact 3.11-5 regarding deposition of sediment downstream of Iron Gate Dam provides no reasoning for why the impact is considered unavoidable.

- Impact 3.2-3 regarding suspended sediments released by the Proposed Project throughout the Klamath River provides no reasoning for why the impact is considered unavoidable. Mitigation through a slower drawdown or a phased multi-year removal could be considered as a potential mitigation measure to reduce sediment concentrations released into the river.

- Impact 3.2-9 regarding potentially low levels of dissolved oxygen downstream of Iron Gate Dam following removal and release of sediments is categorized as significant and unavoidable with no discussion of potential mitigation. The analysis indicates that reaeration alleviates the impact naturally at points downstream of the Salmon River (RM 65), but does not discuss the possibility of artificial aeration at upstream locations or why this is not feasible.

- **The DEIR Baseline for the Project Is Inconsistent.** Baseline conditions are inconsistently described throughout the Draft EIR. Under CEQA, the baseline must be based on conditions at the time the Notice of Preparation (NOP) for the Proposed Project was issued in 2016 (14 Cal. Code Regs. § 15125(a)). "Environmental conditions must be described as they exist when the notice of preparation is published, or, if a notice of preparation has not been published, at the time the environmental analysis begins" (14 Cal. Code Regs. § 15125(a)). "These existing physical conditions 'will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant" (14 Cal. Code Regs. § 15125(a); see also *Neighbors for Smart Rail v. Exposition Metro Line Constr. Auth.* (2013) 57 Cal. 4th 439, 448; *Communities for a Better Env't v. South Coast Air Quality Mgmt. Dist.* (2010) 48 Cal. 4th 310, 320.)

  A non-exhaustive list of examples of this problem include:

  - In the fish disease discussion (Section 3.3.5.5), the DEIR does not present the effects of routine implementation of Court-ordered disease management flows (i.e., surface flushing, deep flushing, or dilution) as part of the existing conditions (see *Hoopa Valley Tribe v. National Marine Fisheries Service et al.*, 230 F.Supp.3d 1106 (2017)). The DEIR does, however, discuss the effects of these flows on the polychaetes that host *C. shasta*. While these flows are not included in the modeling used in the DEIR (flows, sediment transport, or water quality) and they are not part of the Proposed Project, USBR will be implementing them through the removal period and has proposed surface flushing flows in their Biological Assessment for reconsultation (USBR 2018a).
  - In Section 3.19 Aesthetics, the DEIR misleadingly uses a pre-dam construction baseline to evaluate effects of the Proposed Project and justify a less-than-significant impact to visual resources.

  - In the alternatives analysis, Section 4, the aesthetics analysis consistently uses the pre-dam construction baseline conditions.

- **The DEIR Should Reanalyze the No Project Alternative.** The DEIR's discussion of the No Project Alternative (DEIR Section 4.2) falls short of CEQA's requirement that analysis of the no project alternative give decision-makers a gauge for measuring the environmental advantages and disadvantages of the project and the alternatives to it (*Planning & Conserv. League v. Castaic Lake Water Agency, supra*, 180 Cal. App. 4th at 247).

  An EIR's discussion of alternatives to a project must include a no project alternative, including an analysis of the impacts of that alternative. The purpose of discussing the no project alternative is to allow the public and agencies to compare the environmental impacts of approving the proposed project with the effects of not approving it (14 Cal. Code Regs. § 15126.6(e)(1)). "The no-project alternative is a fact-based forecast of the environmental effects of maintaining the status quo" (*Planning and Conserv. League v. Castaic Lake Water Agency* (2009) 180 Cal. App. 4th 210, 247). Also the no-project alternative allows decision-makers to compare impacts of a proposed project with impacts of no project (*Mira Mar Mobile Community v. City of Oceanside* (2004) 119 Cal. App. 4th 477) and is necessary to provide decision-makers and public with basic information on impacts of project (*Planning & Conserv. League v. Department of Water Resources* (2000) 83 Cal. App. 4th 892, 917).

  A non-exhaustive list of examples of this problem include:

  - The DEIR indicates that the long-term effects of the No Project Alternative are not discussed because they "would be speculative…and would be contrary to the CEQA Guidelines' mandate to discuss and assess the environmental impacts that would 'reasonably be expected to occur in the foreseeable future' " (DEIR pg. 4-15). The DEIR could have assumed that existing operations simply continued into the future making a uniform set of conditions in both the short and long term against which the Proposed Project and the alternatives could have been compared.
  - The No Project Alternative analysis includes analysis of the 2017 Court-ordered flushing and dilution flows. The DEIR should make it clear that this order was directed at USBR and not PacifiCorp's operations. The inclusion in this section of the DEIR is confusing because USBR (2018a) proposed to only include surface flushing flows in their update to their operations that is currently undergoing consultation under Section 7 of the Endangered Species Act, a process that is expected to be complete in 2019, well within the short-term period analyzed in the DEIR. The DEIR does not include operations under a new 2019 USBR BiOp in the short-term No Project Alternative.
  - The hydrology under the 2013 BiOp should have been included in the baseline conditions for the Proposed Project analysis. Using 2013 BiOp flows for the No Project Alternative analysis makes comparisons of this alternative and the Proposed Project inconsistent.

- <u>**The DEIR Should Reanalyze Alternatives**</u>**.** The DEIR does not uniformly to present, discuss, and analyze each of the alternatives, including comparing <u>both</u> short- and long-term effects; therefore, it does not satisfy CEQA's requirement that the EIR provide information sufficient to allow an informed comparison of the impacts of the project with those of the alternatives (*Kings*

County Farm Bureau v. City of Hanford (1990) 221 Cal. App. 3d 692, 733 [absence of comparative data precluded meaningful consideration of alternatives]). Omitting such a meaningful analysis prevents decision-makers and the public from making informed comparisons between the alternatives and the Project, precluding meaningful public participation (*Laurel Heights, supra.*; *City of Rancho Palos Verdes v. City Council* (1976) 59 Cal. App. 3d 869, 892 [An EIR's analysis of alternatives must be specific enough to allow informed decision-making and public participation; alternatives should be described in sufficient detail to provide information to governmental body that will act and public that will respond through political process]).

A non-exhaustive list of examples of this problem include:

- The Partial Removal Alternative includes a series of detailed tables (DEIR Tables 4.3-1 to 4.3-6) with the recommended eligibility of various Klamath Hydroelectric Project facilities under the National Register of Historic Places. This same information was not provided in the No Project Alternative even though that alternative would result in preservation of these resources.
- The Continued Operations with Fish Passage Alternative includes implementation of the USBR's 2013 BiOp flows. These are not included in the existing conditions or Proposed Project discussions.
- Climate change effects appear to be included in the Continued Operations with Fish Passage Alternative, but not in the other alternatives or the Proposed Project.
- There are no spring-run Chinook Salmon in the Klamath River upstream of the Salmon River. It is unclear why the alternatives evaluate the impacts to a species that does not occur (e.g., DEIR pg. 4-140).
- While Table ES-1 presents an alternatives comparison of sorts, not all of the alternatives are evaluated for every impact.

- **DEIR Reliance on Total Maximum Daily Load (TMDL) Modeling and Data Approaches Requires Additional Explanation.** The DEIR relies on the flawed TMDLs from Oregon and California without providing a reasonable explanation supporting its TMDL analysis, nor does it adequately summarize the substantial body of technical information discrediting the TMDL modeling approach, nor does the DEIR provide any other substantial evidence supporting the use of the TMDL in the DEIR. As it relates to the TMDL, the DEIR does not fulfill CEQA's requirement that the EIR summarize the main points of disagreement when experts disagree about data or methodology (14 Cal. Code Regs. § 15151). A lead agency may choose among differing expert opinions as long as the EIR identifies arguments correctly and in a responsive manner (*Browning-Ferris Indus. v. City Council* 1986, 181 Cal. App. 3d 852) which the DEIR fails to do. An impact analysis that fails to explain major discrepancies in critical data may be legally inadequate in the absence of evidence supporting the EIR's discussion or resolution of the conflict (*Preserve Wild Santee v. City of Santee* (2012) 210 Cal. App. 4th 260).

  For example, the DEIR relies extensively on the TMDLs for both Oregon and California reaches of the Klamath River. The State Water Board should be aware that the 2010 temperature TMDL in Oregon (ODEQ 2010) was withdrawn by Oregon Department of Environmental Quality (ODEQ 2015), does not represent the best available information upon which to base the DEIR analysis, and therefore should not be used to set conditions in the Klamath River at the state line. This

2010 temperature TMDL was withdrawn because it was based on modeling that contained substantial errors which, along with other technical deficiencies, overstated the Klamath Hydroelectric Project's effects on water temperatures in the river, and did not accurately account for natural pollutant loadings and processes (Campbell 2011). An updated version of the nutrient Upper Klamath and Lost River Subbasin TMDL (ODEQ 2018) was released for public comment in mid-2018 and a final version in January 2019 (ODEQ 2019). PacifiCorp understands that a revised temperature TMDL for the Oregon portions of the Klamath River may be complete in Fall 2019.

The California TMDL modeling results are not an appropriate basis for comparing alternatives. PacifiCorp has previously documented substantial technical flaws with the assumptions, modeling, and analyses used in development of the California TMDLs. PacifiCorp's position that the compliance scenarios, technical analysis, and modeling supporting the California Klamath River TMDL are flawed was presented during the development of the TMDL and is contained in PacifiCorp's Petition for Writ of Mandate filed to challenge the same (*PacifiCorp v State Water Resources Control Board*, 2011, case 34-2011-80000769). PacifiCorp's legal challenge has not been resolved, and is currently stayed.[3]

- **The DEIR Lacks Sufficient Analysis of Regional Power Supply in the Utilities Section.** The DEIR fails to describe the baseline condition concerning electric utilities and power generation provided by the Klamath Hydroelectric Project, which violates CEQA's requirement that an EIR describe the existing environment in the vicinity of the project from both a local and regional perspective (14 Cal. Code Regs. § 15125(a)). The DEIR does not describe the potentially significant impacts associated with removal of the dams and associated power transmission facilities on electricity service in the region, which violates CEQA's requirement that the EIR identify and describe a proposed project's significant environmental effects (Cal. Pub. Res. Code § 21100(b)(1); 14 Cal. Code Regs. § 15126.2(a)). The DEIR also fails to comply with CEQA's requirements by failing to evaluate potentially significant energy implications of a project (CEQA Guidelines Appendix F (II); Pub. Res. Code § 21100(b)(3)). The environmental impacts to be evaluated in an EIR include (but are not limited to): 1) the project's effects on local and regional energy supplies and on requirements for additional capacity; 2) the project's effects on peak- and base-period energy demands; and 3) the project's effects on energy resources (CEQA Guidelines, Appendix F (II)).

  The DEIR does not describe the baseline condition concerning electric utilities, the power generated by the Klamath Hydroelectric Project, or the impacts associated with removing those dams and associated power generation and transmission facilities on electricity service in the region. In the DEIR, Section 3.18 Public Services and Utilities, should contain a complete description about the ability to deliver utilities, including electricity. While the Proposed Project likely will not result in new need for local power generation, it will eliminate existing power sources at the hydroelectric dams, and remove local generation resources that provide power in an area without significant generation resources. The impact analysis should address the

[3] PacifiCorp does not waive, and expressly preserves, its legal challenge to the California TMDL and TMDL models, and preserves its rights to challenge TMDL implementation plan measures and conclusions regarding the Klamath Hydroelectric Project's effects on water quality in other proceedings.

removal of these utilities, how those utilities will be replaced, and the impacts of that replacement. Because the DEIR fails to do so, it does not satisfy CEQA's requirements.

- **The Application of the DEIR's Significance Criteria Is Inconsistent.** The DEIR attempts to define significance criteria for each resource area in the DEIR. While this is generally accomplished, the actual definitions are subject to reasonable differing interpretation and, in places, the definitions even contradict each other. CEQA requires that a threshold of significance be an identifiable quantitative, qualitative, or performance level of a particular environmental effect (14 Cal. Code Regs. § 15064.7(a); *Protect the Historic Amador Waterways v. Amador Water Agency* (2004) 116 Cal. App. 4th 1099, 1107). Inconsistent and insufficient definitions also creates the issue of misapplication of the thresholds of significance. CEQA requires that the EIR consider evidence of potential significant environmental effects, and therefore; a threshold of significance cannot be applied in a way that would foreclose the consideration of other substantial evidence tending to show the environmental effect to which the threshold relates might be significant (*Communities for a Better Environment v. California Resources Agency* (2002) 103 Cal. App. 4th 98, 114).

  A non-exhaustive list of examples of this problem include:

  - The term "substantial" or "substantially" is not consistently defined. In Section 3.2 Water Quality, for example, the definition of "substantial" is meaningless (DEIR pg. 3-44) because according to the DEIR "...'substantial'...means the effect on water quality and the support of beneficial uses...is of considerable importance." The DEIR does not define "of considerable importance." This same "of considerable importance" phrase is used in the same manner in Section 3.11 Geology, Soils, and Mineral Resources and is not defined there either.
  - As an example of an improperly applied threshold of significance, the threshold the DEIR identifies that a short-term impact to Coho Salmon is defined as significant if it would "substantially reduce the abundance (greater than 50 percent reduction) of a year class for aquatic species" (DEIR pg. 3-258). This definition ignores the fact that over 50 percent of the Coho Salmon population returns to the Trinity River (Naman and Perkins 2015; Kier et al. 2018) and would be substantially unaffected by the project. This significance definition also has the absurd result that even a complete extinction of the upper Klamath Coho population would not be considered significant. Under *Communities for a Better Environment v. California Resources Agency*, *supra*, 103 Cal. App. 4th 98, the small population of Coho in the mainstem Klamath River upstream of the Trinity River would be substantially impacted, and therefore this impact should be considered significant. This is just one example where the DEIR's significance criteria lack meaningful or adequate definition and application, in contravention of the requirements of CEQA.
  - In Sections 3.5, 3.6, 3.7, 3.9, 3.15, 3.16, 3.17, 3.19, 3.20, 3.21, 3.22, the term "substantial" is used in the criteria, but is not defined.
  - In Section 3.8 Water Supply/Water Rights the term "unreasonable injury" is not defined as it applies to water rights.

- The first criteria in Section 3.5.3 (DEIR pg. 3-514) says that impacts would be considered significant if they "[r]esult in population-level impacts on state species of special concern, USDA Forest Service sensitive wildlife species on USDA Forest Service lands, or BLM sensitive species on BLM lands." The next bullet (DEIR pg. 3-515) states that an impact would be significant if it would "[r]esult in any of the following to the other types of special-status species[112]:[sic] not listed above: direct mortality or physical harm to individuals…". Footnote 112 goes on to define a long list of sources of special status species leaving the reader to attempt to sort out what's to be analyzed at the population level per the first bullet and which could be analyzed at the individual level per the second bullet.

The DEIR Should be Augmented. The DEIR omits inclusion and analysis of significant information critical to an appropriate analysis of the effects of the Proposed Project, much of which is in the existing public record (Pub. Res. Code § 21092.1; 14 Cal. Code Regs. § 15088.5 *[recirculation is generally required when the addition of new information deprives the public of meaningful opportunity to comment on substantial adverse project impacts or feasible mitigation measures or alternatives that are not adopted]*; see *Mountain Lion Coalition v. Fish & Game Comm'n* (1989) 214 Cal. App. 3d 1043 [recirculation required where draft EIR omitted any analysis of cumulative impacts, and a detailed analysis was first provided in the final EIR]; *Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova* (2007) 40 Cal. 4th 412, 447; see also *Laurel Heights Improvement Ass'n v. Regents of Univ. of Cal.* (1993) 6 Cal. 4th 1112, 1129).

The DEIR should analyze substantial information cited in these comments concerning significant effects on water quality, Coho Salmon, fill of Waters of the U.S., and loss of Copco and Iron Gate reservoirs as related to instream flows, substantial changes in periphyton communities, impacts associated with greenhouse gas emissions, and impacts from release of reservoir fish from the Proposed Project, which are not addressed in the DEIR but must be addressed in a recirculated DEIR (14 Cal. Code Regs. § 15088.5(a)(1)).

If new mitigation measures or alternatives are considered in response to comments, the DEIR should be augmented and provided for additional public review and comment (*South County Citizens for Smart Growth v. County of Nevada* (2013) 221 Cal. App. 4th 316, 330); *Laurel Heights Improvement Ass'n v. Regents of Univ. of Cal.* (1993) 6 Cal. 4th 1112; CEQA Guidelines (14 Cal. Code Regs. § 15088.5(a)(3)); In *Spring Valley Lake Ass'n v. City of Victorville* (2016) 248 Cal. App. 4th 91, 108).

Exhibit A – Detailed Comment Table

PacifiCorp's detailed comments on the DEIR, organized to correspond with the DEIR Chapter, page, and paragraph to assist the State Water Board's review of comments are presented on the following pages.

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Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
Executive Summary					
ES.1	Proposed Project	ES-6	Paragraph 1		In the Draft Environmental Impact Report's (DEIR's) impacts and alternatives analyses, "short-term" is variably defined. For example, for analyses of water quality, dam-released sediment, and sediment resupply, short-term is generally defined as 2 years following dam removal (e.g., DEIR pgs. ES-6, 3-44, 3-760, 3-775). For the aquatic resources impact analysis, short-term is defined as less than 5 years following dam removal (e.g., DEIR pg. 3-258). In the alternatives analysis, short-term is considered to be less than 5 years (e.g., DEIR pgs. 4-15, 4-24, 4-26). Correspondingly, long-term is defined as occurring greater than 2 years after dam removal for water quality and sediment resources (DEIR pg. 3-44) and greater than 5 years after dam removal for aquatic resources (DEIR pg. 3-258). These variable definitions pose a dilemma in that long-term water quality and sediment impacts overlap with short-term impacts to fish and other aquatic biota. In the case of water quality and sediment impacts on fish, this overlap underestimates the severity of short-term impacts, particularly as they pertain to fish and other resources. The DEIR does not account for this when evaluating the severity and significance of short-term impacts. This discrepancy will mislead the public and decision-makers about the actual short- and long-term impacts of the Proposed Project across the various environmental resources and alternatives.
ES.2		ES-6	Paragraph 2		The DEIR states "approximately 36 to 57 percent of the total sediment stored in J.C. Boyle, Copco No. 1, and Iron Gate reservoirs by 2021 is expected to be eroded and transported downstream during the drawdown period and the year following dam removal (i.e., short-term), which is equivalent to 5.4 to 8.6 million cubic yards (1.2 to 2.3 million tons)." These eroded volumes estimates are very large numbers that are difficult to put into perspective; it would be helpful for the DEIR to relate the

Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
					eroded volume estimates to the average annual sediment load to provide context. These estimates also indicate that approximately 6.5 to 9.7 million cubic yards of sediments would be retained in the reservoirs after initial reservoir drawdown. The DEIR should address the longer-term effects caused by these retained sediments that could occur during future high flow events.
ES.3		ES-6, 2-60, and other locations throughout the report	Paragraph 2 on ES-6		The DEIR contains the repeated conclusion that the fine sediment predicted to be released during drawdown will be efficiently and shortly transported all the way to the Pacific Ocean. For example, on page ES-6, the DEIR states: "Most of the fine sediment is expected to be transported in suspension to the ocean shortly after being eroded. Fine sediment erosion would result in elevated suspended sediment concentrations downstream of Iron Gate Dam in the short term (Stillwater Sciences 2010, USBR 2012)." For example, on page 2-60, the DEIR states: "Over 80 percent of the reservoir sediments are fine sediment (organics, silts, and clays), which are expected to remain suspended in the Klamath River flow as it moves downstream and out into the Pacific Ocean." For example, on page 2-68, the DEIR states: "Based on estimated annual sediment deposition rates, an approximately 15.13 million cubic yards (4.16 million tons [dry weight]11) of sediment would be present behind the dams by 2020 (USBR 2012c) (Table 2.7-10). Because the trapped sediments consist primarily of organic material (e.g., dead algae), silts, and clays, they would be easily eroded and flushed out of the reservoirs into the Klamath River, and would continue to be suspended in the river downstream to the Pacific Ocean." The notion implied in these statements is highly simplified. Some deposition of fine sediment would occur downstream during high

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					discharges when flows go over-bank and inundate the floodplain – a scenario that could occur during drawdown. In addition, at lower discharges when flows remain in-channel, fine sediment likely would deposit in backwaters, alcoves, side-channel inlets and outlets, and areas along the channel margins. Fine sediment that deposits in backwater areas such as alcoves and side-channels could adversely affect aquatic and riparian biota and habitats and could become remobilized in subsequent high flow events, extending the duration of sediment impacts on aquatic biota. For example, fine sediment can infiltrate spawning gravels and significantly impact spawning success. The DEIR should be revised and recirculated to include this analysis. The transport and deposition of the fine sediment predicted to be released under the Proposed Project is fundamentally important to understanding a wide-range of environmental impacts, both short-term and long-term. Therefore, the DEIR should include a more detailed discussion and supporting numerical or quantitative analysis to document the expected impacts from fine sediment transport and deposition. Analysis of fine sediment transport and deposition downstream of Iron Gate is not included in either of the DEIR's cited references (i.e., Stillwater Sciences 2010 and USBR 2012c). In general terms, the 1-D modeling used in the DEIR's cited references (i.e., Stillwater Sciences 2010 and USBR 2012c) is a computationally efficient means to assess overall sediment loads for many miles of river, over several years, and for multiple scenarios. However, the 1-D modeling has germane limitations in that it cannot simulate the distribution of sediment erosion and deposition in the river, particularly across the channel or in split or side channels. The modeling also assumes that fine sediment would behave as wash load, which by definition is sediment that remains in suspension and does not deposit. However, while the DEIR's cited references (i.e., Stillwater

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					Sciences 2010 and USBR 2012c) intend this as only a simplifying assumption of the 1-D modeling, the DEIR appears to couch this basic modelling assumption as a finding from the model. This is a global comment that applies to all statements which conclude that the fine sediment predicted to be released during the drawdown will be transported to the Pacific Ocean without any discernible deposition in the river reaches downstream of Iron Gate Dam.
ES.4	Phytoplankt on and Periphyton	ES-10			Regarding the Phytoplankton and Periphyton section, there is no discussion of periphyton benefits expected to occur as a result of the Proposed Project such as those to seasonal nutrient uptake and sequestration, photosynthesis, habitat, and food web. Such benefits should be acknowledged (see detailed comments on Section 3.4).
ES.5	Water Quality	ES-12			Regarding the Water Quality section, adverse impacts associated with increased turbidity include burying and scour of aquatic vegetation (e.g., periphyton, macrophytes), which could limit or preclude growth. The resultant effects would include: lack of photosynthesis (oxygen production), lack of nutrient uptake, lack of cover and food for macroinvertebrates, and lack of cover and food for juvenile fish rearing. Such effects should be acknowledged in the DEIR. Additionally, TMDLs have been established for the Klamath River to address nutrient impairment. The removal of Copco and Iron Gate reservoirs, which retain 18 to 21 percent of total nitrogen and 12 to 16 percent of annual phosphorus loading from the Klamath River (PacifiCorp 2006; Kann and Asarian 2005, 2007; Asarian et al. 2009), should be acknowledged in the DEIR as potentially having adverse impacts on Klamath River water quality. The long-term impacts of increased nutrient delivery to the Klamath River downstream of Iron Gate on water quality has not been evaluated in the DEIR. See comments 3.2-53 to 3.2-55 and 3.4-5 below.

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ES.6	Aquatic Resources	ES-12			The loss of production from Iron Gate Hatchery, which contributes a substantial portion of the Tribal, commercial, and sport fishing Chinook salmon harvest, would seem to be an unavoidable adverse impact of the Proposed Project, but this impact is not discussed in the Executive Summary. The contribution of Iron Gate Hatchery to Chinook harvest has averaged about 28,000 per year (California HSRG 2012).
ES.7	Phytoplankton and Periphyton	ES-12			Regarding the Phytoplankton and Periphyton section, there is no reason why growth of periphyton would be restricted to the margins of the stream. Light limitation, which would be the element restricting periphyton growth, is not a restricting factor for much of the growing season in the Klamath River downstream of Iron Gate Dam but can be a factor in the river upstream of Copco Reservoir. Light conditions in aquatic systems are typically characterized based on irradiance values for photosynthetically available radiation (PAR). Light limitation is assumed to occur beneath water depths associated with "onset saturation" values of PAR, which are values that occur when photosynthesis for typical macrophytes and diatoms produces excess oxygen. Onset saturation values in aquatic systems are typically less than about 50 µmol PAR m^{-2} s^{-1} (Kirk 1994). Previous PAR measurements in the Klamath River have been used to calculate light extinction coefficients (PacifiCorp 2004a, 2014), which can then be used to calculate the depth of water where onset saturation occurs. The approximate range of light extinction (Ke) measurements are 0.5/m to 1/m in the Klamath River downstream of Iron Gate (see graph below). Based on this Ke range and a maximum PAR intensity of 1800 µmol PAR m^{-2} s^{-1} (measured) at the water surface, the saturation compensation value of 50 µmol PAR m^{-2} s^{-1} (per Kirk 1994) is reached at depths of about 11 to 20 feet. The vast majority of the Klamath River downstream of Iron Gate Dam

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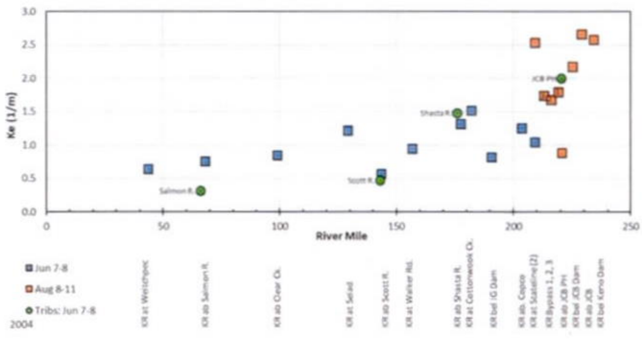
					is less than 11 feet in depth during the growing season. This indicates that light is generally not limiting periphyton growth in the Klamath River downstream of Iron Gate Dam. By comparison, the approximate range of Ke measurements are 1.0/m to 2.5/m in the Klamath River upstream of Copco Reservoir (see graph below). This higher range of Ke measurements is attributable to the large organic loads contributed to the upper river by Upper Klamath Lake (PacifiCorp 2004a, 2014). Based on this Ke range, the saturation compensation value is reached at depths of about 5 to 11 feet. The depth of the Klamath River upstream of Copco Reservoir is more variable, with an appreciable portion is 5 to 11 feet or more in depth during the growing season. This indicates that light is likely limiting periphyton growth in many areas of the Klamath River upstream of Copco Reservoir. 

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Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
ES.8	Alternatives to the Proposed Project No Project Alternative	ES-16	Paragraph 4		The DEIR states "efforts aimed at meeting Klamath River total maximum daily loads (TMDLs) are not analyzed for the short term under No Project Alternative because the basin response to the restoration measures to meet the TMDLs during the short term is too speculative." The DEIR is not clear in this section or elsewhere in the document whether and how the TMDLs are relied upon for analysis of short-term impacts for other alternatives. The DEIR also does not include a specific single location in the document where the rationale, assumptions, and approach for long-term impacts using the TMDLs are described.
ES.9		ES-26	Header row	Table ES-1	If the impacts are increasing in severity toward the right of the table, Significant and Unavoidable should be the final column. Switch the final two columns and indicate when there is no feasible mitigation for a specific impact.
ES.10		ES-59	Third row	Table ES-1	The coding of long-term Potential Impacts 3.17-2 (Public Services) as significant and unavoidable with mitigation does not match the significance statement on page 3-919 (significant and unavoidable). The coding in Table ES-1 appears correct because the text on page 3-919 indicates that even with mitigation response time would increase, and any additional response time is defined as significant on p 3-916.
ES.11		ES-51		Table ES-1	The potential impacts 3.10-1 and 3.10-2 contained in Table ES-1 related to Greenhouse Gas Emissions do not acknowledge the emissions impacts of removing hydroelectric generating resources that are qualified renewable resources under the California Renewal Portfolio Standard. Previous environmental analysis of potential removal of the Klamath Hydroelectric Project dams have evaluated a range of emissions impacts. FERC (2007) estimated an increase in carbon emissions impacts of removing the four Klamath dams to range between 68,600 and of 106,330 metric tons of carbon per year (FERC 2007, Table 4-8) while the Department of the

Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
					Interior (DOI) and California Department of Fish and Wildlife (CDFW) (2012) estimated that removal of the hydroelectric facilities would result in an increase in regional emissions impacts from potential dam removal ranging between 341,539 to 396,575 metric tons of carbon dioxide equivalent ($MTCO_2e$; see Tables 3.10-6 and 3.10-7 in DOI and CDFW 2012) assuming PacifiCorp attains the California Renewable Portfolio Standard of 33 percent renewable energy in 2020. The DEIR fails acknowledge the emissions impacts related to dam removal and only evaluates the increased emissions impacts related to dam deconstruction activities. However, the DEIR does state that removing the reservoirs would reduce methane emissions from the reservoirs. It is inconsistent for the DEIR to describe the potential for reduced methane emissions from Klamath Hydroelectric Project reservoirs – emissions which have never been documented and that FERC (2007) described as "speculative" – while failing to acknowledge or even attempt to quantify the emissions increase that will result from dam removal. The Klamath Hydroelectric Project generates carbon-free energy that can power the equivalent of approximately 70,000 homes. The Klamath Hydroelectric Project also provides voltage support, dependable capacity necessary to meet planning reserve and reliability standards mandated by the North American Energy Reliability Corporation. The Klamath Hydroelectric Project also provides ancillary services such as spinning reserve and voltage support that contribute to the reliability of the transmission system that cannot be entirely replaced through renewable energy resources. PacifiCorp will need to rely on the remainder of its generation fleet and market purchases to make up power lost from the Klamath Hydroelectric Project, and those sources, while increasingly renewable, have higher emissions than the Klamath Hydroelectric Project. The DEIR should be revised and recirculated to evaluate these impacts.

Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
ES.12		ES-64 and ES-65	Various rows	Table ES-1	Potential impacts 3.22-1 through 3.22-6 (Transportation and Traffic) should be coded as Significant and Unavoidable because the State Water Resources Control Board (State Water Board) cannot ensure implementation of that mitigation.
ES.13		ES-53 to ES-56		Table ES-1 (related to Historical Resources and Tribal Cultural Resources)	This table of potential impacts shows no quantified data associated with each alternative, study area, or resource type (e.g., tribal, historic period archaeological, historic built environment) that allow for an effective comparison between alternatives and the Proposed Project. The numerous cultural resources studies previously conducted for the Klamath Hydroelectric Project identified tribal cultural resources, historic-period archaeological resources, and historic built environment resources using records searches, surveys, and consultation with tribes and local agencies. As-yet identified resources certainly will be found during future phases of the Proposed Project; however, known quantifiable data should be shared in the DEIR as a way to effectively compare alternatives and the Proposed Project while preserving the confidential nature of that data.
Section 2 Proposed Project					
2.1	2.0	All			We recommend referencing the USBR hydrology, hydraulic, and sediment transport study as 2011 even though an errata was issued in 2012. U.S. Bureau of Reclamation (USBR). 2011. Hydrology, Hydraulics and Sediment Transport Studies for the Secretary's Determination on Klamath River Dam Removal and Basin Restoration, Technical Report No. SRH-2011-02, including Jan 2012 errata. Prepared for Mid-Pacific Region, Bureau of Reclamation, Technical Service Center, Denver, Colorado.
2.2	2.3	2-8		Table 2.3-1	Neither J.C. Boyle or Copco No. 1 have functional low-level outlets as indicated on the table.

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Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
2.3	2.6.1	2-20	Paragraph 6	1998 Entry	Lost River and Shortnose suckers were listed in 1988 (53 FR 27130) not 1998 as listed in the text.
2.4	2.6.1	2-21	Paragraph 7	Second 2010 Entry	The DEIR states that the Klamath Tribes have experienced their 92nd year without access to salmon yet provides no supporting evidence for this point. This year count does not correspond to the completion date for Copco No. 1 in 1918 which did block fish passage.
2.5	2.6.1	2-20 to 2-22			The timeline (in Section 2.6.1) is incomplete in terms of it missing any PacifiCorp actions (like the issuance of the original Project license in 1954, relicensing application in 2004, implementation of a Habitat Conservation Plan (HCP) for Coho salmon in 2014, the use of reservoir storage to benefit USBR irrigators and river flows in 2014 and 2018), and so on. There is also no mention of water quality issues and cyanobacterial blooms in Upper Klamath Lake that will persist following potential dam removal.
2.6	2.6.3	2-22	Paragraph 9 (first full after list)		The second half of this paragraph has no bearing on the content of the DEIR and should be removed.
2.7	2.6-3	2-23-24	General Comment		While basically accurate, this discussion omits mention of the current FERC status. The text should clarify that at this time, PacifiCorp is still the sole owner of the entire Klamath Hydroelectric Project and that FERC has not acted on the transfer request let alone the surrender request. Significantly, FERC has not yet evaluated the Definite Plan (presented in DEIR Appendix B) or conducted analysis in accordance with the National Environmental Policy Act (NEPA) to determine if the Definite Plan should be modified to reflect dam safety concerns or mitigate potential environmental impacts.

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Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
2.8	2.7	2-27		Table 2.7-1	Using the term 'Dam Removal Year 1' to refer to Proposed Project actions that occur before dams are actually removed is confusing to the reader.
2.9	2.7	2-29	Paragraph	Figure 2.7-1	This figure oversimplifies the relationship between reservoir drawdown and the fish life cycles on the Klamath River. Based on the other information in the DEIR, suspended sediment loads could extend well through the spring following drawdown yet the figure limits this to early March for Copco No. 1 and Iron Gate reservoirs. This is misleading. Also, this figure is missing Eulachon, an anadromous and ESA-listed species found in the lower Klamath River. Coho adult migration may end in December at Iron Gate Dam, but in the tributaries downstream of Iron Gate Dam it can extend into early January (MKWC 2015, 2016, 2017). Why is there a * for Copco 1 which according to the footnote means "No significant release of sediment expected" yet there is no information presented to support this assertion?
2.10	2.7.2	2-54	Paragraph 2		The Proposed Project includes the cessation of power generation at Copco No. 1 in fall 2020. As per Section 7.3.3 of the Klamath Hydropower Settlement Agreement (KHSA), cessation of generation before December 31, 2020, requires that additional value to customers be identified. Unless that is included, the Proposed Project should be revised to accurately reflect the requirements of the KHSA. Operations of Copco No. 2 following drawdown of Copco No. 1 are unclear from the Proposed Project discussion in the DEIR. PacifiCorp would not continue to attempt to operate Copco No. 2 after drawdown of Copco No. 1. Once the sediment from Copco Reservoir begins to mobilize, operations of Copco No. 2 would not be feasible.
2.11	2.7.2	2-57	Paragraph 4		The discussion of operations of the low-level outlets seems to have gotten confused with the spillways. Presumably once reservoirs are drawn down,

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					there would be no complete refill such that the spillways at Iron Gate or Copco dams could be activated.
2.12	2.7.2	2-57	Paragraph 5		Once Iron Gate Reservoir is below the spillway elevation, the only way to pass water out of the reservoir is through the turbine, bypass valve at the turbine, or the low-level outlet. The powerhouse will be offline and unavailable and the spillway will be well above the water surface elevation. It is unclear from this paragraph what the intent is, but the facilities would not be able to spill this water and so inflow greater than the capacity of the low-level outlet would accumulate in the reservoir. The list of flood capacities seems inappropriate and does not include March-May which includes the peak snowmelt period.
2.13	2.7.2	2-58	Paragraph 1		This paragraph has the same flow control issues as the one on the previous page (see comment 2.12). With J.C. Boyle Powerhouse offline, use of the power intake and the power canal to move water would require use of the emergency spillway which seems unlikely. The DEIR also fails to consider the possibility of flood flows during spring when snowmelt is most likely. J.C. Boyle Reservoir would be drawn down by mid-March like the rest of the reservoirs.
2.14	2.7-2	2-58	Paragraph 2		The DEIR states that "Release flows would add water to the otherwise existing flows in the river (i.e., Keno Reservoir releases and tributary inflows)." This is true, but if the Klamath River Renewal Corporation (KRRC) is releasing water from Copco and Iron Gate reservoirs as part of drawdown, PacifiCorp expects that USBR will release the minimum necessary to achieve biological opinion (BiOp) target flows at the Iron Gate U.S. Geological Survey (USGS) gage and not release anything above the absolute minimum from Keno Dam to J.C. Boyle Dam. All that extra water would be retained in Upper Klamath Lake by USBR for other uses.

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2.15	2.7-3	2-60	Paragraph 2-3	Figures 2.7-7 to 2.7-9	The DEIR does not include any of the 2017 reservoir sediment boring data collected by the KRRC.
2.16	2.7.3	2-60	Paragraph 2		The DEIR states that 80 percent of the reservoir sediment is composed of fine sediment but other references in the DEIR (e.g., Stillwater Sciences 2010, USBR 2012c) say the value is 85 percent.
2.17	2.7.3	2-60	Paragraph 2		This section of the DEIR should include a discussion of how the sediment size classes are distributed spatially within the reservoir and what impact that spatial variability has on the mobilization of the respective sediment classes during drawdown. For example, larger particles are often preferentially located at the head of the impoundment and these head areas will be the first areas exposed to steeper water surface slopes and increased bed shear stress during the drawdown.
2.18	2.7.3	2-62 to 64		Figures 2.7-7 to 2.7-9	The figures in the DEIR showing sediment depths should be updated to reflect data collected by the KRRC during studies to support removal, including detailed bathymetric mapping and additional geotechnical investigations. This would help address the "uncertainty in sediment volume estimates" (DEIR pg. 2-65).
2.19	2.7.3	2-65	Paragraph 1		The DEIR states that "Whether the actual reservoir sediment volumes are on the higher end or the lower end of the uncertainty estimate, the dam removal approach and the significance of potential impacts due to sediment transport during reservoir drawdown would remain the same." The DEIR should explain why the significance of potential impacts associated with downstream sediment transport during the drawdown is unrelated to the total volume predicted to be transported. This conclusion appears tied to the DEIR's incorrect assumption that fine sediment released during the drawdown would remain in suspension in the 190-mile-long reach downstream of Iron Gate Dam to the Pacific Ocean (see

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					Major Issue 2.4 and comment 3.5-8). However, some fraction of the total fine sediment load will settle out in the riverine system, such as on the channel margins, back waters, pools, or point bars. Therefore, it follows that the magnitude of the impact would be directly related to the volume of sediment estimated to transported downstream.
2.20	2.7.3	2-65	Paragraph 3		The DEIR states "Sediment jetting would be focused in the six areas where restoration actions are proposed within the Copco No. 1 Reservoir footprint (Figure 2.7-11) and the three areas where restoration actions are proposed within the Iron Gate Reservoir footprint (Figure 2.7-12)." It is not clear from the referenced figures where sediment jetting will occur as these areas are not called out in the figures.
2.21	2.7.3	2-65	Paragraph 3		Sediment jetting was not included in the modeling conducted by USBR (2012). The DEIR needs to explain how this activity would affect suspended sediment concentrations and should be discussed to determine if sediment jetting will increase the amount of sediment mobilized from the reservoirs, which could presumably increase the magnitude and/or duration of sediment impacts downstream.
2.22	2.7.3	2-66	Paragraph 4		The DEIR states "A faster drawdown rate would reduce the time of interaction between the flow and reservoir sediment deposits, thus reducing the overall amount of sediment erosion, whereas a slower drawdown rate would increase the time of interaction between the flow and reservoir sediment deposits, thus increasing the overall amount of sediment erosion. It is expected that increasing the previously modeled maximum drawdown rate of 2.25 to 3 feet per day (USBR 2012c) to the Proposed Project maximum drawdown rate of 5 feet per day (Appendix B: Definite Plan – Appendix P) would slightly decrease the total amount of sediment erosion that occurs during drawdown."

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					The DEIR needs to clarify the basis for this stated conclusion. As written, this statement is an oversimplification of a complex set of interrelated forces. A faster drawdown rate might reduce the duration of direct erosion, but it might increase the rate of erosion resulting from the steeper water gradient (higher velocities) and increase the probability of slump failures due to increased pore-pressure. In addition, the numeric model used in the DEIR does not account for erosion from slump failures. Therefore, the conclusion in the DEIR that a faster drawdown rate would result in lower total mass erosion is not accurate. Rather, it is possible that a faster drawdown rate would produce higher volumes of eroded sediment.
2.23	2.7.3	2-66	Paragraph 4		The DEIR states "The previously modeled maximum drawdown rate would result in 36 to 57 percent of erosion of the sediment deposit from the reservoirs (Table 2.7-11) and increasing the drawdown rate to 5 feet per day would most likely result in an amount of erosion toward the lower end of the estimated range or slightly lower." See the comment 2.22 above regarding effects of drawdown rates on potential erosion. These eroded volume estimates are very large numbers that are difficult to put into perspective; it would be helpful for the DEIR to relate the eroded volume estimates to the average annual sediment load to provide context. These estimates also indicate that approximately 6.5 to 9.7 million cubic yards of sediments would be retained in the reservoirs after initial reservoir drawdown. The DEIR should address the longer-term effects caused by these retained sediments that could occur during future high flow events.
2.24	2.7.6.1	2-77 2-78	Paragraph 4, 1		According to the KHSA, PacifiCorp is to provide funding for up to 8 years of operations of Iron Gate Hatchery following decommissioning. What

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					happens to the hatchery after that period of time is unclear, but it is speculative to assume that it would cease to function entirely.
2.25	2.7.6.1	2.78	Paragraph 2		The auxiliary trap at the Iron Gate Hatchery already exists. While there is other construction work proposed to occur at the hatchery, there is no new construction for this item.
2.26	2.7.6.1	2.78	Paragraph 3		It would appear that there is not enough water to operate Iron Gate Hatchery during certain months of the year (in both spring and fall) and the DEIR does not propose a viable alternative. The DEIR says that recirculation and early release 'would be studied' to see if they meet the goals. Early smolt releases would have an effect on overall returns of adult Chinook salmon and should be evaluated as an alternative hatchery operations in the effects analysis. These fish would be smaller than target sizes and may not survive as well as those released later in the season.
2.27	2.7.6.2	2-82	Paragraph 2		The DEIR states that "As Fall Creek Hatchery is part of PacifiCorp's Klamath project...facilities are subject to the terms of any new FERC action for 2082." While the Fall Creek Development (diversions, penstock, powerhouse, tailrace, etc.) are in the FERC license, the Fall Creek Hatchery is not in the current license for the Klamath Hydroelectric Project (P-2082). Reference to any terms and conditions for Fall Creek Development (including the hatchery facilities) is speculative and should be removed from the DEIR.
2.28	2.7.6.2	2-83	Paragraph	Figure 2.7-15	This figure is out of date and does not represent the current proposed improvements at the Fall Creek Hatchery. PacifiCorp's understanding is that the two settling pond locations shown in the inset on this figure were removed from consideration because of cultural resource concerns and that the settling pond is currently planned to go where the figure shows

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					the lower rearing tanks. The DEIR needs to be updated to reflect the actual proposal.
2.29	2.7.7	2-85	Paragraph 1		Similar to the comment on the Fall Creek Hatchery, the DEIR does not accurately represent the Proposed Project, which would limit the upstream distribution of anadromous fish in Fall Creek such that they would not be provided access to either of the areas where the City of Yreka diverts water thereby eliminating the need for updated fish screens.
2.30	2.7.7	2-85	Paragraph 3		Daggett Road bridge gets completely replaced under the Proposed Project. The DEIR references the "...existing timber traffic bridge along Daggett Road... ."
2.31	2.7.8.1	2-89	Paragraph 4-5		Except for the salvaging of overwintering fish from the mainstem Klamath River, AR-2 does nothing to minimize the impacts of high loads of suspended sediments juvenile salmonids migrating from the tributaries. This means that AR-2 is not a true mitigation measure for many of the impacts associated with the Proposed Project.
2.32	2.7.8.3	2-93	Paragraph 4		The DEIR indicates that the KRRC recreation plan is proposing a trail from J.C. Boyle to Iron Gate even though this crosses property that would be retained by PacifiCorp. No easement or easement-related discussions have occurred that would make this a reasonably foreseeable action. PacifiCorp recognizes that the DEIR says that the KRRC "may" provide these recreational opportunities, but inclusion of them in the DEIR misleads the reader into thinking that these are actually proposed. If they are truly proposed, then the DEIR needs to evaluate the impact of constructing, operating, and maintaining these elements of the Proposed Project.
2.33	2.7.8.4	2-95	Paragraph 1		The DEIR says the Proposed Project would alter the 100-year floodplain immediately downstream of Iron Gate Dam but does not explain the cause or the nature of the alteration.

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2.34	2.7.8.4	2-95	Paragraph		There are two concerns with this discussion. First, given that more sediment has accumulated behind the dams since USBR completed their floodplain modeling in 2012 and that material would be moved downstream under the Proposed Project, the DEIR needs to explain why the modeling from 2012 is still accurate. Second, what happens if, after dam removal, FEMA decides that the 100-year floodplain is substantially higher than that generated by USBR in 2012 and there are MORE structures in this zone that should have been protected? Who is responsible for providing flood protection for those additionally at-risk structures? The DEIR also needs to state how was the 0.5 foot (ft) threshold chosen as the level at which flood mitigation was required.
2.35	2.7.8.5	2-95	Paragraph 3		The DEIR states that "The Draft Cultural Resources Plan, submitted with the Definite Plan CITE [sic], describes consultation completed by the date of submission by KRRC and PacifiCorp, acting as FERC's non-federal representatives..." • CITE appears to be a missing citation. • PacifiCorp is only involved tangentially in the consultation process. • The KRRC has been leading this effort and is responsible for all of the material in the Definite Plan including the Cultural Resources Plan.
2.36	2.7.8.6	2-96	Paragraph 2		The Traffic Management Plan represents coordination with the Oregon Department of Transportation, Caltrans, Klamath and Siskiyou counties, and the Oregon State Police/California Highway Patrol. However, the DEIR does not mention whether the Traffic Management Plan represents coordination with local towns, communities, and neighborhoods. These communities will be directly impacted by the Proposed Project and the DEIR should expand the discussion of outreach to include local towns, communities, neighborhoods, citizen's groups, and businesses.

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2.37	2.7.9	2-103		Table 2.7-19	In the first line of this table and footnote #2, the DEIR indicates that the Interim Measures Implementation Committee (IMIC) would continue to function following implementation of the Proposed Project. This is not the case; the IMIC would cease to exist when the KHSA is fully implemented. Additionally, footnote #2 references the Priority List of Projects and funds to be provided by PacifiCorp for water quality projects. Although this is accurate, it should only be attached the table entry for Interim Measure 11; as is noted in PacifiCorp (2018c) this water quality fund would be overseen by a steering committee and while member organizations may be similar to the IMIC, it would not be the IMIC. PacifiCorp has no responsibility to continue any of the interim measures except Interim Measures 19 and 20 past decommissioning.
2.38	2.7.10	2-108	Paragraph 1		The transfer of lands from PacifiCorp's ownership to the KRRC is included in the transfer application for the Lower Klamath Project that is pending before FERC.
Section 3 Environmental Setting, Impacts, and Mitigation Measures					
Section 3.1 Introduction					
3.1-1	3.1.5	3-2	Paragraph 2		The inclusion of the statement "Because CEQA requires analysis of potential impacts and mitigation measures that are outside the State Water Board's regulatory purview for the Proposed Project, this EIR discusses and analyzes the effects of some mitigation measures that would not be enforceable by the State Water Board. It is the State Water Board's understanding that the KRRC may agree to implement certain mitigation measures through good neighbor agreements or other legally enforceable mechanisms (Appendix B: *Definite Plan – Section 1*)" leads to confusion in the document about which of these measures are enforceable by the CEQA lead agency, despite the footnotes, and it would be inappropriate to

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					rely on any speculative agreements as the basis for the DEIR to reduce an impact to less than significant [Pub. Res. Code § 21002.1(b); CEQA Guidelines § 15126.4(a)].
3.1-2	3.1.6	3-4	Paragraph 2		In addition to the topics raised in Major Issue 2.2, the following specific changes should be made to Section 3.1.6: • A description of differences in assumptions and analytical methods used to derive the model results. • Figures and charts should include clear definition of the parameter and time periods presented, including the hydrologic period used. • A complete discussion of why it is sufficient to "bracket the range of 2013 BiOp flows" rather than maintain more comparable and updated probability distributions of flow duration and magnitude. • Specific examples that demonstrate the robustness of the DEIR's assumption that merely bracketing the range of flows is sufficient to assess impacts.
Section 3.2 Water Quality					
3.2-1	3.2.2.1	3-17,3-18	Last paragraph on 3-17, first paragraph on 3-18		The DEIR states "Cold air temperatures and precipitation generally occur from November to March, corresponding to periods of higher flows and colder water temperatures. Warmer air temperatures and drier conditions occur from April to October, corresponding to periods of lower flows and warmer water temperatures." These statements erroneously attribute water temperature conditions solely to air temperature changes. Water temperature responds in a more complex manner to heat exchange associated with meteorological parameters that include solar radiation, relative humidity (or wet bulb or dew point temperatures), wind speed, barometric pressure, as well as air temperature.

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3.2-2	3.2.2.1	3-18 and 3-19	Paragraph 3	Figure 3.2-2	Regarding "River and reservoir water temperatures," the DEIR's general description that cooler water is released from reservoirs in spring and warmer water is released in early fall is not a universal tenet. This description is overly simplistic and does not account for reservoir residence time, stratification, outlet works, operations, and other factors. Regarding Figure 3.2-2, algal toxins should probably not be on this graphic; recommend that the figure use the term "Algae" instead.
3.2-3	3.2.2.1	3-20	Paragraph 1		The DEIR states "Releases of this deeper, oxygen depleted water from the bottom of the reservoir can cause serious problems for downstream fish and other aquatic biota." This statement should include: "…if release waters are not oxygenated through the outlet facilities and/or powerhouse, or through other means." While this statement can be true in general, it does not necessarily apply to the existing Klamath Hydroelectric Project where intakes for the powerhouses are not at the bottom of the reservoir. There is also no evidence that dissolved oxygen has ever been a problem downstream of Iron Gate Dam as is implied in the DEIR. The discussion should more accurately reflect existing conditions.
3.2-4	3.2.2.1	3-20	Paragraph 1		In the discussion of "Reservoir mixing and dissolved oxygen," the DEIR states "In late fall, thermal stratification typically breaks down as the surface water layer cools and wind mixing of the water column occurs. This process is called reservoir turnover (Figure 3.2-2)." This discussion belongs in Section 3.2.2.2 Water Temperature.
3.2-5	3.2.2.1	3-20	Paragraph 2		In the discussion of "Phytoplankton in reservoirs," the DEIR states "This can result in wide daily swings in dissolved oxygen and pH, which is stressful to aquatic biota." The Klamath River is naturally weakly buffered and within both reservoir surface waters and in river waters the pH can vary considerably over a day during summer periods (PacifiCorp 2004a,

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					2014). These pH swings will occur in this weakly buffered aquatic system with or without reservoirs (PacifiCorp 2004a, 2014). The remainder of paragraph 2 (pg. 3-20) focuses on toxin producing algae and toxins. The DEIR should clarify that there are always times or locations where the reservoirs do not have toxin producing algae present. In addition, PacifiCorp has installed and maintained a barrier curtain in Iron Gate Reservoir to segregate surface waters and limit release of phytoplankton to downstream reaches. Although operational refinements and investigations are still going on, work to date indicates that the barrier curtain successfully segregates the surface waters and reduces release of surface waters were most of the cyanotoxins are found (Watercourse 2016; PacifiCorp 2017b).
3.2-6	3.2.2.1	3-20	Last paragraph		In the discussion of "Nutrient cycling in reservoirs and internal loading," the DEIR states "On an annual basis, the majority of nutrients entering a reservoir from a watershed are eventually discharged downstream, with only a small fraction being retained in the reservoir sediments." The "only a small" modifier is biased and should be replaced with the actual quantity of retention in percent and mass (in tons). The magnitude of nutrient retention has been calculated for Copco and Iron Gate reservoirs combined at 12 to 16 percent of the total phosphorus inflow and about 18 to 21 percent of the total nitrogen inflow (PacifiCorp 2006; Kann and Asarian 2007; Asarian and Kann 2005; Asarian et al. 2009). The DEIR states "During reservoir turnover when the stratification breaks down, these nutrient rich waters are mixed throughout the reservoir water column and the nutrients can be released downstream, resulting in a secondary (fall) phytoplankton bloom (which includes blue-green algae)." However, the DEIR does not describe or address the dynamics of destratification in the reservoir, including the fact that Copco 1 and Iron Gate reservoirs are two large reservoirs in series which can affect the

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					turnover of Iron Gate Reservoir depending on conditions in Copco Reservoir. The DEIR suggests that downstream releases of nutrients can lead to phytoplankton blooms in the river. This is undocumented, and late in the year has a low chance of occurring. Complete destratification and a return to isothermal conditions typically occurs in Iron Gate during November or December, which is after the growth season for phytoplankton is over (see PacifiCorp 2014).
3.2-7	3.2.2.1	3-21	Paragraph 3		The DEIR states "Slow transport of water downstream and modified timing and magnitude of river flows can affect the growth of periphyton downstream of hydroelectric dams." Although this statement can be true in the larger-scale and the Klamath Hydroelectric Project reservoirs do impound water, the overall flow rates in the Klamath River are largely unaffected by the hydroelectric dams due to their lack of active storage capacity, with the exception of the peaking reach between J.C. Boyle Powerhouse and Copco Reservoir. Downstream of Iron Gate Dam, flow rates under current operations, particularly during summer periods when periphyton growth occurs, will be similar to those under the Proposed Project because they would continue to be managed by USBR with essentially the same target flow rates (USBR 2018b). Under current operations, periphyton is limited to the river margins, and growth in the inundated river channel is absent due to depth and light limitation. The DEIR states "Natural scouring of periphyton populations can be diminished downstream of large dams due to altered flows and interception of coarse sediment movement by the dam, leading to seasonal occurrence of large periphyton mats that can cause water quality problems and provide abundant habitat for fish parasites." However, the flow rates downstream of Iron Gate Dam under current operations during summer (when much of the periphyton growth occurs) will be similar to

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					those under the Proposed Project. Periphyton colonizes the channel bed after winter flows abate and will extend continuously throughout the river reaches from J.C. Boyle Reservoir to the Iron Gate Dam site following potential dam removal. The DEIR needs to further update this discussion with recent observations from the Klamath Fish Disease Workgroup that the polychaete worms that are the intermediate host for fish parasites are also found in high densities in sand/silt habitat and on boulders (see True et al. 2016). The DEIR should also acknowledge that the Klamath Hydroelectric Project does not meaningfully reduce the magnitude of river flows downstream of Iron Gate Dam that would be necessary to result in periphyton scouring. Prior analysis conducted by USBR shown that river flows will not appreciably change as a result of potential dam removal (USBR 2011) due to the small amount of active storage in the reservoirs. Dam operations can achieve flow variability downstream of Iron Gate Dam to provide biological benefits that can mitigate for potential impacts related to flow modifications. Reservoir storage can also be activated to provide for special flow releases downstream of Iron Gate Dam to mitigate fish disease in the Klamath River as has occurred in recent years (PacifiCorp 2018b). The DEIR states "Periphyton can influence riverine water quality by affecting nutrient cycling and diel (i.e., 24-hour cycle) fluctuations in dissolved oxygen and pH." However, the impact of an additional 30 miles of periphyton and macrophytes on water quality has not been addressed in the DEIR.
3.2-8	3.2.2.2	3-22	Paragraph 2		The DEIR states "While natural diel (24-hour) water temperature variations occur in the river, daily peaking operations at J.C. Boyle Powerhouse (river mile [RM] 225.2) result in an increase in the daily water temperature range in the Bypass Reach because warmer reservoir discharges are diverted around this reach (see also Section 2.3.1 J.C. Boyle Dam Development) and

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					cold groundwater springs enter the river and dominate remaining flows." The DEIR should clarify that bypassing waters around this reach result in a notably cooler river and reduced diurnal range (not increased) because of the dominance of spring inflows in the bypass reach. The DEIR incorrectly states that "At the upstream end of the Peaking Reach, the natural, cold groundwater input into the Bypass Reach, combined with fluctuations in river flow due to hydroelectric power operations in the Peaking Reach also produces an observed increase in daily water temperature range above the natural diel water temperature fluctuations (Kirk et al. 2010)." Peaking flows are derived from water stored in J.C. Boyle Reservoir and are large relative to those likely to exist if the J.C. Boyle Development were not in place and USBR was managing flow releases for salmonids out of Keno Dam. Both factors lead to a diel range that is more attenuated under existing conditions than would occur under a no dams scenario such as the Proposed Project.
3.2-9	3.2.2.2	3-23	Paragraph 2		The DEIR mentions the powerhouse intake barrier curtain in Iron Gate Reservoir installed by PacifiCorp under Interim Measure 11. The principal purpose of the barrier curtain is to segregate surface waters in Iron Gate Reservoir and thereby reduce concentrations of blue-green algae releases to the Klamath River. A byproduct of the curtain is slightly cooler release temperatures (Watercourse 2016; PacifiCorp 2017b). The DEIR concludes that "modest" water quality improvement is possible with the curtain but suggests such improvement would not be adequate to achieve compliance with the Water Quality Plan or Klamath River TMDLs. Aside from PacifiCorp's position that the Klamath River TMDLs are technically flawed (as explained in TMDL-specific comment 3.2-34), the DEIR does not accurately point out that the powerhouse intake barrier curtain in Iron Gate Reservoir installed by PacifiCorp under Interim Measure 11 is a prototype for testing and design refinement. The curtain is

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					not designed and installed, nor is it operated to achieve compliance with the thermal plan included in the TMDL. The DEIR also does not adequately explain or assess the results of the studies conducted on the prototype intake barrier curtain in Iron Gate Reservoir. These studies indicate that the curtain is effective at isolating near-surface waters of Iron Gate Reservoir upstream of the curtain (e.g., Watercourse 2016; PacifiCorp 2017b). Water quality samples, physical measurements, velocity profiles, and field observations of conditions consistently identified that waters of the photic zone, where the majority of blue-green algae occur, were largely isolated to the upstream side of the curtain. Water that ultimately passed under the curtain was drawn from deeper, cooler depths in regions of Iron Gate Reservoir upstream of the curtain. Regarding blue-green algae concentrations, monitoring results indicated reductions in *Aphanizomenon* (97 percent), *Microcystis* (82 percent), microcystin (70 percent), and chlorophyll-*a* (61 percent) occurred downstream of Iron Gate Dam when compared to surface samples collected at a depth of 0.5 meter upstream of the barrier curtain (Watercourse 2016; PacifiCorp 2017b).
3.2-10	3.2.2.2	3-24	Paragraph 2		The DEIR should include a discussion of the magnitude of "relatively low" diurnal temperature range downstream of Iron Gate Dam, and how that range is associated with intake depth in Iron Gate Reservoir.
3.2-11	3.2.2.2	3-25	Paragraph 3		The DEIR states "Water temperatures in the Klamath River Estuary are linked to temperatures and flows entering the estuary, salinity of the estuary and resulting density stratification, and the timing and duration of sand berm formation across the estuary mouth." The DEIR should state that meteorological conditions are a large factor as well. While coastal "fog" and ocean-water input minimizes extreme water temperature much

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					of the time, short duration heat spells (e.g., clear weather in the late summer and early fall) can quickly lead to elevated Estuary temperatures.
3.2-12	3.2.2.3	3-26	Paragraph 3		The DEIR states that the trapping of fine sediments does not appear to be a critical function of the Lower Klamath Project reservoirs with respect to the overall system, citing that only 3.4 percent of the annual sediment load originates from the upper and middle Klamath River. This statement appears intended to demonstrate that the fine sediment load flowing into the reservoirs is nominal relative to the overall basin and thus has little impact to the river system. However, adopting a basin-scale perspective neglects to acknowledge the relative importance of the upstream sediment load at the reach-scale, for example, for the reaches immediately downstream of Iron Gate Dam where the relative proportion of the sediment load that comes from upstream of the reservoirs is nearly 100 percent. The relative proportion of sediment originating from upstream of the reservoir system may only be 3.4 percent for the basin as a whole but may be close to 100 percent of the annual load for the reach immediately downstream of the reservoirs. Therefore, from the reach-scale perspective, the local impact may be more significant.
3.2-13	3.2.2.3	3-26	Paragraph 4		The DEIR does not explain the seasonal periphyton and macrophyte growth on the bed of the Klamath River downstream of Iron Gate Dam, and how that extensive growth contributes to the Klamath River organic matter load. Periphyton and macrophyte growth in the Klamath River is extensive, particularly upstream of the Scott River, where sediment transport frequency is lower. Growth is made possible by nutrients transported downstream from upstream sources including natural geologic nutrients (Shasta River springs, springs downstream of J.C. Boyle Dam, and sources from Upper Klamath Lake and in the Upper Klamath Basin), inputs at Upper Klamath Lake via nitrogen-fixing blue-green algae *Aphanizomenon flos aquae*, and anthropogenic activities along the

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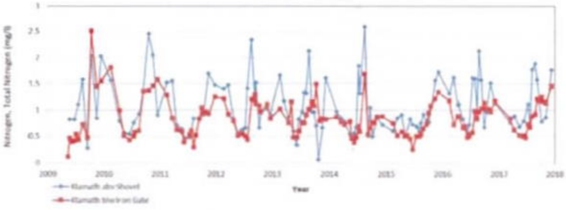
					mainstem (including Upper Klamath Lake and upstream sources) and in tributaries. Periphyton and macrophytes convert bioavailable nutrients to plant biomass, and subsequent senescence yields particulate organic matter to the Klamath River. With removal of the dams under the Proposed Project, the spatial extent of periphyton and macrophytes would increase by approximately 30 miles (from Iron Gate Dam through what is now J.C. Boyle Reservoir). The impacts of this substantial spatial increase in periphyton and macrophytes on water quality are not addressed in the DEIR.
3.2-14	3.2.2.4	3-27	Paragraph 2		The DEIR states "On an annual basis, nutrients typically decrease slightly through the Hydroelectric Reach due to settling of particulate matter and associated nutrients in Copco No. 1 and Iron Gate reservoirs…" However, the critical aspect of the residence time through the reservoirs is absent from this discussion. Using data from KHSA Interim Measure 15 monitoring, the attenuation and lag through Project reservoirs (for example from upstream of Copco Reservoir at the Klamath above Shovel Creek site to downstream of Iron Gate Dam) is apparent. In the data presented below, the annual outflow in total nitrogen was notably less than the annual inflow in total nitrogen. This nutrient loading lag effect is also assessed in PacifiCorp (2006). 

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					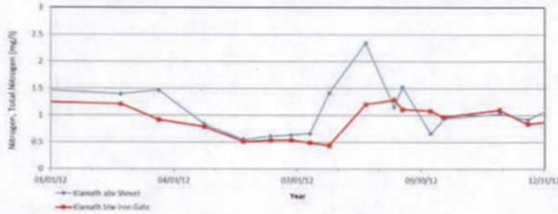 The DEIR states "Seasonal nutrient releases occur during periods of in-reservoir phytoplankton growth, and, in the case of TP [total phosphorus], can also result in downstream transport of bioavailable nutrients to the Lower Klamath River where they can stimulate excessive growth of periphyton (aquatic freshwater organisms attached to river bottom surfaces)." While nutrients sourced from the sediments do occur, the overall concentrations (or loads) are minor compared to the loads conveyed into the reservoirs via the Klamath River. Production occurs year-round, albeit seasonal maxima occurs in the late spring through early fall. While seasonal nutrient release occurs during periods of peak in-reservoir production, this nutrient release coincides with periods of thermal stratification and hypolimnetic anoxia – a necessary condition. However, thermal stratification also impedes mixing of hypolimnetic waters with surface waters (i.e., epilimnion) where the vast majority of primary production occurs. Thus, while nutrient release occurs during the peak primary production period, these nutrients are trapped in the hypolimnion and unavailable to promote surface water productivity. Further, the thermoclines in both Copco and Iron Gate reservoirs associated with seasonal stratification are located downstream of the invert of the intake works at both dams. Thus, little hypolimnetic water is

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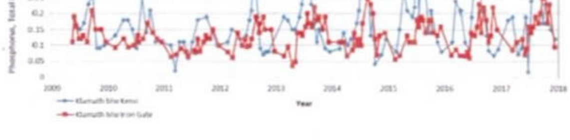
					entrained in the outlet works, and little nutrient enriched water is released to downstream river reaches. The DEIR overstates this contribution and attributes seasonal variations downstream of the reservoir, in part, to this internal loading of the reservoirs. However, the inflowing Klamath River is by far the dominant source of nutrients into these reservoirs. Typical summer flows into (and through) Copco and Iron Gate reservoirs are on the order of 900 to 1,000 cubic feet per second (cfs). Given that Copco and Iron Gate reservoir storages are approximately 40,000 acre-feet and 50,000 acre-feet, respectively, and both stratify seasonally, these flow rates result in residences times of several weeks. Large upstream organic matter and nutrient loads are thus conveyed continuously throughout summer into these reservoirs and having a dominant impact on reservoir water quality (PacifiCorp 2006, 2014). This can be clearly seen in the KHSA Interim Measure 15 data for total phosphorus concentrations at the Klamath River at Keno Dam as compared to the Klamath River downstream of Iron Gate Dam (see below). 
3.2-15	3.2.2.4	3-27	Paragraph 4		The DEIR recognizes that the Copco No. 1 and Iron Gate reservoirs act to retain particulate matter and nutrients on an annual basis but characterizes the resulting decrease in particulate matter and nutrients as

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					"slight." What this modifying adverb actually means in this instance is clearly debatable. A similar use of "slight" or "very small" is used throughout the DEIR when discussing nutrient retention effects of the reservoirs (e.g., DEIR pgs. 3-114, 3-115, 3-117, 3-118, 3-137, 3-431, 3-846). For example, on page 3-117, even after making the unrealistic assumption of full compliance with TMDL load allocations, the DEIR characterizes annual increases in total phosphorus of 10 to 15 micrograms per liter (µg/L) as "very small," when in fact such increases are arguably substantive. Furthermore, on page 3-116, the DEIR states "…TP [total phosphorus] concentrations in the Middle and Lower Klamath River would increase by approximately 2 to 12 percent for the June–October period if the dams were to be removed, while increases in TN [total nitrogen] concentrations would be relatively larger, at an estimated 37 to 42 percent for June through October and 48 to 55 percent for July through September (see Figure 3.2-18)." It is inaccurate to characterize changes in nutrient loading of up to 55 percent as either "slight," "very small," or "relatively larger." In fact, given the large inflowing nutrient loads to Copco Reservoir, particularly the large loads emanating to the Klamath River from Upper Klamath Lake, the substantial net retention provided by Copco and Iron Gate reservoirs (618 and 38 metric tons of nitrogen and phosphorus annually, respectively; Asarian and Kann 2007) is an important process for reducing nutrient loads to the Klamath River downstream of Iron Gate Dam. The DEIR goes on to conclude that the loss of this long-term nutrient retention following reservoir elimination is "No Significant Impact" for the Proposed Project and the other partial dam-removal alternatives (e.g., see Table ES-1). On the other hand, the DEIR describes in several places that Copco No. 1 and Iron Gate reservoirs do not retain but rather release nutrients on a seasonal basis and the DEIR concludes that elimination of this seasonal release would be a "Beneficial Effect" of the Proposed Project

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					and the other partial dam-removal alternatives (e.g., see Table ES-1). This differing characterization of annual versus seasonal nutrient retention in Copco No. 1 and Iron Gate reservoirs is not supported with any analysis and instead represents a bias in which the significance of long-term nutrient retention in the reservoirs is downplayed and the significance of seasonal effects is elevated. Regarding the seasonal effects related to reservoir nutrient retention or release, the DEIR does not adequately explain or account for the substantial variability in these assumed seasonal effects as evident in the calculated input and output nutrient loading values. Moreover, the DEIR's analysis of the reservoirs' seasonal nutrient loading and retention does not adequately explain or account for the hydraulic residence time of water in the reservoirs. The reservoir residence times are considerable, allowing for processes such as decay and settling to occur. These processes are important to recognize and consider when assessing the roles of nutrient retention in the system. If inflow and outflow nutrient conditions are compared for a time interval that is less than water residence and travel time through the reservoirs, it is easy to mistakenly identify the reservoirs as sources of nutrients. For example, as discussed in PacifiCorp (2006), Copco Reservoir inflows may indicate higher levels of total nutrients than Iron Gate Reservoir outflows. However, Iron Gate is actually further reducing the input from Copco Reservoir because of the considerable residence time in Iron Gate Reservoir; that is, total nutrients in Copco Reservoir inflows has been reduced as the "peak" passes through the reservoirs.
3.2-16	3.2.2.4	3-28 3-29	Paragraphs 2 and 3		These paragraphs do not adequately address the role of primary production and associated impacts on water quality in the Klamath River. The Klamath River is weakly buffered and existing seasonal primary production can readily produce pH in excess of 9 coincident with elevated

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					water temperatures, particularly between Iron Gate Dam and the Scott River. Further, review of periphyton data indicates that the lower Klamath River is nitrogen-limited in late summer, as evidenced by the dominance of *Epithemia sorex*. *Epithemia sorex* contains endosymbiotic cyanobacteria in many of the cells, which fix atmospheric nitrogen for use by the cells. The seasonal dominance by *Epithemia sorex* (as well as other nitrogen-fixing periphyton) are a source of nitrogen to the Klamath River that are not discussed in the DEIR. Also, there is minimal light limitation in much of the Klamath River from Iron Gate Dam to the Trinity River creating good growing conditions for periphyton. The DEIR states "Measured levels of TP [total phosphorus] in the estuary are typically below 0.1 mg/L during summer and fall (June–October) and TN [total nitrogen] levels are consistently below 0.7 mg/L (June – October)." These total nutrient values mean little without some context that establishes the bioavailable, inorganic forms of nutrients, such as ammonia, nitrate, and orthophosphate, which are more directly usable for primary production. Primary production can occur at very low values of inorganic nitrogen and phosphorous based on their half saturation constants, e.g., 0.014 milligrams per liter (mg/L) and 0.003 mg/L respectively (Tetra Tech 2009). These half saturation constant values are far lower than the estuary concentrations presented in the DEIR.
3.2-17	3.2.2.5	3-29	Paragraph 4		The text in this paragraph focuses solely on blue-green algae and relates all dissolved oxygen conditions to this group of algae, suggesting there are no other algae present or that have an impact on dissolved oxygen conditions. Blue-green algae should be replaced with "phytoplankton" in this text.
3.2-18	3.2.2.5	3-29	Paragraph 5		While there is some variation in dissolved oxygen concentrations in J.C. Boyle Reservoir, the DEIR erroneously states that "This variation can affect dissolved oxygen concentrations further downstream in the California

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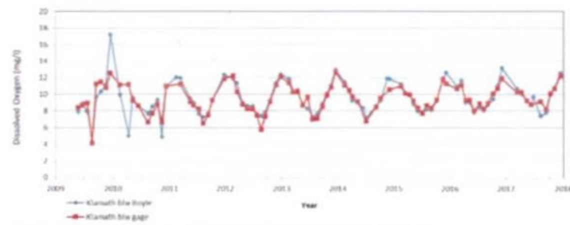
					portion of the Hydroelectric Reach." A simple review of the KHSA Interim Measure 15 data indicates that dissolved oxygen levels downstream of J.C. Boyle Dam (labeled "Klamath blw Boyle" in figure below) are essentially identical to those downstream of the J.C. Boyle Powerhouse (Klamath blw gage in figure below). The DEIR acknowledged that high gradient stream reaches increase dissolved oxygen to near saturation for the reach from Keno Dam to J.C. Boyle Reservoir. The DEIR fails to note that the same effect is found downstream of J.C. Boyle Dam. The reaeration rate is sufficient that by the time waters reach the California-Oregon state line the dissolved oxygen levels in the river are near saturation and any deficit introduced from J.C. Boyle Reservoir has been largely ameliorated via mechanical reaeration. 
3.2-19	3.2.2.5	3-30	Paragraph 1		The DEIR states "The low surface dissolved oxygen levels and their occurrence later in the season at Iron Gate Reservoir is believed to be associated with seasonal algal blooms, as dead algal cells are decomposed by aerobic organisms, exhausting dissolved oxygen in reservoir bottom waters and sediments." The DEIR should clarify that low surface concentrations of dissolved oxygen are associated with seasonally diminishing photosynthesis and continued algae biomatter loading from Upper Klamath Lake and other upstream Klamath River sources.

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					Stratification persists through October for Copco Reservoir and well into November for Iron Gate Reservoir, precluding anoxic bottom waters from mixing with surface waters as is alluded to in the DEIR. Fall cooling and deepening of the epilimnion may contribute to lower dissolved oxygen water; however, the process of fall cooling deepens the epilimnion and increases its volume, and lower primary production cannot overcome the continued oxygen demand associated with organic matter (and associated oxygen demand) in Klamath River inflows.
3.2-20	3.2.2.5	3-30	Paragraph 3		The DEIR states "Daily fluctuations in dissolved oxygen (ranging from 1 to 3 mg/L per day) measured in the Klamath River immediately downstream from Iron Gate Dam have been attributed to daytime algal photosynthesis and nighttime bacterial respiration in the upstream reservoirs." This sentence should be corrected to "…algal and bacterial respiration…" The DEIR also should clarify that releases from the reservoir experience modest diurnal variation. Additionally, monitoring locations "immediately downstream of Iron Gate Dam" are some 1,000 feet downstream of the dam. Mechanical reaeration occurs in this reach between the powerhouse and the monitoring equipment, as does aquatic vegetation photosynthesis and respiration (and bacterial respiration). These latter mechanisms also contribute to variable dissolved oxygen conditions downstream of the dam.
3.2-21	3.2.2.5	3-31	Paragraph 1		The DEIR should acknowledge that dissolved oxygen levels reach saturation in the Klamath River within a couple of miles downstream Iron Gate Dam (PacifiCorp 2018a), well above Seiad Valley, which is approximately 60 miles downstream.
3.2-22	3.2.2.6	3-31	Entire pH section		The water quality impact assessment of reservoir drawdown on pH does not address sediment-related acidification. This is an important omission that affects the adequacy of this section. The substantial sediment load

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					released by the Proposed Project to downstream reaches will include anoxic sediments. As stated elsewhere in the DEIR (Section 3.2.5.4), these sediments will exert a substantial oxygen demand in downstream reaches during reservoir drawdown. Section 3.2.5.4 states that part of the oxygen demand would be from ferrous iron content of anoxic sediments. However, nowhere in the DEIR is there consideration of the acid production potential in these oxidation reactions. Oxidation of sulfidic minerals will produce acid. With such a large sediment load and in such weakly buffered waters (Section 3.2.2.6), the DEIR must assess the potential for acidification in the river downstream of Iron Gate Dam. Another potential source of acidification that is not acknowledged and assessed in the DEIR is drainage from residual sediments in reservoirs. These drained sediments are no different than dredge spoils in their potential for acidification with oxidation. Acid seeps can form on the exposed banks within the former reservoir areas. Low pH can also mobilize metals in the seeps at concentrations that could have adverse impacts on water quality. It may be that acidification will not be severe; however, without any analysis, it is impossible to know. Typically, an acceptable analysis of acidification potential is based on analysis of sediment minerology and a pH mass balance model is created to assess potential acidification impacts. The DEIR is lacking any of this information.
3.2-23	3.2.2.6	3-31	Paragraph 4		The DEIR states that alkalinity "Levels below 10 mg/L indicate that the system is poorly buffered and very susceptible to changes in pH." The correct value indicative of a weakly buffered system is 100 mg/L, not 10 mg/L. The pH of water is an important parameter in aquatic systems because many reactions that control water quality are pH dependent. Typically, surface freshwater (rivers and lakes) contain both acids and bases, and biological processes tend to increase either acidity or basicity.

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					The interactions among these opposing compounds and processes determine pH. Carbon dioxide ($CO_{2(aq)}$) is particularly influential in regulating pH in aquatic systems. $CO_{2(aq)}$ is acidic, and its concentration varies as a result of its utilization by aquatic plants in photosynthesis and release in respiration of aquatic organisms. The alkalinity of water results primarily from carbonate (CO_3^{-2}) and bicarbonate ions (HCO_3^-), and alkalinity tends to buffer water against excessive pH change (Boyd 2000; Stumm and Morgan 1996; Tchobanoglous and Schroeder 1987). Alkalinity in environmental waters is beneficial because it minimizes pH changes in response to various factors that include acidification (e.g., acid rain), pollutant inputs to aquatic systems, and primary production (Kalff 2002). Primary production in systems that have low to moderate alkalinity can experience increases in pH during periods of high photosynthesis. During these periods, algae deplete available $CO_{2(aq)}$ and utilize HCO_3^- as a secondary source of $CO_{2(aq}$, excreting excess hydroxyl ions (OH^-) to the water, contributing the elevated pH conditions (Kirk 2011). Review of the 2009 through 2017 KHSA Interim Measure 15 water quality data indicates that alkalinity concentrations in the Klamath River system typically in the 40 to 70 mg/L (as $CaCO_3$) range in the upper basin (Link River Dam), 65 to 85 mg/L (as $CaCO_3$) range downstream of Iron Gate Dam, and 50 to 100 mg/L (as $CaCO_3$) range in the lower basin (Orleans). Given the naturally productive nature of the Klamath River, alkalinity values below approximately 100 mg/L are subject to seasonal pH deviations during periods of maximum photosynthetic activity. A 48-hour trace of pH is shown in the figure below for the Klamath River downstream of the Shasta River (June 28, 12:00 to June 29, 12:00, 1997; Deas 2000), indicating an increase of 1.5 pH units due to primary production. Elevated pH in the upper basin and throughout the river system in response to seasonal productivity has been identified through the KHSA Interim Measure 15 monitoring program as well as other monitoring efforts. Elevated pH can

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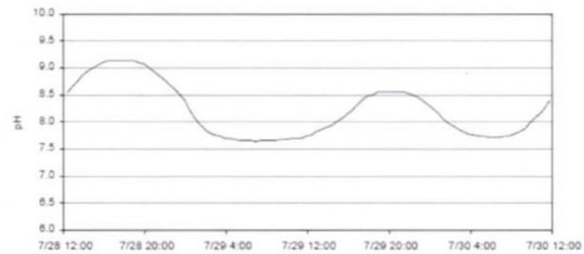
					lead to short duration chronic, and in extreme cases acute ammonia toxicity (USEPA 2013). 
3.2-24	3.2.2.7	3-35	Paragraph 4		The DEIR states "Historically, seasonal algal blooms and elevated chlorophyll-*a* concentrations have been observed in the Hydroelectric Reach, including a 1975 survey in Iron Gate Reservoir documenting algal blooms in March, July, and October, including diatoms and blue green algae (USEPA 1978)." It should be noted that of the three sample dates in USEPA (1978), *Microcystis sp.* and *Dolichospermum sp.* are absent, and in only one of the three sample dates is a blue-green algae dominant (*Oscillatoria sp.*). The "more contemporary data" discussion in this paragraph should be updated following a review of the data generated in the KHSA Interim Measure 15 monitoring program through 2017. The reference in the text to Figure 3.2-5 only includes data through 2007 (note that the DEIR text incorrectly refers to Figure 3.2-25). In addition, the DEIR states that "...chlorophyll-*a* levels in Copco No. 1 and Iron Gate reservoirs can be two to ten times higher than in the Klamath River..." without telling the reader where in the river the data are being compared. This is important because chlorophyll-*a* levels in Iron Gate Reservoir, for example, have been

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					consistently lower than those in Keno reservoir. Since 2015, reductions in chlorophyll-*a* downstream of Iron Gate Dam when compared to Iron Gate Reservoir are at least partially attributable to operation of the intake barrier curtain in Iron Gate Reservoir (Watercourse 2016; PacifiCorp 2017b).
	3.2.2.7	3-37	Paragraphs 1 and 2		Algae toxins may be produced wherever conditions are suitable for associated blue-green algae growth (benthic or planktonic forms), and there are no data to support the conclusion that algal toxins in the lower river only occur because of the presence of Iron Gate and Copco reservoirs. The DEIR should be revised to acknowledge this. The DEIR indicates that Copco No. 1 and Iron Gate reservoirs are responsible for the production of algal toxins, such as microcystin, in the Klamath River downstream of Iron Gate Dam. This is not thoroughly correct and is somewhat misleading. Algal toxins (including microcystin) have been documented upstream of the hydroelectric projects in Agency Lake, Upper Klamath Lake, and Keno Reservoir. The DEIR should be revised to accurately reflect the complexity of algal-toxin production in the Klamath River. For example, in addition to the citation of Otten et al. (2015), the DEIR should include more recent information on the causes and instances of algal toxins in the Klamath River such as presented by Otten (2017), Otten and Dreher (2017), and Paerl et al. (2018). This more recent information indicates that *Microcystis* blooms and microcystin concentrations have increased in magnitude and persistence in recent years in Upper Klamath Lake, and that microcystin concentrations are consistently elevated in the lake during the bloom season (Otten 2017b; Otten and Dreher 2017). Key message from Paerl et al. (2018) is that management of eutrophication and harmful algae blooms should recognize causes and interconnection across watershed gradients. Paerl et al. (2018) conclude that it makes little sense to attempt controls in

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					the downstream reservoirs without first addressing the predominant sources coming from upstream. However, Paerl et al. (2018) indicate that in practice most management responses to eutrophication issues have involved interventions aimed at treating individual segments of the system and frequently focus on the problem rather than the underlying causes of the blooms that often take place upstream.
3.2-25	3.2.2.7	3-38	Paragraph 1		The DEIR states "In contrast, data from 2008 and 2009 did not show microcystin bioaccumulation in the tissue and liver samples from fish collected from Copco No. 1 and Iron Gate reservoirs (CH2M HILL 2009; PacifiCorp 2010)." This discussion is inadequate and incomplete. The DEIR needs to include all the results for fish sampled for microcystin in the Klamath River. In 2008, tissue was collected from a total of 272 resident fish (Yellow Perch, Crappie, and Rainbow Trout) and all laboratory analysis did not detect microcystin in these samples. In 2009, a total of 43 fish tissue and liver samples were collected from Yellow Perch, and again microcystin was not detected. These studies are posted on PacifiCorp's Klamath website (http://www.pacificorp.com/es/hydro/hl/kr.html). The data from the anadromous fish sampling for microcystin that was done in 2007 and 2010 should also be presented and discussed. In 2007, fish and liver samples were collected from 11 adult Chinook Salmon and 8 Steelhead and microcystin was not detected in any of these samples (CH2M HILL 2009). In 2010, tissue and liver samples were collected from 25 Steelhead, 20 fall Chinook, and 3 Coho in the Klamath River. While microcystin was not detected in any of the fish tissues, four Chinook livers and a Steelhead liver had detectable amounts of microcystin present. The DEIR analysis needs to go beyond discussion of simple microcystin presence in these sampled tissues and discuss what the toxin quantities mean in terms of associated levels of potential human health risk. The DEIR also needs to distinguish where microcystin concentrations have

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					been detected in fish tissue versus liver since it is toxin levels in the consumed tissue that pose a human health risk because fish livers are not consumed. To PacifiCorp's knowledge, no microcystin has been found in adult salmonid fish tissue in the Klamath River, yet the DEIR fails to mention this. The DEIR discusses the risk to fish but presents no evidence to show what harm, if any, occurs at the individual or population level from microcystin exposure. Any analysis related to microcystin effects on the fisheries must distinguish between resident and anadromous fish since most of the anadromous salmonids enter the river as adults to spawn and die.
3.2-26	3.2.2.8	3-38	Last paragraph		This section of the DEIR concludes that trace metals decline as water flows downstream, with the exception of nickel, magnesium, and calcium. The decline is attributed to binding and precipitation. However, the section does not provide a reason why such a decline was not observed for nickel, magnesium, and calcium. Please provide more detail to support the conclusions.
3.2-27	3.2.2.8	3-39	Paragraph 1 (first full paragraph)		The DEIR indicates that acid volatile sulfides (AVS) were measured but does not indicate if simultaneously extracted metals (SEM) were measured. This is important because AVS measurements are meaningless without the companion SEM measurements. If SEM data were collected, a discussion of the potential for metals toxicity should be discussed using the USEPA's *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver and Zinc* (USEPA 2005).
3.2-28	3.2.2.8	3-39	Paragraph 1, first line		The DEIR uses the term "dioxin" without defining it. The reader is left to assume that when using that term the authors are referring to the 17 dioxin and furan congeners. The text further uses the term "toxic

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					equivalency concentrations" without defining that for the reader. To fully inform the reader, the text should be rewritten to clarify the terminology.
3.2-29	3.2.2.8	3-40	Paragraph 1 (partial paragraph)		The DEIR compares "dioxin" concentrations to threshold values. We suspect that these are 2,3,7,8 2,3,7,8-tetrachlorodibenzodioxin (TCDD) toxicity equivalent quotients or toxic equivalents but the DEIR fails to indicate specifically what is being evaluated.
3.2-30	3.2.2.8	3-41	Paragraph 1		The DEIR discusses the results from whole sediment toxicity tests with the amphipod *Hyalella azteca*. The text states "Toxicity tests generally indicate a low potential for toxicity...." Additional text should be provided that describes the criteria for classifying toxicity as 'low' or 'moderate' potential and what this means for the Proposed Project.
3.2-31	3.2.2.8	3-42	Paragraph 1		The DEIR presents comparisons of sediment chemical concentrations to risk-based screening values. The paragraph as written is confusing and hard to follow and it is impossible to differentiate between ecological and human health-based screening values. To increase readability, this paragraph should be split into two, with one devoted to ecological and one to human health.
3.2-32	3.2.3	3-44	Paragraph 3		The definition for "substantial" is not adequate. The DEIR states that "...substantial, as used in the significance criteria, means the effect on water quality and the support of beneficial uses (or human health or environmental receptors, as specified) is of considerable importance." The connection to the beneficial uses is appropriate, but the term "of considerable importance" is not defined.
3.2-32	3.2.3	3-58	Paragraph 1		The discussion of turbidity references a lack of data but fails to acknowledge that turbidity data has been routinely collected with all KHSA Interim Measure 15 water quality samples since 2009. While this is spot

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					data at a monthly or bimonthly time-step, it is certainly more precise than the approach taken in the DEIR. The DEIR connects the criterion for turbidity to "natural conditions" but does not characterize or define natural. According to CEQA the comparison should be made for turbidity impacts relative to baseline conditions (those present at the time of the Notice of Preparation (NOP) for the DEIR.
3.2-33	3.2.3	3-58	Footnote 39		The DEIR acknowledges that there are differences between suspended sediment concentrations and total suspended solids but fails to explain what these differences mean in terms of data interpretation and how this difference may affect the impact analysis. The assumption that they are equivalent as made in the DEIR needs to be justified.
3.2-34	3.2.4	3-64	Paragraph 5		The discussion in this section indicates that certain aspects of water quality in the DEIR impact analysis relied on models developed for the Klamath River TMDL. The DEIR's Thresholds of Significance for these aspects of water quality are tied to specific Klamath River TMDL-derived quantities (such as, for water temperature, dissolved oxygen, nutrients, chlorophyll-*a*, and algal toxins). The DEIR's analysis of long-term water quality impacts explicitly includes the Klamath River TMDLs and incorporates TMDL scenarios and results of modeling performed for development of the TMDLs. By doing so, the DEIR analysis incorporates the assumption that TMDLs will be fully achieved, despite unknowns and uncertainties regarding potential TMDL actions and their implementation. The TMDL modeling results are not an appropriate basis for comparing alternatives. PacifiCorp has previously documented substantial technical flaws with the assumptions, modeling, and analyses used in development of the TMDLs. PacifiCorp has previously presented the flaws in the compliance scenarios and the technical analysis and modeling supporting the California Klamath River TMDL during the development of the TMDL

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					and is contained in the Petition for Writ of Mandate filed to challenge the same (*PacifiCorp v State Water Resources Control Board*, 2011, case 34-2011-80000769). PacifiCorp does not waive, and expressly preserves, its legal challenge to the TMDL and TMDL models, and preserves its rights to challenge TMDL implementation plan measures and conclusions regarding the Klamath Hydroelectric Project's effects on water quality in other proceedings. PacifiCorp's position remains that the TMDLs will require nutrient loads in the Klamath River that are less than those that would occur naturally (that is, without anthropogenic effects). Independent assessments of conditions for anadromous fish in the Klamath Basin by the National Research Council (NRC 2004, 2008) and the Klamath River Expert Panels (Dunne et al. 2011; Goodman et al. 2011), although not referring to the TMDLs specifically, indicate that very substantial water quality improvements in the Klamath Basin, such as assumed in the TMDLs, are unrealistic, unlikely, or at best highly uncertain. Therefore, the DEIR makes the flawed assumption of full attainment of TMDLs which in turn results in an analysis that unrealistically assumes dramatic long-term water quality improvements in the basin. Disclosure and discussion of substantial uncertainties related to TMDL assumptions is absent in the DEIR. This represents a major flaw relative to the DEIR's ultimate accuracy in assessing the effects of the Proposed Project and utility for supporting decisions on the Proposed Project.
3.2-35	3.2.4.1	3-66	Paragraph 2		The DEIR relies on the River Basin Model 10 (RBM10) for quantifying the sensitivity of water quality and related impacts to projected climate change. Specifically, the DEIR states that "The RBM10 model was developed as part of the Klamath Dam Removal Secretarial Determination studies and includes the effects of climate change and KBRA hydrology on water temperatures (Perry et al. 2011)." Given the limitations of the climate change projections and methodology used, the DEIR rightfully

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					limits the use of RBM10-related results for significance determinations. "The climate change predictions are used to give additional context to the temperature discussion, but they are not relied on for significance determinations. Future climate changes are not part of the existing condition against which this EIR compares potential impacts under the Proposed Project." This approach is appropriate because climate change would be expected to compound the errors previously raised regarding the flow modeling. However, in contrast to this statement, the approach used in the DEIR was to integrate climate change predictions throughout the discussion and finding of impacts in the water quality and aquatic resources sections of the Proposed Project and to a lesser extent the alternatives. More than 20 statements throughout the impacts discussions highlight the climate change adaptation aspects/benefit of the Proposed Project and its benefit over other alternatives. For example, page 3-77 paragraph 4 states "In the long term, the beneficial effects would also help to offset the impacts of climate change on late summer/fall water temperatures." This style of presentation creates confusion in the impacts discussions. A better approach would be to present the climate change adaptation aspects/benefit of the Proposed Project and the other alternatives in a climate change adaptation section.
3.2-36	3.2.4.2	3-69	Paragraph 1		In this paragraph, the DEIR describes the predicted short-term suspended sediment concentrations during Proposed Project reservoir drawdowns. These suspended sediment concentrations predictions are a major factor used in the DEIR's assessment of impacts, particularly on water quality and aquatic biota. However, these suspended sediment concentrations predictions rely on professional judgement and extrapolations of previous modeling work, rather than detailed quantitative analysis of the actual Proposed Project. In addition, the DEIR assessment makes the simplified and unsupported assumption that the predicted suspended sediment

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					concentrations would be within the range of model-uncertainty. However, this type of extrapolation is inappropriate because it compounds the uncertainty that already exists in the model results. The prediction of suspended sediment concentrations during drawdown also neglects the effects from slump failure and sediment jetting, which would likely further increase suspended sediment concentrations. Given the importance of suspended sediment concentrations as a factor in the assessment of impacts, the DEIR needs a more thorough and rigorous analysis and discussion regarding the factors that would contribute to predicted suspended sediment concentrations.
3.2-37	3.2.4.3	3-69	Paragraph 5		Regarding the TMDL model assumptions for full TMDL implementation the DEIR states that "Despite this assumption, the Klamath River TMDL model results are still informative with respect to the analysis of potential nutrient impacts under the Proposed Project, particularly since nutrient models were not developed for the FERC relicensing process." Nutrient models as part of the Klamath River Water Quality Model (KRWQM) were developed by Watercourse Engineering for the FERC relicensing process (PacifiCorp 2004a). These models were subsequently used with modification by the North Coast Regional Water Board in the developing the Klamath River TMDL in California. The TMDL model included only a single simulation year based on the year 2000. Since the TMDL model was developed, the KRWQM models have incorporated additional years of data that have substantively improved model representation of water quality processes in the Klamath River (see PacifiCorp 2014). The TMDL's use of a single year yields no information on natural annual variability. As an example of interannual variability, total nitrogen for the Klamath River upstream of Copco Reservoir (Klamath above Shovel Creek site) is plotted below using data from the KHSA Interim Measure 15 monitoring program in comparison to data from 2000 (Watercourse 2003a, 2003b). While the

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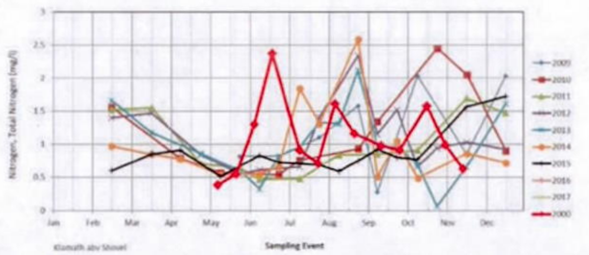
					year 2000 may represent a proxy for an "average" condition, the year is not a conservative assumption because there are several years with notably higher total nitrogen concentrations. Similar results are apparent for other constituents, as well. Therefore, relying solely on the TMDL is a serious limitation of the DEIR, not only because a single year is insufficient to capture variability, but also because well over a decade of additional data have been collected since the year 2000 and the modeling upon which the TMDL is based has been substantially improved. 
3.2-38	3.2.4.3	3-70	Paragraph 1		The challenge with nutrient budgets is that they are generally calculated based on long averaging periods (e.g., annual budgets or monthly budgets) and occur at discrete locations in the reservoir-river system. Thus, they are spatially and temporally coarse. By their very nature, nutrient budgets are not mechanistic models meaning that relationships and processes among constituents are not represented. Overall, they represent a simplification of processes. By using the results of an up-to-date water quality model, a more accurate and effective assessment of potential outcomes associated with the various alternatives could have been conducted in the DEIR.

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3.2-39	3.2.4.4	3-71	Paragraph 2		The TMDL modeling results are not an appropriate basis for comparing alternatives (see comment 3.2-34).
3.2-40	3.2.4.4	3-72	Paragraphs 4 and 5		Rather than explain why the State Water Board believes that the Klamath River TMDL model over-predicts chlorophyll-*a* for a dam removal scenario, the DEIR simply states "Instead, this EIR's chlorophyll-*a* impact analysis is based on a qualitative assessment of whether the Proposed Project would result in exceedances of the California 10 µg/L [sic] target for the Lower Klamath Project reservoirs and adversely affect beneficial uses with respect to water column concentrations of chlorophyll-*a*." The numerical endpoints analysis used in the DEIR is inadequate to assess a "without dams" condition because it does not address the conversion of inorganic nutrients to periphyton and macrophyte biomass in the Klamath River from J.C. Boyle Reservoir to Iron Gate Dam. Periphyton and macrophyte growth will be extensive in this reach due to nutrients from upstream reaches (Upper Klamath Lake and Keno reservoir). Senescence, reproductive processes, sloughing, grazing, and scour of the bed community (periphyton and macrophytes), coupled with phytoplankton release from Upper Klamath Lake and Keno reservoir, have not been addressed in the DEIR. The assumed timeline to achievement of the TMDL is unclear in the DEIR. Upper Klamath Lake is not expected to achieve compliance with the Upper Klamath Lake TMDL for decades (ODEQ 2002, 2018). Further, even under a future TMDL compliance scenario, compliance at Upper Klamath Lake will not occur in every year. Specifically, very large fluxes of organic matter would still be periodically released into the river from Upper Klamath Lake. According to studies upon which the Upper Klamath Lake TMDL analysis was based, very large fluxes would still occur 2 out of every 8 years after the TMDL measures are achieved (ODEQ 2002). These large nutrient and organic matter fluxes from Upper Klamath Lake are not explicitly

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					considered in the DEIR's analysis. Certainly, DEIR long-term impacts (3 years or more into the future) will occur simply as a result of the decades it will take to achieve TMDL compliance. This point is made in the DEIR (pg. 3-80, paragraph 1): "Note that the Klamath River TMDL model for both "dams-in" and "dams-out" scenarios assumes full implementation of the TMDLs, a condition that is currently highly speculative with respect to the mechanisms and timing required to achieve future compliance." The DEIR should clarify the rationale for the use of chlorophyll-*a* as a surrogate to address toxin producing algae. As stated in the DEIR "chlorophyll-*a* target of 10 µu/L [sic] (i.e., reduction to) is a conservative estimate of mean summer chlorophyll-*a* concentrations required to move the system toward support of beneficial uses." These beneficial uses extend beyond toxin-producing algae.
3.2-41	3.2.5.1	3-75	Paragraph 1		The DEIR states "The KRWQM did not model water temperatures within the Hydroelectric Reach." This statement is incorrect because the KRWQM did model water temperature in this reach. The KRWQM model was developed for the Klamath River system from Link River Dam, near Klamath Falls (RM 254) to Turwar (RM 6), and includes existing Klamath Hydroelectric Project facilities, as well as a without dam representation (including alternatives with selected dams removed and others retained). However, the TMDL model that was adapted from the original KRWQM by the North Coast Regional Water Quality Control Board, has an error that under-predicts water temperature in riverine reaches.
3.2-42	3.2.5.1	3-78	Paragraph 2		The DEIR erroneously states that "The KRWQM indicates that the overall water temperature influence of the Hydroelectric Reach is mostly attenuated by RM 66.3 at the confluence with the Salmon River (see Figure 3.2-10)." Regarding this statement, PacifiCorp model results (see PacifiCorp 2004a, 2008) show that the thermal effects of the Project

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					reservoirs on water temperatures downstream of Iron Gate Dam (RM 190) progressively diminish until reaching a downstream location where effects are absent. From December through July, the effects are quite small or absent by the time the river reaches the confluence with the Scott River (RM 143.9). In August and November, the effects are small or absent by the time the river reaches Seiad Valley (RM 120), and in September and October, by the time the river reaches the confluence with Clear Creek (RM 95). In no cases does modeling indicate that thermal effects extend to the confluence with the Salmon River.
3.2-43	3.2.5.1	3-81	Paragraph 3		The DEIR states that water temperatures would be "more favorable for salmonids in the mainstem" under the Proposed Project. This conclusion is not supported by available information either spatially or temporally. PacifiCorp (2008) concludes that the Klamath Hydroelectric Project-related effects on water temperature progressively diminish until reaching a downstream location where effects are absent (see comment 3.2-42). From a temporal perspective, Klamath Hydroelectric Project dams serve to cool water temperatures during the spring months, which may lessen *Ceratanova shasta (C. shasta)* severity in the reach of the river downstream of Iron Gate Dam. Klamath Hydroelectric Project dams also reduce summer peak water temperatures, which decreases stress on salmonids (see Figure 3.2-8). The DEIR asserts that "...fall-run Chinook salmon spawning in the mainstem Klamath River during fall would no longer be delayed (reducing pre-spawn mortality), and adult migration would occur in more favorable water temperatures than under existing conditions." This assertion completely ignores the fact that, as discussed above, during fall migration (September-October) the existing Klamath Hydroelectric Project's effects on water temperature are not apparent downstream of the confluence with Clear Creek (RM 95). When fall-run Chinook migration is delayed by water

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					temperatures, the fish are typically downstream of the confluence with the Trinity River (RM 40). Review of water temperature data for locations at Weitchpec and downstream of Iron Gate Dam in September and October illustrates that water temperatures are quite similar. That is, prior to reaching the spawning areas in the vicinity of Iron Gate Dam, fish must first migrate through warm water in the lower Klamath River where water temperature effects from dam removal would not occur (e.g., see "Significance" page 3-82 where it is stated: "No significant impact for the Middle Klamath River downstream from the Salmon River, Lower Klamath River, Klamath"). If migrating fish are moving past the Trinity River under current conditions without delay, then there would be no additional delay upstream near Iron Gate Dam.
3.2-44	3.2.5.1	3-81	Paragraph 3		The DEIR states "The return to a more natural thermal regime compared with existing conditions would align better with the California Thermal Plan's prohibition on increased temperature discharges above natural temperatures and would be beneficial." Natural temperatures in certain reaches could lead to elevated temperatures at critical times of the year. (e.g., spring outmigration). This is also a condition that could be exacerbated by climate change, as noted on page 3-81 (paragraph 2): "…water temperatures in the Upper Klamath Basin are expected to increase on the order of 2°F to 5°F between 2012 and 2061." The DEIR should explain the risk that the future thermal regime, even if more natural, might not support current (and desired) beneficial uses (e.g., salmon populations) under expected climate change conditions. The DEIR should recognize the limitation of the TMDL assessment in that temperature criteria (as well as other constituents) are based on only a single year (2000). There is no hydrology or meteorology variability assessed in the TMDL. Year 2000 is neither a particularly wet nor a particularly dry hydrologic year. Under more variable dry or wet year

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					conditions, it is unclear if temperature targets can be met. This is a serious limitation of the TMDL that is not addressed in the DEIR.
3.2-45	3.2.5.1	3-81	Paragraph 3		The DEIR states "Warmer springtime temperatures would result in fry emerging earlier, encountering favorable temperatures for growth sooner than under existing conditions, which could support higher growth rates and encourage earlier outmigration downstream, similar to what likely occurred under historical conditions, and reduce stress and disease." This statement regarding the effects of water temperatures on egg development and fry emergence is incorrect (see comment 3.3-55 and Major Issue 2.9.4). Additionally, elevated temperatures could exacerbate disease effects on fish. The DEIR should clarify the importance of the natural variability of thermal condition in the spring period. Water temperatures respond to meteorological conditions in a highly variable manner with spring period conditions experiencing both cool (e.g., high snowmelt runoff years) and warm (e.g., drought years) spells. Thus, fish may remain upriver later in cool to moderate spring weather conditions, only to be caught far from the ocean when warmer weather conditions occur later in the spring. The DEIR's qualitative assessment is overly simplistic to accurately represent the complexities of water temperature and fish movement.
3.2-46	3.2.5.2	3-84	Paragraph 2		The DEIR claims that the predicted suspended sediment concentrations during Proposed Project reservoir drawdowns are conservative, but this claim relies on extrapolation of model results and does not include the effects of bank slumping or sediment jetting. The realized short-term suspended sediment concentrations could be higher and extend for a longer period of time.
3.2-47	3.2.5.2	3-85	Paragraph 1		The DEIR acknowledges that sediment jetting could potentially increase the amount of sediment discharged from the reservoirs but fails to

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					specifically quantify this or discuss the effects of this in the DEIR. Because sediment jetting would occur during drawdown, reservoir sediments may not yet have dewatered or consolidated sufficiently for the sediments to be stable. Thus, sediment jetting, which the DEIR states could mobilize up to 34 and 41 percent of expected sediment erosion in Copco and Iron Gate reservoirs, respectively, could increase sediment delivery to the river if it induces slope and bank failures in areas of the reservoir that were anticipated by USBR (2011) to be stable following drawdown.
3.2-48	3.2.5.2	3-94	Paragraph 2		The DEIR indicates the need to stabilize stranded sediments along banks of the Klamath River that would be formed by the former lake bed sediments. However, bank stabilization would be primarily a function of geomorphology. The DEIR does not clearly discuss how the newly exposed river banks (composed primarily of reservoir sediments) would be formed into stable slopes and landforms that can be further stabilized by planting. Moreover, as it is likely that the sediments could strongly acidify, the DEIR should describe how it is that plants can be established (see comment 3.2-22 for discussion of acidification). This discussion is necessary to evaluate the feasibility of the Proposed Project's plan for revegetation.
3.2-49	3.2.5.2	3-103	Paragraph 3		In this paragraph, the DEIR concludes that there will be no long-term impact to suspended sediment concentrations based on model predictions. However, three factors are not considered in the DEIR that affect this conclusion: 1. The sediment load currently being trapped by the reservoirs would be transported downstream under the Proposed Project (an increase over existing baseline conditions). 2. Any fine sediment released during the drawdowns, that deposits along the channel margins, back waters, pools, or point bars in the 200 miles

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					of river downstream of Iron Gate may become remobilized during future high flow events. 3. Proposed erosion control measures (revegetation) would not be 100 percent effective. There would likely be an increase in long-term fine sediment supply from erosion within the reservoirs.
3.2-50	3.2.5.2	3-109	Paragraph 3		The DEIR states "Measurements of organic suspended sediment between 2001 and 2003 and median turbidity values over the long-term historical record (1950–2001) both follow a similar pattern, with values decreasing with distance downstream to J.C. Boyle Reservoir, indicating it is likely that the suspended sediment concentrations crossing the Oregon-California state line under the Proposed Project would not increase beyond typical existing conditions concentrations of 10 to 15 mg/L." The DEIR should be updated to present the more recent data that are readily available from the KHSA Interim Measure 15 water quality monitoring program. Shown in the graphs below are volatile suspended solids (organic fraction of total suspended solids) for (a) Klamath River upstream of J.C. Boyle Reservoir (Klamath abv Boyle) and downstream of the J.C. Boyle Powerhouse (labeled "Klamath blw gage"), and (b) J.C. Boyle Powerhouse (Klamath blw gage) and upstream of Copco Reservoir (Klamath abv Shovel). These figures indicate modest decreases through the reach due to short residence time in J.C. Boyle Reservoir as well as the peaking power operations at J.C. Boyle Powerhouse. These modest reductions are largely a function of dilution from springs input in the bypass reach. Deas (2008) also found that there was little change in total nitrogen, total phosphorous, and dissolved organic carbon between Keno Dam and J.C. Boyle Reservoir. This reach is a useful surrogate for possible conditions in a downstream river reach without dam.

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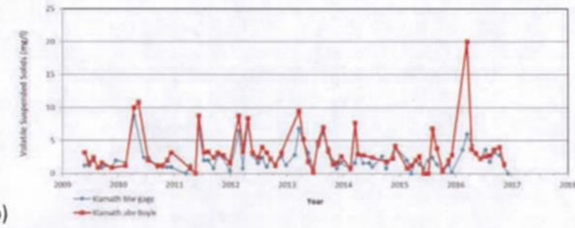
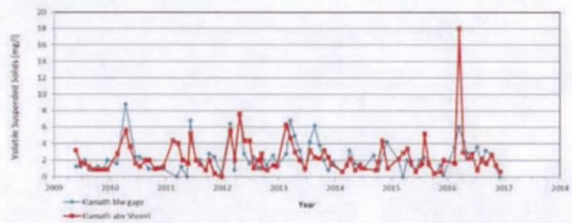
					(a)  (b)  The DEIR should also include a discussion of periphyton and aquatic macrophytes that will colonize the reaches in question, including J.C. Boyle Reservoir, the Klamath River from J.C. Boyle Dam to Copco Reservoir, and the reach downstream to Iron Gate Dam. This aquatic vegetation will convert nutrients imported from the upper basin (e.g., Upper Klamath Lake) into aquatic vegetation biomass, which will in turn contribute to particulate organic matter, leading to a potential increase in organic suspended materials.
3.2-51	3.2.5.2	3-110	Paragraph 2		The DEIR states "Following completion of the Proposed Project, it is very unlikely that summertime algal-dominated (organic) suspended material in

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					the Middle and Lower Klamath River would increase beyond a sustained 100 mg/L for two weeks (the water quality criterion adopted for significant adverse impacts on the COLD beneficial use for the Lower Klamath Hydroelectric Project EIR analysis (see Section 3.2.3.1)." The 100 mg/L criteria developed in Section 3.2.3.1 referred to potential impact of increases in suspended sediments due to release of sediments currently trapped behind the dams. This suspended sediment criterion cannot be reasonably applied to long-term alterations in algal-derived (organic) suspended material from the lack of continued interception and retention by the dams. Therefore, the DEIR should be revised to include the appropriate criterion for algal-derived material. A reasonable criterion would be to assess if there will be an increase from current condition to a future condition without dams such as under the Proposed Project. The DEIR goes on to state "If slight long-term increases in suspended materials did occur, such increases would be well below the algal-derived suspended material previously produced in Copco No. 1 and Iron Gate reservoirs and would not exceed levels that would substantially adversely affect the cold freshwater habitat (COLD) beneficial use or any other existing designated beneficial use at the levels currently supported, exacerbate an existing exceedance of water quality standards, or result in a failure to maintain an existing beneficial use." This statement acknowledges that slight increases could occur (although the magnitude is unquantified). While the statement focuses on the reach downstream of Copco Reservoir, the DEIR does not address such potential impacts upstream of Copco Reservoir, where the implications of a cessation of peaking and removal of J.C. Boyle Reservoir would potentially lead to higher pH excursions and production of organic matter generated by colonization of this reach by periphyton and macrophytes. Without such

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					an assessment, the level of effect the Proposed Project may have on organic suspended material cannot be determined.
3.2-52	3.2.5.3	3-110	Paragraph 3		The DEIR states "However, minimal deposition of fine suspended sediments, including associated nutrients, would occur in the river channel and the estuary." Given the importance and potential severity of suspended sediments impacts under the Proposed Project, the DEIR should carefully and thoroughly define "minimal" in this context. The DEIR should also recognize that following events that produce excessive sediment, deposition of fine material can accumulate on the banks and bed of streams, pools, and side channels, and within point bars (see Major Issue 2.4).
3.2-53	3.2.5.3	3-113	Paragraph 4		The DEIR states "Modeling conducted for development of the California Klamath River TMDLs (North Coast Regional Board 2010) does provide some information applicable to the assessment of long-term impacts of the Proposed Project on nutrients at locations in the Hydroelectric Reach (Kirk et al. 2010)." The DEIR goes on to state "Klamath River TMDL model results indicate that if the Lower Klamath Hydroelectric Project dams were to be removed ("TMDL dams-out, Oregon" [TOD2RN] scenario), TP [total phosphorus] and TN [total nitrogen] in the Hydroelectric Reach immediately downstream from J.C. Boyle Dam would increase slightly (by less than 0.015 mg/L TP and less than 0.05 mg/L TN) during summer months compared to existing conditions." The increase by less than 0.015 mg/L total phosphorus and less than 0.05 mg/L total nitrogen are not necessarily "slight." The DEIR should recognize that the half saturation constant for phosphorous and nitrogen in the TMDL models is on the order of 0.003 mg/L and 0.014 mg/L, respectively (Tetra Tech 2009). Thus, increases of up to 0.015 mg/L total phosphorus is five times the half saturation constant. Similarly, an increase of 0.05 mg/L in total nitrogen is

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					about 3.5 times the half saturation constant. These increases are clearly potentially biostimulatory in magnitude. Further, increases of up to 0.015 mg/L total phosphorus are of the same approximate magnitude of the monthly TMDL mean concentration targets in the Copco tailrace (see Table 5.10 below from NCRWQCB [2010]). Given that the TMDL targets will be challenging to meet, essentially doubling the total phosphorus concentrations would seem to be a significant impact. This impact would be further exacerbated by the existing nitrogen-fixing periphyton (e.g., *Epithemia sp.*) in the river that, given sufficient or even just additional phosphorous will dominate periphyton communities in late summer and fall (Power et al. 2016). The nitrogen-fixing by these organisms will provide another source of nitrogen to the Klamath River and this source of nitrogen is not assessed in the DEIR.

Table 5.10: Nutrient and organic matter monthly mean concentration targets (mg/L) for Copco 2 and Iron Gate tailraces

Copco 2 Tailrace						
	May	June	July	August	September	October
TP	0.017	0.015	0.016	0.016	0.015	0.015
TN	0.259	0.201	0.174	0.178	0.168	0.211
CBOD[5]	2	1	1	1	1	1
	November	December	January	February	March	April
TP	0.017	0.023	0.016	0.019	0.019	0.018
TN	0.264	0.341	0.241	0.315	0.303	0.278
CBOD[5]	1	1	1	2	2	2
Iron Gate Tailrace						
	May	June	July	August	September	October
TP	0.255	0.202	0.157	0.149	0.140	0.161
TN	0.016	0.014	0.013	0.013	0.013	0.013
CBOD[5]	1	1	1	1	1	1
	November	December	January	February	March	April
TP	0.203	0.276	0.195	0.298	0.299	0.267
TN	0.015	0.017	0.013	0.018	0.019	0.017
CBOD[5]	1	1	1	2	2	2

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3.2-54	3.2.5.3	3-115	Paragraph 2		The DEIR states "As described above in this potential impact analysis, Copco No. 1 and Iron Gate reservoirs currently intercept and retain suspended material behind the dams, including nutrients (TP and TN)

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					associated with suspended material that originates upstream of the Hydroelectric Reach. Results of all the existing evaluations (FERC 2007; North Coast Regional Board 2010; Asarian et al. 2010) recognize the trapping function of the reservoirs with respect to TP and TN, and they provide results indicating that ending this trapping by converting the reservoirs to free-flowing river reaches would, on an annual basis, result in a slight increase in annual TN and TP in the Middle and Lower Klamath River and the Klamath River Estuary." As explained in previous comments (see, for example, comment 3.2-53), the reservoir retention of nutrients is not "slight" and the discussion in the DEIR should be modified to reflect the actual quantified magnitude of reduction (expressed both in tons and percent of annual load at Iron Gate Dam) under existing conditions and the change under the Proposed Project. The increased nutrient delivery to the Klamath River following the Proposed Project has the potential to increase biostimulatory conditions in the river and result in algal impacts in the river and the estuary. The DEIR does not acknowledge or attempt to evaluate these potential impacts from increased nutrient delivery to the Klamath River from upstream sources.
3.2-55	3.2.5.3	3-117	Paragraph 1		The DEIR states "...results of the Klamath River TMDL model are in general agreement with PacifiCorp (FERC 2007) and Yurok Tribe (Asarian et al. 2010) analyses regarding dam removal impacts on nutrients, with very small annual increases in TP (0.01 to 0.015 mg/L) and relatively larger annual increases in TN (0.1 to 0.125 mg/L) immediately downstream from Iron Gate Dam due to dam removal." The magnitude of these increases is clearly potentially biostimulatory (see comment 3.2-53). The DEIR needs to be revised to reflect that such increases are not "very small" in terms of supporting seasonal primary production.

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3.2-56	3.2.5.3	3-117	Paragraph 2		The DEIR states that "The Klamath River TMDL model does not include denitrification as a possible nitrogen removal term in river segments (Tetra Tech 2009), meaning that TN concentrations being transported into the Middle Klamath River under the Proposed Project may be over-predicted." The DEIR describes no mechanism that would justify appreciable denitrification. The key nitrogen removal process would be plant uptake by periphyton and macrophytes. Further, the DEIR neglects nitrogen fixation as a key nitrogen input to the Klamath River. The DEIR must clearly present the potential effects the inaccuracies in the TMDL model have on the assumptions and effects analysis presented in the DEIR and present technically sound reasoning as to why incorporating those known inaccuracies into the DEIR analysis is appropriate.
3.2-57	3.2.5.3	3-117	Paragraph 3		The DEIR states "While there would be a slight increase in absolute nutrient concentrations entering the Middle Klamath River under the Proposed Project, phytoplankton, especially blue-green algae, would be limited in their ability to use those nutrients for growth and reproduction without calm reservoir habitat." As explained in previous comments, the estimated increase in nutrients is not "slight" and the DEIR needs to be adjusted to reflect the actual quantified magnitude of nutrient load increase. Further, the Klamath River downstream of Iron Gate Dam contains areas of stagnant water conditions in which blue-green algae can and currently does proliferate. Blue-green algae have also been documented to be present and to bloom in riverine conditions without reservoirs (e.g., Trinity River, Eel River, Willamette River, etc.) and so the elimination of the reservoirs will not result in the elimination of blue-green algae from the lower Klamath River, especially in light of the increase in nutrient delivery to the river following potential dam removal (see comment 3.2-24).

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					The DEIR analysis should recognize that the travel time from Keno Dam downstream to Iron Gate Dam will be reduced dramatically under several of the alternatives presented in the DEIR. Currently, few algae survive the high water pressures experienced through J.C. Boyle penstock and powerhouse, which conveys over 90 percent of the Klamath River flow from J.C. Boyle Dam through the powerhouse to the river downstream. Without J.C. Boyle and other dams, toxic algae from upstream sources (e.g., Keno reservoir) could readily be transported through the river reaches to downstream locations. Currently, algae released from Iron Gate Dam have been observed flowing into the estuary 185 miles downstream (Otten et al. 2015). This is sufficient evidence to suggest that algae released from Keno Dam would similarly be transported downstream to Klamath River reaches under the Proposed Project. This will be a long-term impact and unavoidable condition because Upper Klamath Lake is a hypereutrophic system that produces high levels of nutrients and algae.
3.2-58	3.2.5.3	3-118	Paragraph 1		The DEIR states that "Overall, the slight increase in annual nutrient concentrations would not result in significant biostimulatory impacts on phytoplankton growth under the Proposed Project relative to existing conditions, and the elimination of potential seasonal releases of dissolved nutrients from the reservoir bottom waters would be beneficial." However, as explained in previous comments, the analysis included in the DEIR does not support this finding (see comment 3.2-55 and 3.2-57).
3.2-59	3.2.5.3	3-118	Paragraph 2		The DEIR states "However, concentrations of both nutrients are high enough in the Klamath River from Iron Gate Dam to approximately Seiad Valley (RM 132.7) (and potentially further downstream) that nutrients are not likely to be limiting primary productivity (e.g., periphyton growth) in this more upstream portion of the Middle Klamath River." The DEIR does not adequately acknowledge and account for the fact that periphyton and macrophytes will uptake nutrients in currently inundated reservoir reaches

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					and in the J.C. Boyle peaking reach where periphyton and macrophytes growth is currently limited by hydropower peaking operations. The DEIR fails to acknowledge the extension of macrophyte and periphyton growth into about 30 miles of existing inundated reservoir and riverine habitat and the impacts this could have on water quality.
3.2-60	3.2.5.4	3-126	Paragraph 1		The DEIR states "However, the KRWQM does not include nutrient retention in the mainstem river downstream from Iron Gate Dam and assumes relatively high nutrient contributions from tributaries (Asarian and Kann 2006b). These input assumptions lead to a likely overestimate of the increase in periphyton growth, and therefore a likely overestimate of modeled predicted daily variations in dissolved oxygen." Regarding this statement, the DEIR should clarify how "nutrient retention" is being defined because contrary to this statement, the current version of KRWQM model does include the two most prevalent forms of seasonal nutrient retention in the Klamath River downstream of Iron Gate Dam: (1) aquatic vegetation growth and the concomitant nutrient uptake; and (2) senescence and contribution to organic matter (and the associated nitrogen and phosphorus fractions). These characterizations have provided key insight into nutrient cycling dynamics in the riverine portions of the Klamath River. Because there appears to be a misunderstanding in the DEIR regarding the mechanisms at work in the Klamath River regarding nutrient retention, the statement that the model over-predicts daily diurnal variation in dissolved oxygen is not adequately supported and fails to recognize that the KRWQM calibration reproduces hourly observed diurnal variation in dissolved oxygen.
3.2-61	3.2.5.5	3-131	Paragraph 6 (last paragraph)		The DEIR states "Klamath River TMDL model results indicate that under the "TMDL dams-out" scenario for Oregon reaches (TOD2RN), pH at the Oregon-California state line would exhibit less daily variability during spring (March to May) and fall (October to November) (see Figure 3.2-24)

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					than the "TMDL dams-in" scenario (T4BSRN)." The DEIR analysis should recognize TMDL modeling flaws (see comment 3.2-9 and 3.2-34). Specifically, the nutrient boundary conditions assumed in the Oregon Klamath River TMDL (ODEQ 2002) at Upper Klamath Lake are infeasibly low and result in almost no primary production in the Klamath River between Keno Dam and J.C. Boyle Reservoir (such a reduction in nutrients and associated primary production, if it were ever able to be achieved, would have detrimental effects on aquatic food webs in the Klamath River). This condition carries on downstream, resulting in low diurnal variation in dissolved oxygen at the California-Oregon state line (see comment 3.2-39). This erroneous TMDL assumption and the subsequent result is apparently the basis for the DEIR statement above. Further, under the Proposed Project, the J.C. Boyle Peaking Reach would be colonized by aquatic vegetation (currently absent because of the variable flow regime associated with hydropower peaking operations), which would yield a notably higher diurnal pH in this weakly buffered system.
3.2-62	3.2.5.5	3-133	Paragraph 1		The DEIR states "The Proposed Project also would be expected to eliminate the occurrence of high pH (greater than 8.5 s.u. [standard units]) and large daily fluctuations (0.5–1.5 s.u.) that occur in the surface waters of Copco No. 1 and Iron Gate reservoirs under existing conditions during periods of intense phytoplankton blooms (see Section 3.2.2.6 pH)." The DEIR further states "The pH in the free-flowing reaches of the river replacing these reservoirs would not be likely to exhibit such extremes in daily pH and would not result in a failure to meet the existing instantaneous maximum pH objective at the levels currently supported and would be beneficial." The DEIR fails to acknowledge that while pH values may not attain the same magnitude values of reservoir surface waters, colonization of this reach and upstream reaches by periphyton and macropyhtes under the Proposed Project will lead to pH values in excess of

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					9 s.u. and potentially allow ammonia toxicity to develop. Toxicity concerns are greater at the more upstream locations because these locations are closer to the source of organic matter (e.g., Keno Reservoir and Upper Klamath Lake) and thus would have a greater propensity to experience higher organic matter concentrations and the associated nitrogen fraction of organic matter that mineralizes to ammonia. Daily maximum pH values in excess of 9 would most likely occur frequently during summer and early fall months.
3.2-63	3.2.5.5	3-134	Paragraph 4		In this paragraph, the DEIR discusses the use of the Klamath River TMDL model for assessing impacts of the Proposed Project and other alternatives. The DEIR correctly points out that "...the full TMDL compliance modeling assumption does not reflect the existing conditions, and it would be speculative at this point to identify either the mechanisms necessary to implement the TMDLs or the timing required to achieve full compliance." After this acknowledgement of the speculative nature and uncertainty of TMDL-driven nutrient load reductions, the DEIR goes on to state that "However, the nutrient retention mechanism modeled in the Klamath River TMDL would be the same even if model inputs for nutrients were increased to concentrations under existing conditions, such that the general trend indicated by the Klamath River TMDL model output (i.e., dam removal would slightly increase downstream transport of total nutrients) is still informative for conditions where full TMDL compliance has not occurred." In effect, the DEIR rationalizes use of the TMDL model by assuming general trends would be representative of existing "slight" nutrient retention; however, it is quite plausible that this assumption is incorrect. Under the substantial reductions in nutrient loadings in the Klamath River that are assumed in the TMDL, the nutrient retention "mechanisms" could be quite different in kind and quantity. For example, as nutrient loads are systematically reduced, the relative amount of

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					nutrients that move downstream in soluble form through the water could be reduced in comparison to the amount moving via biotic transformations between the periphyton and flocculent detrital components (i.e., nutrient spiraling) (e.g., Gaiser et al. 2005). For this reason, the DEIR's assumption that "nutrient retention mechanisms" modeled under full TMDL compliance would be applicable to existing conditions may not be valid. In addition, the assumptions made in the TMDL model for the full compliance simulations, including boundary conditions, temperature conditions, and other factors also are questionable (see comment 3.2-34).
3.2-64	3.2.5.5	3-135	Paragraph 1		The DEIR states "As discussed above, the Proposed Project also would be expected to eliminate the occurrence of high pH (greater than 8.5 s.u.) and large daily fluctuations (0.5–1.5 s.u.) that occur in the surface waters of Copco No. 1 and Iron Gate reservoirs under existing conditions during periods of intense phytoplankton blooms, where the blooms can be transported downstream into the Middle Klamath River and adversely affect pH (see Section 3.2.2.6 pH)." While seasonal phytoplankton blooms would be less frequent without the Project reservoirs, the DEIR does not acknowledge that colonization by periphyton and macropyhtes into the hydroelectric reach will lead to pH values in excess of 9 during summer and early fall at least down to the Scott River (see comment 3.2-62).
3.2-65	3.2.5.6	3-136	Paragraph 2		The DEIR states "While algal toxins and chlorophyll-*a* produced in Upper Klamath Lake may still be transported downstream after dam removal, existing data indicate that microcystin concentrations in the Klamath River decrease to below California water quality objectives (see Section 3.2.3.1 Thresholds of Significance) by the upstream end of J.C. Boyle Reservoir, regardless of the microcystin concentration measured leaving the Upper Klamath Lake (Watercourse Engineering, Inc. 2011, 2012, 2013, 2014, 2015, 2016)." The DEIR analysis does not recognize that the travel time from Keno Dam downstream to Iron Gate Dam will be reduced

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					substantially under the Proposed Project (and several of the alternatives) and that delivery of algal toxins and chlorophyll-*a* would continue from Keno Reservoir. Currently, few algae survive the high water pressures generated by the J.C. Boyle Powerhouse, which conveys over 90 percent of the Klamath River flow at J.C. Boyle Dam through the powerhouse and into the river downstream. Without J.C. Boyle Dam and other dams, toxic algae from upstream sources (e.g., Keno reservoir) could readily be transported through the river reaches to downstream locations. In addition, the flow regime would further stabilize flows through much of what is now the Klamath Hydroelectric Project. Meeting USBR's 2013 Biological Opinion (2013 BiOp) flows that are currently measured downstream of Iron Gate Dam with operations at Keno Dam under the Proposed Project would change the hydrologic regime for the entire river downstream of Keno Dam. Currently, operations at Keno Dam are focused largely on maintaining a stable water surface in Keno Reservoir to support agricultural diversions. Given the fluctuation in inflow that occurs at Keno Dam and the resultant changes in releases from Keno Dam, J.C. Boyle Reservoir can be viewed as a sort of reregulating reservoir that stores this water before it is eventually metered out to the J.C. Boyle Powerhouse and points downstream. Thus, under current conditions, flows in the Keno Reach are quite variable. However, to meet 2013 BiOp flows in the future, Keno Dam releases will likely be far more stable (especially during the summer and fall months) only varying at most on a daily time-step. The analysis in the DEIR should assess potential implications of reduced travel time, the elimination of J.C. Boyle Powerhouse pressure-related destruction of entrained algae, and a more stable flow regime on transport of algae and algae toxins through this upstream reach (as well as the implication on other water quality parameters).

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3.2-66	3.2.5.6	3-138	Paragraph 1		The DEIR suggests that, while algal toxins produced in Upper Klamath Lake may still be transported downstream after dam removal, algal toxins produced upstream of J.C. Boyle Dam would not be transported into California and result in concentrations that would cause water quality standards exceedances. This is misleading. Rather, the DEIR should describe that the presence of microcystin can occur throughout the Klamath River system, including where conditions, such as nutrients, light, and slow-moving water environments (i.e., pools, backwater eddies, or the estuary), are present to support *Microcystis* growth or growth of other toxin-producing species. The DEIR should provide a more balanced discussion that includes acknowledgement that *Microcystis* is a common cyanobacteria in lakes, rivers, and estuaries around the world, where conditions are suitable to support *Microcystis* growth. In addition, *Microcystis* is not the only species found in the Klamath River that is capable of producing toxins (e.g., *Dolichospermum* and *Phormidium* which both produce anatoxin-a). The DEIR needs to provide a complete and accurate discussion of the cyanobacterial species present, their potential to produce toxins, their growth mechanisms (benthic versus planktonic), and how those populations could change as a result of the Proposed Project. It is overly simplistic to portray that *Microcystis* in the Klamath River is purely the result of delivery from upstream lakes and reservoirs and that *Microcystis* is the only blue-green algae worth considering.
3.2-67	3.2.5.7	3-139	Paragraph 1		The DEIR states that the screening values for inorganic and organic contaminants are "conservatively protective of human health" but does not explain why these values are considered conservative. Similar explanations should be provided at other places in this section where the term "conservative" is used to describe a screening value for a particular contaminant.

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3.2-68	3.2.5.7	3-143	Paragraph 3 (second full paragraph)		The DEIR discusses the 2009 and 2010 sediment sample results and indicates that 19 compounds were not detected in these samples but that the laboratory reporting limits for those compounds were above the human health screening values. While this is not an uncommon situation, the DEIR discussion needs to include the details about which analytes are involved and should also provide the laboratory reporting limits relative to the screening values so the reader understands the differences between these values. Additionally, because the laboratory limits of detection were higher than the human health screening values, there needs to be a cohesive logical process to support the conclusion that these substances would not affect human health, this is currently missing from the DEIR.
3.2-69	3.2.5.7	3-143	Paragraph 4, first sentence		The DEIR states "Elutriate concentration results (characterizing the water between the grains of sediment, which can be referred to as pore water)." This is an inaccurate statement. Elutriate tests measure what may be released from sediment during resuspension. This includes sediment porewater, which would only be a small fraction of what may be released. For this reason, the elutriate test needs to be more accurately defined.
3.2-70	3.2.5.7	3-144	Paragraph 4 (last one), first sentence		The DEIR states "...sample results at concentrations above Basin Plan, national priority, and national non-priority fresh water quality criteria..." but does not define what these criteria are.
Section 3.3 Aquatic Resources					
3.3-1	3.3.1	3-191	Last paragraph		The DEIR describes that the analysis area includes most of the Trinity River, but then states that the lower 0.25-0.5 mile of the Trinity River is also included in the analysis. On DEIR page 3-192, only the lower portion of the Trinity River (which is not defined) is included in the definition of the middle and lower Klamath River area of analysis. The DEIR should clearly

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					define the geographic extent of the Trinity River included in the analysis area and that is shown in Figure 3.3-1 of the DEIR.
3.3-2	3.3.2.1	3-197 to 3-198		Table 3.3-2	This table has a variety of issues, many of which relate to the availability of more recent data not shown in the table or inconsistent use of data presented in the table. The data in the DEIR should be consistently updated to reflect what is actually known about these fish populations. Specifically: 1. Table 3.3-2 of the DEIR should more clearly define the origin of the adult spawners as well as the definition used for wild and hatchery fish. Chinook, Coho, and Steelhead spawning in the wild, and at the hatchery, consist of both hatchery origin and natural origin fish. Although the table notes that Chinook and Steelhead run size includes hatchery fish, the table should also note that this applies to Coho as well. No data are provided for fall-run Steelhead. The footnotes should also be checked for accuracy. 2. Recent run size for Steelhead at Iron Gate Hatchery should be less than 10 not less than 100 3. Coho run size estimates do not take into account that data are available through the 2017/2018 spawning season and spawning surveys of major tributaries downstream of Iron Gate Dam that have been conducted annually since the 2015 spawning season (see MKWC 2016, 2017, 2018). 4. For all salmon on this table, is the subtext (spawners) in the location description supposed to indicate pairs of fish or just females? 5. CDFW publishes annual reports for Iron Gate Hatchery and Bogus Creek Coho returns that are not apparently used in this discussion (e.g., Giudice and Knechtle 2018).

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					6. It does not appear that the Trinity River Hatchery population is included in the total yet there is no explanation provided for this. 7. Similar comments to the above #3 through #5 but as apply to Chinook. There were only 2,587 total Chinook in the 2016-17 adult return year at Iron Gate Hatchery. 8. Counts of spring-run Chinook in the Salmon River should be updated through 2018. 9. Regarding the Green Sturgeon run size estimate, it would seem helpful to at least provide the harvest estimate so the reader can understand how large that segment of the population is. 10. Regarding Cutthroat Trout it is not clear how the population can be listed in the table as "stable to increasing" when there is no data upon which to base this conclusion. 11. Eulachon are anadromous and yet are completely missing from this table.
3.3-3	3.3.2.1	3-199	Last paragraph		Chinook and Steelhead redds can contain substantially more than 3,000 eggs with the number usually correlated with the size of the fish.
3.3-4	3.3.2.1	3-200	Last paragraph		The smolt-to-adult ratio (SAR) for Trinity River Hatchery fall Chinook should be replaced with data from Iron Gate Hatchery. The Iron Gate Hatchery would be affected by the Proposed Project while Trinity River Hatchery would not. Also, the SAR data should be updated through 2017 and separated by smolt/yearling release type to clearly understand how the different ages of released juvenile Chinook affects return rates. The yearling Chinook released from Iron Gate Hatchery usually return at substantially higher rates than those released as smolts.
3.3-5	3.3.2.1	3-201	Last paragraph		This section of the DEIR discusses Chinook abundance information as cited to documents produced in 1998 and 2011. Yet, the DEIR then states that

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					spawner abundance has not declined from 1970 to 2016. Beyond the obvious need to provide the population data for more recent years, this section could be strengthened by clearly separating the proportion of the populations that consist of hatchery origin versus natural origin spawners. This information can be found in the rebuilding plan for the Klamath River fall-run Chinook (Pacific Fishery Management Council 2018).
3.3-6	3.3.2.1	3-203	Paragraph 2		*Microcystis* is listed as a stressor to upstream migrating Chinook, yet the DEIR provides no information to support this assertion.
3.3-7	3.3.2.1	3-207	Paragraph 4		The statement in the DEIR that "Coho salmon are widely distributed in the Klamath River downstream of Iron Gate Dam…" is not supported with a citation and probably not supportable given recent tributary spawning surveys. Work conducted since 2015 to survey tributaries downstream of Iron Gate Dam to Portuguese Creek has reliably found Coho only in Bogus, Horse, and Seiad creeks (MKWC 2016, 2017, 2018). Other Coho populations exist in the Shasta and Scott rivers. The statements regarding PacifiCorp's Coho Enhancement Fund (CEF) are significantly out of date. The DEIR presents a myopic view of projects funded under the CEF and needs to be updated to reflect that as of January 2018, PacifiCorp has provided funding of over $4,900,000 into the CEF. Starting in 2009 and running through the 2017 grant cycle, 42 projects have been funded (with a value of about $4.3 million) that benefit Coho downstream of Iron Gate Dam. Selection of projects to fund is made by PacifiCorp with the assistance of a technical advisory team comprised of staff from the National Marine Fisheries Service (NMFS) and CDFW. PacifiCorp has developed a partnership with the National Fish and Wildlife Foundation to administer the fund. This partnership allows CEF grant recipients to be eligible for additional funding through other grant programs, further enhancing the conservation benefit of the fund. Using

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					this process, grantees have leveraged an additional $7.7 million in matching funds for Coho restoration projects as of 2017. Funded projects have resulted in a substantial benefit to Coho downstream of Iron Gate Dam. When the projects are considered collectively, the CEF has resulted in: • Over 2,300 linear feet of channel restoration • Creation of over 163,000 square feet of off-channel ponds • Installation of three fish screens • Removal of 73 passage barriers • Improved access to over 71 miles of Coho habitat • Installation of over 7 miles of riparian fencing • Implementation of 29 separate water leases providing improved flows in almost 36 miles of stream • Implementation of 71,000 square feet of other types of habitat enhancement projects.
3.3-8	3.3.2.1	3-208	Paragraph 1		The last sentence in this paragraph refers to Chinook when it should refer to Coho; both the species and table reference should be updated.
3.3-9	3.3.2.1	3-210	Paragraph 1		The DEIR states that "The flushing and emergency dilution flows are detailed in Section 4.2.1.1 [Alternative Description] *Summary of Available Hydrology Information for the No Project Alternative* as part of the No Project Alternative because they would likely only apply if Iron Gate Dam were to remain in place or the disease nidus remains." It is unreasonable and unsupported to assume that flushing flows would not be required after implementation of the Proposed Project. The USBR's current proposed action (USBR 2018a) is supposed to span the period through dam removal and into the post-dam operational period and includes a surface

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					flushing flow (6,030 cfs for 72 hours) as part of the proposed action. The existing disease flushing flows have been prescribed pursuant to a court decision regarding USBR's biological opinion and its operation of its irrigation project. Impacts to Klamath River flows as a result of USBR operations are part of the existing conditions and will persist following the Proposed Project.
3.3-10	3.3.2.1	3-217	Paragraph 1		Not all Redband Trout need to migrate to complete their life histories. There is documentation of spawning in the J.C. Boyle Bypass and Peaking reaches (PacifiCorp 2004b; Jacobs et al. 2008)
3.3-11	3.3.2.1	3-219	Paragraph 2		Suckers are also fully protected under the California Fish and Game Code Section 5515 which prohibits any action which can result in take. The reference in the DEIR to Fish and Game Code Section 2081.11 and the allowance of take, does not appear valid, that section does not exist in the Fish and Game Code (https://codes.findlaw.com/ca/fish-and-game-code/#!tid=NFD416841584B4E90941FD12BBC90E6E5).
3.3-12	3.3.2.1	3-221	Paragraph 3		Smallscale Suckers spawn in relatively fast-moving water and Moyle (2002) indicates that tributaries to the Klamath River are the primary spawning habitat. Although little is known about their specific spawning ecology, the assertion in the DEIR that Smallscale Suckers are adversely affected by operations of J.C. Boyle Powerhouse is not supported. Smallscale Suckers are fecund broadcast spawners likely releasing 15,000 to 20,000 eggs depending on the size and age of the female (Moyle et al. 2002; Pirrello 2011). Eggs from broadcast spawners are intended to wash downstream into suitable incubation habitat. Dunsmoor (2006) presents results of fish stranding observations in the J.C. Boyle Peaking Reach on July 5-7, 2006. Dunsmoor (2006) observed considerable stranding of fish, crayfish, and macroinvertebrates on July 5, 2006. However, July 5, 2006, was the first down-ramp event of the season

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					that followed several months of relatively stable flow. This down-ramp was also a two-unit ramp, meaning that flows changed from approximately 3,000 cfs to 350 cfs. Therefore, it is important to recognize that these observations of stranding pertained only to the atypical circumstances of that day and they do not reflect the potential for stranding under current normal project operations (under which PacifiCorp does not conduct two-unit peaking, or likely future project operations under a new license given prescribed ramp rates that would eliminate two-unit peaking). Dunsmoor's (2006) stranding observations on July 5, 2006, were made at a site near the downstream end of the relatively wide Frain Ranch part of the J.C. Boyle peaking reach. The next day (July 6, 2006), following the second two-unit down-ramp, he observed no fish stranded at sites downstream of Shovel Creek in the California section of the J.C. Boyle Peaking Reach. On the third day (July 7, 2006), Dunsmoor (2006) returned to the Frain Ranch area and observed no fish stranded at the same site where stranding was observed 2 days earlier following the first ramp event. Collectively these observations indicate that the first downramp after an extended period of stable flows is the event that poses the most risk to fish rather than the generic observation that down-ramping strands fish that is presented in the DEIR.
3.3-13	3.3.2.1	3-227 3-228	Paragraphs 3 and 4 on 3-227, 1 to 3 on 3-228		In the benthic macroinvertebrate (BMI) discussion there should be a more complete discussion provided that includes other metrics related to the existing populations. The Index of Biologic Integrity (IBI) values (pg. 3-228, 3rd paragraph) are good information; but similar work related to species richness, taxonomic composition, and *Ephemeroptera-Plecoptera-Tricoptera* (EPT) metrics should also be presented along with a stronger link to the effects of the BMI population on fish production to inform the reader as to why these are being considered in the analysis.

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3.3-14	3.3.2.3	3-235	Paragraph 1		The last sentence in this paragraph is misleading. While the mainstem Klamath River dams have disrupted sediment transport into the river from Iron Gate Dam upstream to Link River Dam, there are a large number of tributaries of varying sizes which all continue to provide bedload input into the Klamath River downstream of Iron Gate Dam.
3.3-15	3.3.2.3	3-235	Paragraph 2		A sentence is repeated in the middle of this paragraph that should be deleted: "Per the interim operations of the... (PacifiCorp 2014)." Also, "...interim operations of the Klamath Hydroelectric Project HCP..." is a meaningless statement and is unnecessary. Under the Habitat Conservation Plan (HCP) for Coho salmon, PacifiCorp agreed to place gravel downstream of Iron Gate Dam to augment spawning gravel; however, gravel monitoring was never part of the proposed placement process. Consequently, the sentence that says "...details on the extent of downstream movement have not been reported," while being technically correct, misses the point that there was never any requirement to monitor or report on gravel movement.
3.3-16	3.3.2.3	2-235	Last Paragraph		The DEIR states that "Water temperatures in the Klamath River are of special concern as they are elevated with greater frequency and remain elevated for longer periods of time than temperatures in adjacent coastal anadromous streams..." Ignoring the editorial issues (i.e., the fact that water temperatures cannot be elevated - as in higher in relation to something else - but can be warmer, and that the streams are not anadromous, but support anadromous species), the Klamath River is not a coastal stream. It is one of two rivers in the Pacific Northwest (the other being the Columbia River) that actually crosses both the Cascade and Coast Range mountains. The temperature regime in the Klamath River should not be compared to adjacent coastal streams. All of the 'adjacent streams' originate in the Coast Range and are substantially shorter, rainfall driven

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					systems with some snowmelt contributions (e.g., Trinity River which isn't even adjacent). None of those streams originate in the high desert of southern Oregon, let alone have a 121 square-mile hypereutrophic lake as their headwaters. In this case, DEIR needs to recognize the unique nature of the Klamath River and provide an accurate discussion of how these geographical, physical, hydrologic, and anthropomorphic conditions affect water temperature. The comparison to coastal streams is meaningless and yet mistakenly makes the reader think that there is something abnormal in those elevated water temperatures.
3.3-17	3.3.2.3	3-236	Paragraph 1		The DEIR indicates that warm water temperatures "have been associated with fish kills in the Klamath River downstream from Iron Gate Dam during low flow periods in late summer." While water temperatures certainly play a role in fish kills, the DEIR is making an inaccurate association between the temperature of water released from Iron Gate Dam and the death of adult salmon in the lower Klamath River. The DEIR should clarify that fish kills have occurred in the Lower Klamath River rather than downstream of Iron Gate Dam because as it is currently written, the DEIR inaccurately portrays fish kills as having occurred disproportionately near Iron Gate Dam, or as a result of Iron Gate Dam operations. For example, the well-reported 2002 fish kill occurred in the lower 36 miles of river, over 150 miles downstream of Iron Gate Dam. Analysis on the 2002 fish kill does not specifically attribute effects from Klamath Hydroelectric Project facilities on the key factors considered to have caused the fish kill (i.e., low flows, warm water temperatures, high fish returns resulting in crowding of available habitat, and proliferation of the pathogens Ich and *Columnaris*) that far downstream (CDFG 2004). The DEIR needs to be revised to accurately reflect the distance downstream of Iron Gate Dam that modeling has shown water temperatures could be affected by releases from Iron Gate Dam. As was

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					mentioned previously (see comment 3.2-42), this downstream extent of this effect is the confluence with Clear Creek at RM 95, about 50 miles upstream of where the 2002 fish kill was concentrated. Thus, the DEIR's portrayal of temperature effects of Iron Gate Dam playing a role in the 2002 fish kill is misleading and presents a false portrait to the public that the Proposed Project will ameliorate conditions such as those that led to the 2002 fish kill.
3.3-18	3.3.2.3	3-236	Paragraph 2		The DEIR states that "Temperatures in Upper Klamath Lake are cooler than those in the Klamath River downstream from Iron Gate Dam in the late summer and early fall when fall-run Chinook are migrating." This statement is made without a citation, data, or any other form of support. Upper Klamath Lake is at over 4,140 feet in elevation, is extremely shallow and would be expected to cool off faster in the fall than lower elevation reservoirs and the lower river. While it may be true that Upper Klamath Lake is cooler in the fall, a discussion about the biological significance of the difference in water temperatures is absent in the DEIR. If the temperatures in both locations are all cooler than some threshold that would impair Chinook migration or spawning, as it would appear from the spot KHSA Interim Measure 15 data (see graph below), then it is there may be no biological significance with water temperatures downstream of Iron Gate Dam being warmer relative to those in Upper Klamath Lake. To address this, the DEIR should present a set of biologically-based criteria and review the readily available water temperature data for the different locations and present a biologically-based discussion of the differences along with the significance (if any) of those differences.

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					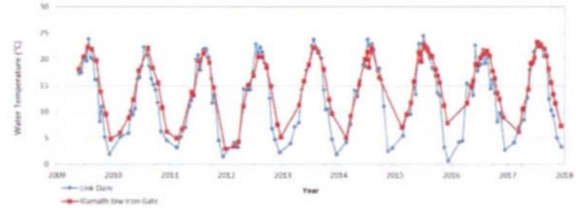
3.3-19	3.3.2.3	3-236	Paragraph 2		This paragraph of the DEIR notes that fast growing Redband Trout can take refuge in cool thermal refugia around Pelican Bay when Upper Klamath Lake water temperatures are very warm. It states that juvenile Chinook can use wetlands in these areas for rearing. The DEIR should then describe that juvenile Chinook using these areas would be highly susceptible to predation from trout residing in the same area and present an analysis of this predation on the rearing Chinook as it relates to the success of reintroduction.
3.3-20	3.3.2.3	3-236 3-237	Last paragraph on 3-236, first paragraph on 3-237		This paragraph grossly oversimplifies the water quality issues in Lake Ewauna and Keno Reservoir. If the DEIR is going to discuss water quality in Keno Reservoir, it should be revised following a complete review of at the available water quality data for this location as it relates to aquatic resources.
3.3-21	3.3.2.3	3-237	Paragraph 1		The DEIR should be consistent when describing effects for different reaches. For example, previously in the DEIR, temperatures of 71.6 to 77 degrees Fahrenheit (°F) are defined as still being within the preferred range for warm and some coldwater species. However, this same conclusion is not presented for the upper Klamath River Hydroelectric Reach. The DEIR emphasizes small areas of thermal refugia having great value for fish in Upper Klamath Lake (see pg. 3-236), but there is

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					comparatively little discussion of the thermal refuge benefits to fish of the 220 to 250 cfs of groundwater in the J.C. Boyle bypass reach. The bypass reach is 4.6 miles in length and exhibits stable stream temperatures (51.8° to 53.6°F) ideally suited for resident and anadromous salmonids. The temperature effects that the Proposed Project and the different alternatives would have on the bypass reach vary substantially but these differences are hardly discussed in the DEIR. For example, the removal of J.C. Boyle Dam results in a large increase in stream temperature and diminished water quality as a result of mixing spring water with Klamath River water that is currently diverted around the J.C. Boyle Bypass Reach (see comment 3.2-8).
3.3-22	3.3.2.3	3-237	Paragraph 1		The DEIR states "In addition, numerous cold-water springs contribute flows to both Copco No. 1 and Iron Gate reservoirs." This statement is unsupported and PacifiCorp is not aware of substantial cold-water springs other than the springs in the J.C. Boyle Bypass Reach that contribute approximately 220 to 250 cfs of inflow. Spring Creek does have a spring water source as its headwaters, but this contribution comes to Iron Gate Reservoir from Jenny Creek and from diversions of Spring Creek into Fall Creek for hydroelectric generation purposes. The DEIR should correct this statement.
3.3-23	3.3.2.3	3-238	Paragraph 1		The DEIR states that water temperatures within the hydroelectric reach are within the tolerance ranges of the species observed there. However, these temperatures regularly exceed the range of chronic effects temperature thresholds (55 to 68°F) for full salmonid support. This and previous sections in the DEIR should consistently discuss if and when chronic effects thresholds are reached for the Proposed Project. The DEIR does not evaluate the relative change between the existing conditions that are cooler in the spring and presumably delay when chronic effects

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					thresholds are exceeded compared to the Proposed Project under which water temperatures would warm sooner in the spring perhaps exceeding these thresholds earlier in the year and for a longer period of time than under existing conditions. Also, the DEIR should mention that the tributary streams in this reach provide thermal refugia for fish. Overall, the description of stream temperature in the DEIR is unbalanced because the discussion of the hydroelectric reaches emphasizes warm water while coldwater is emphasized in other reaches.
3.3-24	3.3.2.3	3-238	Paragraph 2		There are a few areas where the DEIR analysis related to water temperatures downstream of Iron Gate Dam with respect to the thermal lag. and how that may affect salmonids that should be clarified in the DEIR: 1. The DEIR uses monthly average temperatures which are not a good indicator of actual conditions experienced by fish. Fish exhibit complex behavioral mechanisms to allow them to persist in areas where a monthly average temperature would characterize the habitat as unsuitable. 2. The DEIR analysis does not use data more recent than 2007 when there's over 10 years of specific temperature data available downstream of Iron Gate Dam and in the Klamath River in general. 3. Temperature effects of the Klamath Hydroelectric Project do not propagate all the way downstream to the Salmon River (see comment 3.2-42). The DEIR should improve this analysis by using the 7-day average of the daily maximum (7DADMax) water temperature metric as is done by USEPA (2003).
3.3-25	3.3.2.3	3-239	Last paragraph		The DEIR discusses actinospore temperature viability range, viability length of time (3 to 7 days), and distribution. However, the DEIR does not incorporate this information into the effects analysis for the Proposed

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					Project and each alternative. The DEIR should describe the distance downstream an actinospore can travel under various flow regimes before it cannot infect susceptible salmonids. Similar information should be provided on myxospores because it is this *C. shasta* stage that infects the polychaete host and it is polychaete abundance that determines actinospore abundance. The DEIR should incorporate the following information from Som et al. (2016) into the analysis: 1) There is no evidence to suggest that myxospore detection is associated with fish size (age), sex, spawning timing (death), or carcass site; and 2) Carcass removal is not a viable method for reducing myxospore levels, in addition to being contrary to ecological processes (see Foott et al. 2017). This second point is of special interest because it implies that reducing carcasses (spawners) has little effect on myxospore abundance. This is because billions of myxospores are released by a small percentage of the infected adults. Given this, the claims made later in the DEIR regarding the benefits of the Proposed Project through a reduction in spawner densities that in turn leads to decreased disease, is not correct and should be reconsidered. This impacts the DEIR conclusions that the Proposed Project will reduce fish disease in the Klamath River and that flushing flows will be unnecessary following the Proposed Project. The DEIR states that spore concentration and water temperature are more important determinants of the infectious rate than river flow. However, as noted in the DEIR, spore concentration is measured as spores per liter of water sampled. Thus, given the same number of spores, spore concentration would be higher at lower flows and lower at higher flows so it is unclear how spore concentration is not directly linked to flow. Given this conflict, the DEIR needs to be revised to clearly present the logic relating to spore concentrations and infectious rates.

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					Additionally, the DEIR does not evaluate the impacts of modifying the existing temperature regime, in which the thermal lag produced by the hydroelectric reservoirs results in locally reduced river temperatures downstream of Iron Gate Dam during the spring. Removal of the hydroelectric reservoirs could increase disease infection as a result of higher river temperatures. This is not evaluated in the DEIR.
3.3-26	3.3.2.3	3-242	Paragraph 1		The word "atypically" should be deleted from "abundant polychaete populations that are found in atypically stable habitats." Polychaetes are found in stable and unstable stream habitat. If polychaete abundance is higher in "atypical" stable habitat, then the DEIR should provide the level of increase over stable habitat and provide definitions for each. This paragraph also states that parasite densities are as high in the Williamson River as downstream of Iron Gate Dam. Since the *C. shasta* relies on polychaetes to complete its life cycle, if follows that large numbers of polychaetes must be present in this river. The DEIR should provide examples of "atypical" habitat in the Williamson River. The sources supporting the conclusion that the movement of anadromous fish upstream of Iron Gate Dam would present a low risk of introducing *C. shasta* is out of date. While the resident fish might not suffer increased rates of infection following the Proposed Project, there is no reason to assume the same would be true of anadromous fish recolonizing the area. Because the work of Foott et al. (2016) indicates that most myxospore loading comes from relatively few adults and polychaetes are abundant in the Williamson, Sprague, and Klamath rivers as discussed in the DEIR, then asserting that disease would not spread upstream is unfounded.
3.3-27	3.3.2.3	3-243	Paragraph 1		The DEIR cites an incomplete set of prevalence of infection (POI) rate data that only extends to 2012. POI data are readily available for every year since 2013 because the data were required monitoring for USBR as part of

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					their 2013 BiOp compliance (see reports available here: https://microbiology.science.oregonstate.edu/content/monitoring-studies).
3.3-28	3.3.2.3	3-243	Paragraphs 2 and 3		The DEIR does not accurately portray the complexities surrounding infection of Coho and Chinook in the Klamath River for the following reasons. 1. The paragraph links high disease infection rates to high mortality of outmigrating juvenile Coho and uses the results of Coho survival studies conducted by Beeman et al. (2008) to support the claim. However, Beeman et al. (2008) does not reach any conclusions as to the effect disease may have played in Coho juvenile migration survival rates in the Klamath River. Beeman et al. (2008) stated that overall survival from Iron Gate Hatchery to river kilometer (km) 33 was similar to survival in other rivers. The survival rate over this 276 km distance was 0.857 per 100 km. They note that survival rates for Coho in the Yakima River for example ranged from 0.79 to 0.913 per 100 km. 2. The DEIR does not use the most current and best available information in this discussion that shows the shifts in the infectious zone through the years. The DEIR should be use the results of the fish exposure studies conducted by Oregon State University with funding provided by USBR and available for 2008 through 2017 online at: https://microbiology.science.oregonstate.edu/content/monitoring-studies. Even though release of myxospores by upstream spawning salmon drives infection of polychaete hosts, this more recent information indicates that the disease infectious zone has moved downstream from Iron Gate Dam in recent years to locations much further downstream (e.g., Orleans) (see True et al 2017; Voss et al. 2018). This

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					conflicts with the DEIR conclusions that the Proposed Project will ameliorate disease effects in the Klamath River. 3. All adult Chinook that enter Iron Gate Hatchery are removed from the river. The only way the hatchery contributes to the density of infected carcasses is by producing fish that spawn naturally in the Klamath River. 4. Some of the data regarding the highest rates of infection as presented in the DEIR are out of date and it is unclear if the authors are discussing the infection rate of fish or polychaetes.
3.3-29	3.3.2.3	3-245	Last paragraph		The DEIR does not provide any information that defines spawning densities that result in increased disease levels. This information is needed to determine if the expected increase in adult fall-run Chinook production upstream of Iron Gate Dam is likely to exceed this same density level. As written, this paragraph in the DEIR is in conflict with Som et al. (2016) a as cited in DEIR stating that reducing carcasses (i.e., spawners) from the stream has little effect on spore load.
3.3-30	3.3.2.3	3-247	Last paragraph		There has been a great deal of fluctuation in adult return numbers and fish production at Iron Gate Hatchery over the years. This paragraph does not consistently present the information that is readily available for this facility. Specifically, the DEIR should consider that: • There are annual reports available from CDFW through the 2017 return year that document returns and releases (e.g., CDFW 2018). The DEIR obviously did not include any of this information. • There is data on Coho returns to Iron Gate Hatchery since the facility was completed in 1962. Choosing to describe the declines in Coho since a 'peak return year' in 2001-2002 is misleading. If one reviews the entire data set it is obvious that the actual peak was in the 1996/97 year when 4,097 Coho returned. The lowest year(s) were not 2015/16,

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					but 1964-65, 1965-66, and 1966-67 when 0, 2, and 4 Coho were trapped respectively. These years are the flood of record in 1964 and the following 2 years which likely explains the low numbers of fish trapped. • The long-term average release of yearling Coho is almost 95,000 fish. The DEIR presents a similarly fragmented data set for Chinook to that discussed above for Coho. It is not clear why there are only Chinook data presented starting in 2005 or 1978, for adult returns and juvenile releases, respectively, with adult return data possibly extending through 2017.
3.3-31	3.3.2.3	3-248	Paragraph 1		Similar to the data issues presented in the previous comment for Coho and Chinook (see comment 3.3-30), there are adult return data for Steelhead since 1963/64. The real break in the number of returning adults appears to have happened in the 1989-90 year when only 759 adults returned compared to over 3,000 the year before. The long-term average return to Iron Gate Hatchery is 1,105 fish (range 0-4,411). In the last sentence of this paragraph, the DEIR needs to clarify the last release year for Steelhead. The last brood year released was 2012, which was released in 2013.
3.3-32	3.3.2.3	3-248	Paragraph 3		This paragraph should be clarified to reflect implications for Chinook compared to those for Coho. For example, the sentence referencing CDFW (2014) relating adverse hatchery-related effects from hatchery-origin adults mixing with the natural populations and straying (Ackerman et al. 2006) is not true for Coho found in most tributaries downstream of Iron Gate Dam except Bogus Creek and the Shasta River. In 4 years of Coho spawning surveys (through January 2019) only one hatchery Coho carcass has been found in tributaries downstream of Iron Gate (not including the Scott and Shasta rivers) (MKWC 2016, 2017, 2018, unpublished 2019 data).

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3.3-33	3.3.2.3	3-248	Paragraph 4		The Hatchery Genetics Management Plan (HGMP) referenced in this sentence was prepared by CDFW and PacifiCorp and is typically referenced as such (e.g., CDFW and PacifiCorp 2014). The DEIR mentions in passing many of the topics covered in the HGMP, but does not explain how the HGMP is specifically designed to increase the genetic fitness of Coho used in the hatchery Coho program, evaluate the predation and competition aspects of these hatchery fish on the naturally-occurring Coho, or monitor spawning populations in tributaries downstream of Iron Gate Dam. All of this information feeds back into the HGMP and the Iron Gate Hatchery Coho program with the overall goal of increasing the genetic fitness of Coho in the upper Klamath River.
3.3-34	3.3.2.3	3-249	Paragraph 1		The DEIR should evaluate the transport distance for a spore freshly released from a Chinook carcass that moves downstream for 3 days on standard 1,000 cfs flow. The DEIR statement that "Heavily infected…that congregate downstream of Iron Gate Dam and IGH [Iron Gate Hatchery]" misleads the reader to think that a high number of spawners is necessary to fully infect the polychaete population downstream. This is counter to the current scientific understanding that it only takes a few infected carcasses to fully load the system with spores (Foott et al. 2016); a situation that would happen regardless of the presence of Iron Gate Dam and Iron Gate Hatchery.
3.3-35	3.3.2.3	3-249	Paragraph 3		While PacifiCorp does not disagree that there can be negative effects of hatchery releases on natural salmonid populations, it is not clear that such a thing is happening in the Klamath River and the DEIR presents no information to indicate this competition is an issue. The hatchery releases are typically later than the outmigration timing for natural-origin fish which limits the overlap in space and time during which fish compete for the same resources. The Predation, Competition, and Disease (PCD) Risk

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					modeling of hatchery releases conducted annually by PacifiCorp has not indicated a substantial effect on natural origin fish from hatchery releases, even using the most conservative spatial and temporal overlap and competition conclusions (PacifiCorp 2018a). The two citations used as supporting information for the density-dependent impacts of hatchery operations (Kostow et al. 2003; Kostow and Zhou 2006) relate to a hatchery summer Steelhead program on the Clackamas River in northern Oregon. While the cited sources do indicate that the presence of hatchery summer Steelhead depressed the production of winter-run Steelhead, caution needs to be used when extrapolating this finding to the Klamath River. For example, Courter et al. (2018) concluded that hatchery summer Steelhead did not affect winter-run Steelhead abundance in the Clackamas River. There is no discussion in either of these sources or the DEIR about the relative availability of habitat and food supplies between these two rivers. These differences would influence the ability to accurately relate the conclusions of work on the Clackamas River to fish interactions on the Klamath River. The DEIR does not include the information necessary to understand if the comparison of these two streams is accurate.
3.3-36	3.3.2.3	3-249	Paragraph 5		The DEIR notes that algae are produced in Upper Klamath Lake but fails to note that algal toxins are also produced by *Microcystis* from Upper Klamath Lake and Keno Reservoir and that these sources would remain if the Proposed Project is implemented and Copco and Iron Gate reservoirs are removed.
3.3-37	3.3.2.3	3-250	Paragraph 1		The DEIR needs to be revised to clarify this paragraph: 1. This paragraph is out of place. There has been no discussion of suckers up to this point in Section 3.3 and mixing them into the middle of the

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					salmonid discussion only confuses the reader and leads to false analogies between sucker health and salmon health. 2. There has been a substantial amount of work on sucker disease and survival issues since the one study by VanderKooi et al. (2010) that is cited in this paragraph. The DEIR needs provide an up to date discussion that reflects the best available information relating to the effects of algal toxins on suckers in Upper Klamath Lake. 3. Once the DEIR has presented a comprehensive review of this more recent research, it will be apparent that the link between algal toxins and sucker survival has not been demonstrated.
3.3-38	3.3.2.3	3-250	Paragraph 2		It is to be expected that fish living in waters with high levels of microcystin would in turn have high levels of microcystin in their tissues. Variations in toxin loading are likely related to the time of year, life-stage collected, and algal bloom conditions in any given year. While the DEIR acknowledges most of these limitations, it does nothing to help the reader understand what may be influencing the results. It is also unclear in the DEIR, what effect toxin loading in fish tissue may have on those fish. The DEIR indicates that the link between toxin accumulation and fish health is unclear, but goes on for multiple paragraphs expounding on the amount of toxin loading. If this were a public health section, then the discussion would be pertinent, but since the scientific evidence supporting an effect on fish health from microcystin is lacking, the discussion is extraneous and simply confuses the reader.
3.3-39	3.3.2.3	3-253	Paragraph 3		The DEIR states that "These fluctuations in this reach can also result in rapid temperature changes between 5 and 59°F during the summer months (ODEQ 2010)." The ODEQ (2010) source is the Klamath River TMDL that ODEQ developed but which has since been withdrawn, in part because of issues with the modeling (see comment 3.2-34).

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					See also comment #3.3-12. The last sentence in this paragraph states that "...in the trial-type hearing...it was found that this reach had lower macroinvertebrate drift rates...suggesting a reduced food base for fish." While the trail type hearing may in fact have reached this conclusion, this is contrary to the fish populations observed in the peaking reach. This area supports spawning Redband Trout and a high-quality recreational fishery (PacifiCorp 2004b). It is managed by ODFW for the production of wild fish and is a designated conservation population (IRCT 2016). It is not plausible for this area to support a robust trout population along with documented spawning and migration in the mainstem Klamath River and into nearby tributaries if food were limiting. Condition factor data collected by PacifiCorp (2004b) did not indicate that Redband Trout in the bypass and peaking reaches were in poor condition, in fact, they were generally in better condition than fish from the reach downstream of Keno Dam (see table below). Condition factors over 1 are generally considered to be indicative of fish in good condition.

Reach-specific Seasonal Condition Factors of Redband Trout caught in 2002
Number of Fish Used in Calculations in Parentheses.

Season	Reach		
	Keno (#)	Bypass (#)	Peaking (#)
Spring	1.16 (25)	1.43 (28)	1.19 (39)
Summer	1.13 (27)	1.18 (48)	1.26 (31)
Fall	1.24 (105)	1.24 (225)	1.15 (101)
Average	1.18 (157)	1.28 (301)	1.20 (171)

Note: Only fish larger than 50 millimeters.
Source: PacifiCorp 2004b

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3.3-40	3.3.2.3	3-253	Paragraph 4		The historic loss of fish from power peaking operations in the Klamath River resulting from the operations of Copco 1 and Copco 2 was the reason that Iron Gate Dam was built. Iron Gate Dam reregulates the peaking operations of the two Copco powerhouses and releases a stable flow into the Klamath River. This entire paragraph has nothing to do with the Proposed Project and should be removed.
3.3-41	3.3.2.3	3-254	Last paragraph		There is no critical habitat for Green Sturgeon in the Klamath River and this entire discussion should be removed.
3.3-42	3.3.3	3-258 3-259	Paragraph 4-6 and 1-5		PacifiCorp appreciates the effort to attach a quantitative change value to each of the significance criterion; however, the approach presented in the DEIR is fatally flawed and does not describe a criterion that allows for an accurate evaluation of impacts of the Proposed Project on salmonids, especially Coho and Chinook salmon for the following reasons. 1. Because fish use of the river is affected by water quality (including sediment transport analysis) there is a substantial amount of references within the Section 3.3 Aquatic Resources impact analysis to the analysis in Section 3.2 Water Quality. In general, this approach is appropriate; however, "short-term" is inconsistently defined which makes this cross-referenced inaccurate at best and completely wrong at worst. For example, for analyses of water quality, dam-released sediment, and sediment resupply, short-term is defined as 2 years following dam removal (e.g., DEIR pgs. ES-6, 3-44, 3-760, 3-775). For aquatic resources impact analysis, short-term is defined as less than 5 years following dam removal (e.g., DEIR pg. 3-258). Correspondingly, long-term is defined as occurring more than 2 years after dam removal for water quality and sediment resources (DEIR pg. 3-44) and more than 5 years after dam removal for aquatic resources (DEIR pg. 3-258). These variable definitions create a dilemma where long-term water

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					quality and sediment impacts overlap with short-term impacts to fish and other aquatic biota. In the case of water quality and sediment impacts on fish, this overlap creates a situation where the DEIR grossly underestimates the potential severity of short-term impacts as they pertain to fish. The DEIR does not account for this disparity when evaluating the severity and significance of short-term impacts. 2. Regarding the aquatic resources impact analysis, the DEIR states that "A period of five years was selected as short-term, because for most aquatic resources this represents one to two generations." The DEIR fails to provide a rationale for why "one to two generations" is used and how this particular definition was determined. 3. The DEIR notes that there are nine population units of Coho in the Klamath River and that the analysis considers the impacts and benefits for each of the populations separately. However, the DEIR makes significance determinations for all populations in the Klamath Basin combined. This approach to significance determination is inappropriate for Coho because more than 50 percent of the Coho produced in the basin come from the Trinity River hatchery and natural spawning areas in the Trinity River basin (Naman and Perkins 2016; Kier et al. 2018). Because the Trinity River would be unaffected by the Proposed Project, it would be impossible for any element of the Proposed Project to reach the level of significance for Coho as assumed in the DEIR. Given the small numbers of Coho present in the Upper Klamath subpopulation (see #5 below and Major Issue 2.1) the loss of 50 percent of a year-class of the upper Klamath River Coho population could be biologically devastating and yet not be considered a significant impact. 4. The DEIR fails to provide a biologically-based justification for the selection of the 50 percent criterion for the population as a whole

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					versus the individual subpopulations. The DEIR states that resiliency of the population was considered when evaluating potential impacts, yet the use of a single value for all aquatic species would lead the reader to mistakenly believe that all species were equally resilient. For example, the DEIR assumes that a 50 percent loss of a single-year class of federally-threatened Coho is the same as the loss of 50 percent of a year class of unlisted Chinook. Complicating this, Coho have a 3-year life cycle which exposes more of the population to adverse effects of the Proposed Project at one time when compared to Chinook with a variable 4- to 5-year life cycle. Ignoring the fact that the Coho population is extremely small when compared to the Chinook population, using the DEIR's logic, the 50 percent loss of a year class would seem to have a proportionately higher impact to Coho than Chinook. 5. The DEIR analysis of Proposed Project potential impacts to Coho must reflect the relative abundance of this federally-threatened species in the upper Klamath River. There are very few Coho in the upper Klamath River geographic area (Iron Gate Dam downstream to Portuguese Creek) with most populations at or below depensation thresholds (see Major Issue 2.1). Given the extremely small number of fish in these populations, loss of half of the population alone would be an impact that this population could not sustain, possibly leading to extirpation of Coho in the upper Klamath River. Use of a threshold like the one proposed in the DEIR would allow a reduction in fish, without it being characterized as a significant impact, to the extent that Coho would not be abundant enough to colonize areas upstream of Iron Gate Dam following implementation of the Proposed Project. 6. Recent case law supports the need to define this impact as significant even if it technically may not align with the State Water Board's significance criteria. Specifically, "[A] threshold of significance cannot

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					be applied in a way that would foreclose the consideration of other substantial evidence tending to show the environmental effect to which the threshold relates might be significant" (*Communities for a Better Environment v. California Resources Agency* (supra, 103 Cal. App. 4th 98). 7. Given the challenges to basin agriculture and water supplies related of avoiding jeopardy under the Endangered Species Act with respect to operation of USBR's Klamath Project, a 50 percent loss of a year-class of Coho salmon could impact the listing status of Coho and result in additional impacts to agricultural water supply if further irrigations restrictions are required to support flow conditions necessary to avoid jeopardy to a reduced abundance of threatened Coho. Given the minimal benefits to Coho described by the Klamath Expert Panel (Dunne et al. 2011) with respect to the Proposed Project, recovery from this impact could be challenging if not impossible. 8. Similar to the issues discussed above for Coho, loss of 50 percent of a year class of Chinook could dramatically impact the adult return, subsequent generations, commercial and tribal fisheries, success of reintroduction, recreational fishing, etc. 9. Regardless of the threshold issues, the analysis in the DEIR fails to establish an accurate baseline population to clearly establish a value against which losses attributable to the Proposed Project are compared. Related to this, the DEIR needs to discuss how the shot-term effects which can happen within a 5-year time span line-up with the 50 percent threshold for a year-class.
3.3-43	3.3.3	3-258	Last paragraph		The DEIR classifies effects as significant if habitat (quality/quantity) of a native species is reduced by more than 50 percent. If this logic is consistently applied to the Proposed Project and the alternatives, then because reservoirs provide more juvenile salmonid rearing habitat per mile

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					than a free-flowing river and water quality in the reservoirs is suitable for rearing through the spring months, the DEIR should conclude that the removal of dams results in a significant reduction in seasonal rearing habitat for Coho and Chinook (especially for the Existing Conditions with Fish Passage alternative).
3.3-44	3.3.3	2-259	Paragraph 1		The DEIR defines a long-term effect as the period starting 5 years after removal of all dams. Because no end date is set for the definition of long term, it is unclear when benefits would be realized or impacts cease. Because duration is an important factor considered in determining effects, the DEIR should provide more information on what was assumed and used for establishing the end point for long-term effects. In doing this, the DEIR needs to acknowledge that the end point of construction or restoration may not be the actual end of the effects. For example, PacifiCorp and Portland General Electric continue to work on issues associated with Condit Dam and Marmot Dam removal 5 and 12 years respectively after the actual removal.
3.3-45	3.3.4.1	3-262	Paragraph 2		The DEIR references "...taking into account when the species and what percent of the population is likely to be present in the Klamath River mainstem..." Yet the DEIR fails to provide any information about how the percentage of the population present at any given point in time is known or predicted.
3.3-46	3.3.4.2	3-262	Paragraph 3		The DEIR should explain how it was determined that the use of historic hydrology in evaluating the fate of bedload was appropriate. There was a substantial shift in high-flow events in about 2000 (first graph A below from Shea et al. 2016) when USBR's operations changed as a result of the biological opinion under which they were operating which included a shift in the flood control curve in Upper Klamath Lake (second graph B below).

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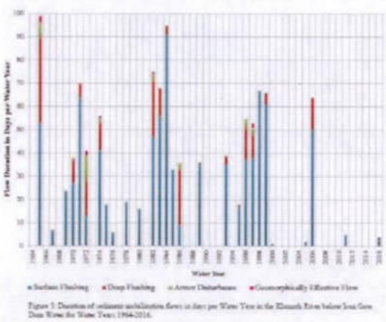
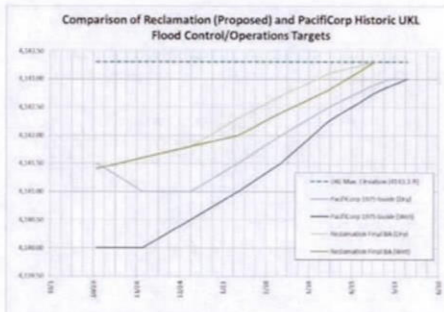
					 Graph A: Figure 5 from Shea et al. (2016)  Graph B: Comparison of Reclamation and PacifiCorp Upper Klamath Lake Flood Control Lake Elevations

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3.3-47	3.3.4.5	3-263	Bullets		The 59°F water temperature criterion according to Bartholomew and Foott (2010 as cited in the DEIR) applies when infectious dose of *C. shasta* is small. Bartholomew and Foott (2010) state (on pg. 38) that when infectious dose is high, temperature is not a strong predictor of survival. The data in Table 6.1 in Bartholomew and Foott (2010) show substantial effects on salmonids at temperatures ranging from about 55°F to almost 70°F (13 degrees Celsius (°C) to 21°C). The DEIR does not accurately reflect the information available in the cited source. The DEIR needs to evaluate potential impacts that could occur over this wider range of temperatures and discuss the relative effects of *C. shasta* on salmonid populations at high dose levels.
3.3-48	3.3.4.6	3-264	Paragraph 3		To evaluate the impact of the Proposed Project on Aquatic Habitat, the DEIR uses a qualitative evaluation but applies that evaluation to the 50 percent change criterion, a quantitative threshold, to determine significance. It is unclear how this qualitative comparison to a quantitative threshold is done in any way that results in a supportable conclusion in the DEIR.
3.3-49	3.3.4.10	3-265	Last three paragraphs		Since they are not a sensitive resource or species, it is unclear why benthic macroinvertebrates are included in the analysis.
3.3-50	3.3.5.1	3-267	Paragraph 1		The DEIR states that "Tributaries between the hydroelectric Reach and the estuary contribute a significant amount of both water and suspended sediments to the Klamath River mainstem." This statement should be supported with a citation and statistically supported in terms of the significance claim.
3.3-51	3.3.5.2	3-269	Paragraph 2		This analysis does nothing to evaluate the effect of bedload movement on fish. Simply saying that natural processes would be restored, while true, does not explain the possible impacts to fish. Impacts to salmonids could

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					occur though changes in channel morphology, conversion of habitat from pool to run or riffle habitat (or the other way around), burying or scour of redds, and so on. None of those appear to be discussed.
3.3-52	3.3.5.4	3-271	Paragraph 4		Residence time in Copco and Iron Gate reservoirs is specifically known to be about 19 days in Copco and 26 days in Iron Gate under typical summer flow conditions. Perhaps these values were added together to get the 'several weeks' as indicated, but not supported, in the DEIR.
3.3-53	3.3.5.4	3-272	Paragraph 2		The DEIR states that spring water temperatures are cooler with dam removal. However, in other sections of the DEIR states that spring water temperatures are warmer. The DEIR should correct this or indicate if cooling is specific to the reach (see comment 3.3-70 regarding water temperatures in the reach). Generally, previous water quality modeling results from PacifiCorp (2004, 2014) indicate that river temperatures downstream of Iron Gate Dam would increase in the spring in the absence of Project facilities (i.e., with dam removal).
3.3-54	3.3.5.4	3-271	Paragraph 4		Two elements of this paragraph need to be addressed: 1. The discussion about how more water would be available is confusing and should be rewritten. An increase of 6,200 acre-feet/year sounds impressive, but even if this all occurs during the May-Sept period, that is only about an increase of 20 cfs per day. The DEIR asserts that because of evaporation losses from Copco and Iron Gate reservoirs would be removed, this extra 6,200 acre-feet water may be available to USBR for diversion. The loss of hydroelectric reservoir storage and the ability to manage flows from Iron Gate Dam through fairly precise releases from the hydropower complex will also mean that flow deliveries that are currently required of USBR, and that are likely to continue following proposed dam removal (such as flow releases for Tribal Cultural Ceremonies), will need to occur from Keno Dam,

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					approximately 40 miles upstream of Iron Gate Dam. To achieve peak flows at locations downstream of Iron Gate Dam will require correspondingly larger peak flows and higher release volumes. The DEIR does not assess this impact, or the impact of the Proposed Project on USBR's operations (including Upper Klamath Lake elevations, water supply, or releases to the Klamath River). All of these could result in flow demands greater than the 6,200 acre-feet reduction in evaporative losses. 2. The statement about tributaries providing refuge habitat or warmer winter habitat should be supported by some actual water temperature data. The assertion that Hamilton et al. (2011) indicates that these areas would be conducive to growth of salmonids is not correct. Hamilton et al. (2011) discusses the input of cooler water from the tributaries and speculates that these would create areas of thermal refuge and that this thermal diversity would "benefit a variety of aquatic biota…" (Hamilton et al. 2011 at p 32) but does not specifically discuss salmonids or growth rates.
3.3-55	3.3.5.4	3-271	Paragraph 5		The DEIR puts forth a hypothesis regarding the effect that changes in river temperature from the Proposed Project would have on mainstem origin fall-run Chinook fry emergence timing and implications for juvenile growth, migration timing, and stress and disease. The DEIR does not present an accurate conclusion regarding the effects of water temperatures on fall-run Chinook egg development, emergence, or growth. A detailed comment on this hypothesis is provided in Major Issue 2.9.4, along with additional information. Given that the DEIR presents some incorrect conclusions, the analysis in the DEIR is incorrect and needs to be reevaluated. In summary, a more "natural" temperature regime in which spring time flows would have higher temperatures, may not be as beneficial to salmonids as the existing temperature regime (PacifiCorp 2014).

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3.3-56	3.3.5.4	3-272	Paragraph 3		The DEIR provides little support for, or connection between the water temperature regimes discussed in this paragraph and the effects on fish. Water temperatures in the absence of the Klamath Hydroelectric Project will still exceed the Basin Plan thermal targets for salmonids (see comment 3.3-61). Similarly, the paragraph asserts that nutrient cycling and aeration process of a natural channel would be created by the Proposed Project but does not support this point. The paragraph goes on to assert that these changes moderate effects of climate-change-generated stream water temperature increases but does not explain the degree of moderation or what this means for aquatic resources. These conclusions are mostly speculation.
3.3-57	3.3.5.4	3-272	Paragraph 5		The DEIR concludes that fall-run Chinook spawning in the mainstem will no longer be delayed with the Proposed Project, which would reduce prespawn mortality. The information in the DEIR does not support this nor is there any indication that prespawn mortality is an issue in most years. The DEIR states that water temperature downstream of the Salmon River (RM 66) would not be altered with the Proposed Project. Because adult fall-run Chinook run timing is heavily influenced by water temperature (Strange 2010, 2012), the Proposed Project will have no effect on their migration timing. Prespawn mortality data for fall-run Chinook in the mainstem Klamath River show similar rates as those for the Trinity River. The Pacific Fisheries Management Council (2018) reported that prespawn mortality for mainstem Klamath River spawning fall-run Chinook averaged 8.3 percent from 2001-2016, while in the Trinity River prespawn mortality averaged 6.9 percent (Rupert et al. 2017). These percentages suggest that there would be little room for improvement in prespawn survival rates as a result of the Proposed Project. This is especially the case if Klamath River

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					fall-run Chinook are more tolerant of warmer water as claimed in the DEIR. The fact that Bogus Creek, immediately downstream of Iron Gate Dam, is one of the most productive salmon streams in the Klamath Basin, and has a high prespawn survival rate, illustrates that temperature effects from Iron Gate Dam are not detrimental to fall-run Chinook. Adult fall-run Chinook salmon migrate upstream within the Klamath River from August through October. During this period, Klamath Hydroelectric Project-related effects on water temperatures diminish as a function of distance downstream from Iron Gate Dam, with effects essentially absent for the lower reaches of the river downstream of the Scott River (RM 144). Thus, under current conditions, Project operations have no thermally-related effect on adult fall-run Chinook salmon migrating in the lower reaches of the Klamath River (PacifiCorp 2014).
3.3-58	3.3.5.4	3-272	Paragraph 5		The DEIR needs to explain the applicability of Perry et al. (2011 as cited in the DEIR) in terms of how applicable this modeling is to the Proposed Project. The Perry et al. (2011) work appears to have included the Klamath Basin Restoration Agreement as part of the modeled management alternative that included dam removal. The Klamath Basin Restoration Agreement expired at the end of 2015 and therefore, restoration and water quality management measures contained in the Klamath Basin Restoration Agreement are no longer applicable to the Proposed Project. Because of this, it is not clear how applicable the Perry et al. (2011) results might be to the Proposed Project and the DEIR does not explain this. Related to this, the Perry et al. (2011 as cited in the DEIR) report does not present any discussion of emergence timing as presented in DEIR Figure 3.3-4.
3.3-59	3.3.5.4	3-275		Figure 3.3-5	There is much more up to date information available on water temperatures both with and without the Klamath Hydroelectric Project

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					than that presented in this figure. Nor does the DEIR indicate why this one figure out of the five available in the source was selected. PacifiCorp's installation of the Iron Gate Intake Barrier Curtain in 2015 has reduced the temperature of flow releases from Iron Gate Dam while also reducing algae entrainment in those releases as a result of drawing from deeper in the reservoir water column. The figure shown in the DEIR does not include these improvements and does not reflect current operations of the Klamath Hydroelectric Project.
3.3-60	3.3.5.4	3-275	Paragraph 1		This paragraph asserts that larger diel fluctuations in water temperature would benefit salmonids rearing in thermal refuges. While PacifiCorp doesn't disagree with the cited sources or benefits of cooler temperatures, the DEIR has not supported the assertion that the Proposed Project would result in cooler temperatures or larger diel swings beyond the one year's worth of modeled data presented in DEIR Figure 3.3-5. There is no comparison of the modeled data to existing conditions, discussion of conditions under different flow regimes, or presentation of any metrics that would help the reader gauge the magnitude of change that could result from the Proposed Project or whether those changes would increase the amount of time that different salmonid life stages are exposed to temperatures that are viewed as suitable based on established criteria. The reference in this paragraph of the DEIR to Figure 3.3-3 is incorrect.
3.3-61	3.3.5.4		General		General comment on water temperature analysis as it relates to fish: 1. The discussion is incomplete. Although the DEIR cites Hamilton et al. (2011), Bartholow et al. (2005), and others, it does not appear that these source materials were adequately reviewed. For example, Hamilton et al. (2011) does indicate that removal of Iron Gate Dam would eliminate the thermal lag and improve timing of water temperatures in relation to historical migration periods. However,

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					Hamilton et al. (2011, pg. 73-74) goes on to cite Bartholow et al. (2005) and state that "...maximum recommended temperatures for juvenile rearing fall Chinook salmon between February 1 and July 1, 1962-2001 were exceeded 49 days with dams and 60 days without dams..." This indicates that water temperatures without the dams could be warmer more frequently than with the dams in place, a possible outcome that is not presented in the DEIR. 2. The DEIR analysis does not present a clear connection between water temperatures and fish health. 3. Use of one year (WY 2002 in Figure 3.3-5) presents an overly simplified view of the system and its variability, and is not representative of average conditions given that 2002 was a drought year. By choosing a drought year, the DEIR analysis makes it appear that effects of the Klamath Hydroelectric Project are worse than if a balanced set of representative years were chosen and a more complete and balanced discussion presented. PacifiCorp does not disagree with using example years in the analysis, but years used need to be chosen for specific reasons based on specific water-year criteria that illustrate the range of potential environmental conditions faced by the resource being considered. Please consider using a range of water year types (wet, average, dry) in the analysis.
3.3-62	3.3.5.4	3-275	All	Figure 3.3-5	Figure 3.3-5 in the DEIR provides simulated hourly water temperatures downstream of Iron Gate Dam for the Proposed Project with ranges of optimal temperature criteria for salmonid growth and migration. These criteria come from the USEPA (2003). Instead of hourly water temperature data, the DEIR should plot and present the 7DADMax water temperature values because this is the metric that the USEPA criteria presented in the DEIR are based on. It is misleading to present hourly water temperature data in relation to a metric that is based on the rolling 7-day average of

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					maximum water temperatures. For example, the USEPA (2003) maximum 7DADMax value for salmonid migration is 20°C and for juvenile growth the criterion is a 7DADMax of 16°C. The 13°C to 20°C range for growth presented in the DEIR is based on an assumption of unlimited food availability; if food is limiting then the 7DADMax temperature range for optimal growth is reduced to 10°C to 16°C (USEPA 2003). USEPA (2003) indicates that results from laboratory studies under food limited conditions is more reflective of environmental conditions that fish experience. Thus, the food assumption drives conclusions about which alternatives provide better growth conditions and should be explained as such in the DEIR. The DEIR should also note that if food is unlimited then competition for food between hatchery releases and natural-origin salmonids would be minimal. The data in Figure 3.3-5 for July indicates that river temperature for the Proposed Project does not drop below 23°C for about 10 days and existing conditions with dams in place moderate river temperature extremes. USEPA (2003) indicates that a 7-day exposure to water temperatures ranging from 23 to 26°C is lethal for salmonids; such conditions would persist following implementation of the Proposed Project. The DEIR analysis indicates that variability in mainstem temperatures benefits feeding salmonids. Fish are expected to leave thermal refugia, migrate to the main river channel, feed, and return to the thermal refugia. Regarding fish movement and feeding, the DEIR speculates that the increase in maximum water temperatures for Proposed Project may be compensated for by lower temperatures at night. But this fish behavior already occurs under Existing Conditions as stated in the DEIR. Because the DEIR assumes that fish would reside in thermal refugia under both Existing Conditions and the Proposed Project, the amount of thermal refugia present under each is the more important factor than fish behavior. In

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					reaches downstream of Iron Gate Dam, thermal refugia area would not increase under the Proposed Project. The DEIR should note that if thermal refugia is a limiting factor for successful rearing, then the elimination of hatchery juveniles may allow these refugia to support more natural-origin fish. The DEIR does not acknowledge that whether fish growth is improved with higher water temperature, combined with more natural variation, depends upon the assumption regarding food effects discussed previously. The DEIR states that "Foott et al. (2012) observed positive growth and no apparent effect of elevated temperature on immune function or fitness in Klamath River juvenile Chinook salmon held over a 23-day period under conditions in the laboratory that simulated fluctuating water temperature profiles similar to what would be observed in the Klamath River under the Proposed Project." (DEIR pg. 3-275). While this is basically correct, the details are important as they relate to late spring and summer water temperatures in the Klamath River. Review of Foott et al. (2012) as cited in the DEIR, shows significant differences in fork length (longer), sodium-potassium-ATPase (higher), and condition factor (higher) at the end of the 3-week study for a test group reared at average temperatures of 18°C compared to a group at 23°C (both groups held with variable daily temperature). Foott et al. (2012) fed fish at 2 percent of body weight per day, which is typical of hatchery-reared fish, so food was not limiting. The DEIR is not consistent in describing the effects of decreased water temperatures on fish. In this section of the DEIR, the 1 to 2 degrees of variability in daily temperature is considered to have substantial benefits to fish, but these benefits are based on speculation, not the best available information. This is contrasted to elsewhere in the DEIR, where a 1- to 2-°C change in temperature of water released from Iron Gate Dam because of

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					operations of the Iron Gate intake barrier curtain is considered modest at best. In discussing water temperature effects, the DEIR should include information available in Appendix 5: *Effects of Temperature, Dissolved Oxygen/Total Dissolved Gas, Ammonia and pH on salmonids* (Carter and Kirk 2008), prepared for the California North Coast Regional Water Quality Control Board. Table 9 from Carter and Kirk (2008) illustrates the effects of water temperature on juvenile Chinook rearing and growth, and is provided below for convenience.

Table 9: Effects of Temperature in Considering Juvenile Chinook Rearing and Growth

°C	Rearing and Growth				
24	22-24 Temperature range which totally eliminates salmonids from area, limiting their distribution (7)			21-24 Decreased growth, impaired smoltification, increased predation compared to juveniles reared at 13-16 (6)	
23					
22					
21					
20			18-22 Temperature range at which transition in dominance from salmonids to other species occurs (7)	17-20 Decreased growth, impaired smoltification, increased predation compared to juveniles reared at 13-16 (6)	
19	19 Temperatures above this do not support maximum growth, lab studies at varying temperatures (3)	15.6-19 Maximum growth expected according to lab studies conducted at constant temperature and satiated rations. Under natural feeding conditions maximum growth may occur at temperatures as much as 4.2C lower (3)			4.5-19 Temperature range at which positive growth takes place (5)
18	15-18 Average temperature where maximum growth occurs, lab studies conducted at varying temperatures (3)				
17					
16			16 Chinook grew faster in a stream where temperatures peaked at 16 than when they peaked at 19C (3) 16 MWMT should not exceed this value to be protective of core rearing locations (2)	13-16 Increased growth, unimpaired smoltification, lower predation compared to juveniles reared at 21-24, or 17-20 (6)	
15			10-15.6 Optimal temperature range for rearing (5)		
14	10-15.6 Temperature range for optimal growth. Anything over this threshold increases the risk of mortality from warm water disease (1)				
13					
12				12-13 Juvenile Chinook acclimated to 20 selectively aggregate to these water temperatures (4)	
11					

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3.3-63	3.3.5.4	3-275	Last paragraph		The DEIR claims that there are lower minimum water temperatures in the spring under the Proposed Project; a statement that is difficult to reconcile with the data presented in Figure 3.3-5. Depending on the definition of

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					spring, this claim is not supported by the data in Figure 3.3-5, which indicates temperatures with dams in place are generally cooler from February through June than would be experienced under the Proposed Project.
3.3-64	3.3.5.5	3-276	Paragraph 4		The DEIR relies upon a high degree of speculation and outdated analysis to conclude that the Proposed Project will reduce fish disease infection rates of salmonids in the Klamath River. The DEIR cites the conclusion of FERC (2007) that a greater distribution of salmonids would presumably reduce crowding and the concentration of disease pathogens released from adult carcasses. However, while removal of the dams may allow Chinook (and Coho) to migrate through a larger reach of the Klamath River (an outcome also achievable through the fish passage alternative), polychaetes are found throughout the river, not just downstream of Iron Gate Dam. Infection of polychaetes will continue to occur as adult Chinook and Coho become infected migrating upstream through the Klamath River. Once these infected salmon pass the current location of Iron Gate Dam, presumably to spawn and eventually die, those spores will be released into the water to be ingested by existing polychaetes. *C. shasta* will not somehow be limited to the river downstream of Iron Gate. Research by CDFW (Foott et al. 2016) has shown that relatively few very highly infected adult Chinook carcasses are capably of fully seeding the polychaete population. Further, researchers from Oregon State University have routinely harvested polychaetes from the J.C. Boyle Bypass Reach (upstream of the large Copco and Iron Gate reservoirs, which are supposed to be an important planktonic food resource contributing to polychaete density downstream of Iron Gate Dam) because these populations are some of the densest anywhere in the river (Alexander et al. 2016b). This recent information contradicts the hypothesis advanced in the DEIR that

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					planktonic food sources from the large Klamath Hydroelectric Project reservoirs contribute to higher polychaete densities downstream of Iron Gate Dam, and reducing or eliminating spawner density may play a determinant role in reducing fish disease transmission. To indicate that spreading out the Chinook population would reduce their proximity to polychaete populations and therefore somehow reduce disease rates is not supported in the DEIR and contrary to the most recent understanding of fish disease dynamics in the Klamath. Related, while FERC's (2007) conclusion may have been valid based on the state of knowledge at that time, a great deal has been learned about *C. shasta* since then. The DEIR should assess the current state of the knowledge regarding infectious zones, infection rates, polychaete dynamics, etc. before reaching conclusions because more recent scientific work does not support the conclusions reached by FERC (2007) with respect to the effect of the Klamath Hydroelectric Project dams on fish disease.
3.3-65	3.3.5.5	3-276	Paragraph 4		The DEIR states "For adult salmon, Ich and columnaris have occasionally resulted in substantial mortality, particularly when habitat conditions include exceptionally low flows, high water temperatures, and high densities of fish (such as adult Chinook salmon migrating upstream in the fall and holding at high densities in pools)." The DEIR does not acknowledge that the most severe documented outbreaks of these diseases, such as occurred during the 2002 fish kill, were not influenced by the Klamath Hydroelectric Project, which does not significantly impact river flows and which did not have temperature effects as far downriver as the location where fish succumbed to these diseases. The DEIR should also note that because the Proposed Project is expected to increase fall-run Chinook abundance, but not alter river temperature downstream of the Salmon River, mortality to adult Chinook from disease

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					could be higher under the Proposed Project if this increase in abundance actually occurs.
3.3-66	3.3.5.5	3-276	Paragraph 4		The DEIR refers to abnormally large concentrations of spawners and carcasses downstream of Iron Gate Dam but never defines what is meant by 'large concentrations.' The DEIR needs to provide a specific numerical definition because it is important for determining whether expected fall-run Chinook spawning density in newly opened habitat would be substantially different. The DEIR uses the modeling results from Hendrix (2011), which indicate that without harvest occurring in ocean and freshwater fisheries an average of 23,000 adult fall-run Chinook would be produced in the river reach from Iron Gate Dam to Keno Dam (about 45 river miles) or roughly 511 fish per mile However, this fish per mile value would change depending on harvest rate, although the Hendrix (2011) modeling assumes no harvest. This fish per mile value would also change depending on the proportion of fish spawning in tributaries and tributary location in the reach. Adult returns can be two to three times higher in good survival years. Additionally, the fish per mile value in the Hendrix (2011) model assumes that fish are evenly distributed over the 45 river miles, which will not be the case given that fall-run Chinook spawning habitat is generally limited to a percentage of the riverine habitat and not all 45 river miles is suitable spawning habitat. The DEIR should further present data reported by Romberger et al. (2017) and Gough and Som (2017), which show that spawner carcasses for the reach extending from the Shasta River (RM 177) to Indian Creek (RM 107) and Iron Gate (RM 190) to Carson Creek (RM 180) average from about 66 to 493 fish per mile, respectively. If the normal concentration of adults per mile is closer to 66 fish per mile, then this has consequences for the expected decrease in fish abundance from Iron Gate to Carson Creek and the expected production from Iron Gate Dam to Keno Dam under the

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					Proposed Project as well as other alternatives. These variations reflect on the uncertainty associated with the Proposed Project that is not discussed in the DEIR. The DEIR does not acknowledge the complexities of the relationship between the numbers of adult fall-run Chinook and disease rates. Specifically, the DEIR should consider that Bartholomew and Foott (2010) reported that there does not appear to be a direct relationship between numbers of returning adults and disease severity in juvenile fish in the infectious zone during the following spring. This observation and further work by Foott et al. (2016) indicate that a low number of infected adult salmon, just over 7 percent in this study, were responsible for 76-95 percent of the total spore count in a given season; a spore load sufficient to maintain high infection prevalence in polychaetes. Thus, high spawner density does not appear to be a factor that, if reduced, would be likely to reduce the high infection prevalence. Overall, the DEIR does not acknowledge that there is considerable uncertainty in future outcomes of each analysis alternative related to fish production and disease effects. The DEIR does not use consistent logic and assumptions in the analysis. If disease effects are expected to be reduced because of a decrease in spawners in one reach, then the expected increase in spawners to other reaches should not exceed the definition of an abnormally large spawner concentration. Because no criterion is established for abnormally large, the DEIR analysis may improperly claim benefits from both decreasing disease and increasing Chinook abundance while not clearly presenting the logic supporting such a counterintuitive conclusion and not recognizing that these factors may act against each other.
3.3-67	3.3.5.5	3-276	Paragraph 5		The infectious zone has changed in the 8 plus years since the source cited in the DEIR and changes almost annually. In 2016, the infectious zone

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					extended from the I-5 Bridge over the Klamath River to Orleans (about 120 river miles), in 2017 it contracted upstream from the I-5 Bridge to Seiad Valley (about 50 river miles) (Bartholomew et al. 2018).
3.3-68	3.3.5.5	3-277	Paragraph 1		The DEIR states (in reference to bedload movement downstream of Iron Gate Dam) that "This increased movement and transport of sediment (sand, silt, and clay) is anticipated to disrupt polychaete habitat from the current location of Iron Gate Dam to downstream from Shasta River, resulting in reduced actinospore releases." Presumably this disruption would come in the form of scour of polychaetes, but the DEIR does not support this assertion. The DEIR fails to make use of recent studies relating polychaete reactions in response to flow changes including the observation that while polychaetes were removed from substrates by increasing flows (with specific dislodgment flows that varied depending on the substrate), polychaetes also exhibited a variety of behavioral reactions to flow changes and proved to have relatively high survival rates (Malakauskas et al. 2013). Additionally, the DEIR fails to acknowledge that recent research indicates that the magnitude of high flows that may be necessary to induce scour that could disrupt polychaete habitat (see Shea et al. 2016) are above the thresholds of flows that are expected to be achieved from the Proposed Project. That is, removal of the Klamath Hydroelectric Project is not anticipated to increase peak flows above baseline conditions with the hydroelectric dams in place to result in significant scour effects. Thus, recent research indicates that scour may be ineffective at combating polychaete densities that contribute to high infectious rates in the Klamath River, and recent research also indicates that the expected hydrologic changes from the Proposed Project are unlikely to result in flows that could accomplish scour anyway.

PacifiCorp's Detailed Comments on Draft Environmental Impact Report for the Lower Klamath Project License Surrender
February 26, 2019

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3.3-69	3.3.5.5	General comment			General comments on the disease discussion: • This section of the DEIR is full of presumptions and lacking up-to-date data and information. Oregon State University has been monitoring infection rates, spore loading, fish mortality rates, and other factors on an annual basis for USBR and none of this information is used in the document. • The connections between what could happen post-dam removal is speculation and is not supported in the DEIR with a reasonable analysis. There are an abundance of terms like "may disrupt," "is presumed to," "presumably," etc., all of which point to the uncertainty associated with the effects of dam removal on fish disease. The assertion that the removal of the Klamath Hydroelectric Project would disrupt microhabitats for polychaetes is not supported with current two- and three-dimensional modeling that is available (see Alexander et al. 2016a) to actually evaluate the changes in microhabitat resulting from flow changes.
3.3-70	3.3.5.5	3-277	Paragraph 2		The DEIR states "Warm water temperatures increase risk of disease transmission. Dam removal would mean cooler temperatures in the late summer and fall, but slightly warmer temperatures during spring and early summer." The DEIR does not clearly describe the location of fish losses downstream of Iron Gate Dam, or the life-stage affected, and the disease causing the losses. The DEIR states that the Proposed Project affects stream temperatures downstream as far as the Salmon River (RM 66). As previously noted in these comments, PacifiCorp model results (see PacifiCorp 2004a, 2008) show that the "thermal lag" effects of the Klamath Hydroelectric Project reservoirs on water temperatures downstream of Iron Gate Dam (RM 190) progressively diminish until reaching a downstream location where effects are absent. From December through

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					July, the effects are within model error or absent by the time the river reaches the confluence with the Scott River (RM 143.9). In August and November, the effects are absent by the time the river reaches Seiad Valley (RM 120), and in September and October, by the time the river reaches the confluence with Clear Creek (RM 95). In no cases does modeling indicate that effects of the thermal lag extend to the confluence with the Salmon River (RM 66). The DEIR fails to accurately reflect existing conditions and the impacts of the Proposed Project. The DEIR states, and PacifiCorp's prior water quality modeling (PacifiCorp 2006, 2014) confirms, that the spring water temperatures are higher under the Proposed Project which could increase *C. shasta* disease rates because polychaete hosts develop spores more quickly under warmer water conditions. The DEIR spends a great deal of time noting the severity of *C. shasta* for Klamath River salmonid populations, but fails to acknowledge that dam removal has the potential to exacerbate *C. shasta* infection prevalence and does not discuss this effect of the Proposed Project in any detail. The DEIR is required to present both positive and negative effects of the Proposed Project.
3.3-71	3.3.5.5	3-277	Paragraph 4		The DEIR should clarify how the 2017 United States District Court ordered flow requirements are included the analysis presented in the DEIR. The DEIR acknowledges that "the Proposed Project would not result in major flow alterations," and yet this paragraph goes into detail about the 2017 United States District Court ordered flow requirements, which are related to USBR's operation of its Klamath Irrigation Project, and not the operation of the Klamath Hydroelectric Project (see *Hoopa Valley Tribe v. National Marine Fisheries Service et al.*, 230 F.Supp.3d 1106 (2017)). This paragraph then continues, "Because polychaete populations are located outside of the main flow along the margins of the river (Bartholomew and Foott 2010), variable flows disrupt this habitat. Therefore, removal of the Lower

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					Klamath Hydroelectric Project dams would disrupt microhabitat conditions and is expected to reduce polychaete populations (Stocking and Bartholomew 2007, Bartholomew and Foott 2010) and presumably, reduce infection rates within polychaete populations both in the short and long term (Hetrick et al. 2009)." The DEIR fails to acknowledge that current operations of the Klamath Hydroelectric Project, consistent with Endangered Species Act requirements, include provisions for variable flow delivery. As previously acknowledged earlier in the paragraph in the DEIR, removal of the Klamath Hydroelectric Project dams is not expected to result in major flow changes. Thus, it is unclear how flow variability that could result from the Proposed Project would produce conditions that could disrupt microhabitat conditions and reduce polychaete populations and therefore infection rates. The DEIR here fails to acknowledge that flow variability can be achieved, and is currently being achieved, through modified operations of the Klamath Hydroelectric Project. Indeed, the available reservoir storage of the Klamath Hydroelectric Project and ability to manipulate flows through relatively precise modifications of Iron Gate Powerhouse releases, and, at higher flows, releases from the upstream Copco No. 1 and No. 2 developments, create opportunities for managed flow variability in the Klamath River that will be more difficult to achieve under the Proposed Project. The DEIR should acknowledge that the Proposed Project has the potential to reduce management tools to address fish disease by constraining the ability to deliver flushing and variable flows without impacting upstream irrigation operations or causing impacts to other aquatic resources, such as through reduced Upper Klamath Lake levels as a result of flushing flow operations that can currently be delivered primarily from Klamath Hydroelectric Project reservoir storage.
3.3-72	3.3.5.5	3-277	Paragraph 4		The current infectious zone is further downstream from Iron Gate Dam than is indicated in this paragraph. The DEIR should consider the

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					information available from Oregon State University through 2018. (https://microbiology.science.oregonstate.edu/content/monitoring-studies). Surface flushing flows are released from Link River Dam and ultimately Iron Gate Dam at USBR's direction to enhance sediment transport throughout the upper Klamath River, not just downstream of Iron Gate Dam. The DEIR asserts that this action has contributed to reduction in disease rates, but there is no real evidence provided to support that and as the DEIR notes, "...the flow regime has not, in isolation, been successful in avoiding high disease concentrations." There is no evidence presented to support the assertion that a new infectious zone would not develop elsewhere.
3.3-73	3.3.5.5	3-278 3-279	Last and first paragraphs		This paragraph is rife with assumptions and qualitative statements that influence the reader in the absence of supporting information (e.g., 'however unlikely'). The DEIR seems to allow for the possibility that the Proposed Project may result in infection of Chinook occurring upstream of Iron Gate Dam – an event incorrectly attributed to continued hatchery operations – and the necessity of surface flushing flows "from a new upstream location" to disrupt *C. shasta* life cycles even though those surface flushing flows have not been shown to be effective. To achieve a surface flushing flow, USBR would have to release water from Keno Dam; USBR is proposing such an action, but from Iron Gate Dam, in its current biological assessment (USBR 2018a). The lack of specifics in the DEIR (e.g., Keno Dam as a release location) illustrates the lack of understanding of the Klamath River and operations of water management by the authors of the DEIR.
3.3-74	3.3.5.5	3-279	Paragraph 2		While the DOI did in fact recommend trap and haul of Chinook around Keno Reservoir, that was in the context of a relicensed Klamath Hydroelectric Project. It is unclear what authority DOI would have to

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					impose such conditions on USBR; recall that USBR who will own Keno Dam if the KHSA is fully implemented. The DEIR indicates that high rates of infection downstream of Iron Gate Dam are a function of the dam and the hatchery concentrating adult salmon. If conditions in Keno Reservoir constitute a water quality barrier and salmon would not be able to pass through the reservoir, they would congregate downstream of Keno Dam. Using the DEIR's logic, a concentration of Chinook in this area would form a new *C. shasta* infectious hot-spot. The next paragraph in the DEIR goes on to say that Chinook historically concentrated their spawning in the Sprague River, but the previous paragraph said that they probably would not be to successfully pass Keno Reservoir. These apparent contradictions in the DEIR makes it difficult to understand the effects of the Proposed Project.
3.3-75	3.3.5.5	3-279	Paragraph 2		There has been a great deal of copying from previous work with little effort to actually assimilate the information in those documents, update it, and prepare a concise discussion of the current status of fish disease on the Klamath River. For example, the beginning of the second paragraph in the DEIR is strikingly similar to that in the 2012 KHSA EIS/EIR (DOI and CDFW 2012). Specifically, in this sentence in the DEIR: *"The current infectious zone and high parasite loads below Iron Gate Dam are the result of a synergistic effect of numerous factors* that occur within the current disease zone in the Klamath River from the reach from Shasta River downstream to Seiad Valley (FERC 2007, Hamilton et al. 2011, Bartholomew and Foott 2010." The italicized part is a direct quote from the 2012 KHSA EIS/EIR (DOI and CDFW 2012 see Volume 1, pg. 3.3-42).

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					Similarly, the following sentence that discusses the factor associated with the infectious zone is only different by a few minor editorial changes from that in the 2012 KHSA EIS/EIR. From the DEIR (at 3-279): "*These factors include: (1) close proximity of myxospore-shedding carcasses (concentration of carcasses); (2) abundant polychaete populations that are found in atypically stable habitats; (3) suitable water temperatures (greater than 59°F) during periods when juvenile salmonids are present; and 4) low flow variability (Bartholomew and Foott 2010). This synergy would be unlikely in the Upper Klamath River (Hamilton et al. 2011).*" From the FEIS (DOI and CDFW 2012 Volume 1 at 3-3-42): "*Factors associated with the current infectious zone and high parasite loads include: 1) close proximity of myxospores-shedding [sic] carcasses (concentration of carcasses), 2) abundant polychaete populations that are found in atypically stable habitats, 3) permissible temperatures (>15 C) during periods when juvenile salmonids are present, and 4) low flow variability (Bartholomew and Foott 2010). This synergy would be unlikely in the Upper Klamath River.*" Because the DEIR fails to take into account more recent scientific information, it provides an outdated analysis that portrays undue certainty that the Proposed Project will result in improved fish disease conditions for salmonids. The "synergistic effects" that are purportedly responsible for the high prevalence of fish disease in the Klamath River is attributed to: 1) high concentration of infected spawners; 2) abundant polychaete habitats from stable flow conditions; 3) suitable water temperatures (warmer than 59°F) when juvenile salmonids are present; and 4) low flow variability. As previously noted, this analysis is flawed (see comment 3.2-34). Regarding factor 1, high concentration of infected spawner, recent work undertaken by Foott et al. (2016) indicates that a low number of infected

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					adult salmon, just over 7 percent, were responsible for 76-95 percent of the total spore count in a given season; a spore load sufficient to maintain high infection prevalence in polychaetes. Thus, high spawner density does not appear to be a factor that, if reduced, would be likely to reduce the high infection prevalence. Regarding factor 2, abundant polychaete habitats from stable flow conditions, the DEIR does not consider its own conclusion that "the Proposed Project would not result in major flow alterations" (DEIR pg. 3-277), which means that flows sufficient to achieve bedload movement and scour (Shea et al. 2016) are unlikely to be provided by the Proposed Project, and that scour may not be very effective at reducing polychaete concentrations due to the relatively high survival rates of polychaetes in response to flow alterations (Malakauskas et al. 2013). Regarding factor 3, suitable temperatures, the DEIR does not acknowledge that the Proposed Project will result in increased water temperatures downstream of Iron Gate Dam in the late winter and spring when juvenile salmon are present, resulting in a more rapid development of *C. shasta* and a greater chance of disease infection than current conditions. Regarding factor 4, low flow variability, the DEIR does not consider that flow variability is currently being provided under current operations of the Klamath Hydroelectric Project to mitigate the effects of current operations (PacifiCorp 2012), that flow variability may actually be reduced under the Proposed Project as hydroelectric reservoir storage and variable powerhouse releases are no longer possible, and that flow management under USBR's biological opinion is likely to result in Klamath River flows similar to those experienced under current conditions (see USBR 2018a for the proposed flow conditions presently being considered by USBR). Further, the DEIR does not consider that polychaete habitat could increase under the Proposed Project as upstream river segments currently within

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					the Klamath Hydroelectric Project experience increased periphyton and macrophyte growth and as downstream river segments are exposed to more fine sediments that can contribute to polychaete habitat formation.
3.3-76	3.3.5.5	3-279	Paragraph 2		Regarding the formation of a disease zone, Hendrix (2011) estimated that upper Klamath River habitat may produce between 17,000 and 53,000 Chinook depending on whether fish express an ocean type or stream type life history. The majority of this production is expected from the Sprague River and Williamson River. This number of fish seems sufficient to create the possibility of large concentrations of spawning adults dependent upon the distribution and total amount of spawning habitat. According to Bartholomew and Foott (2010), the 59°F water temperature criterion (cited in the DEIR) applies when infectious dose is small. Bartholomew and Foott (2010) state (on pg. 38) that when infectious dose is high, temperature is not a strong predictor of survival. The data presented by Bartholomew and Foott (2010) in their Table 6.1 show substantial effects on salmonids at temperatures ranging from 13°C to 21°C (55.4-69.8°F). Hurst et al. (2012) concluded that initially reintroduction of fish will not be adversely affected by the high parasite densities. However, after dam removal, adult salmon would transport parasite genotypes present from downstream of Iron Gate Dam to the upper basin. The polychaete host for *C. shasta* is present throughout the Klamath River, including in high densities in the Williamson and Sprague rivers. Because of this, reintroduction of Chinook and Coho infected with *C. shasta* would likely infect the polychaete hosts when the adults die. The result would be that *C. shasta* would become established and reach spore densities that result in infection of juvenile Chinook and Coho. The DEIR incorrectly concludes that the nidus of *C. shasta* infection is unlikely to occur or will be smaller than that under Existing Conditions. These statements are not adequately supported and need to be updated

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					to indicate that there is a risk such a nidus may develop, but the probability of its occurrence is unknown as are the location, size, and effect on the population of salmonids.
3.3-77	3.3.5.3	3-279	Paragraph 1		The DEIR states that flushing and emergency dilution flows may be required under the Proposed Project. The DEIR does not clearly present the analysis for these flows for the Proposed Project or the alternatives.
3.3-78	3.3.5.3	3-279	Paragraph 4		Refer to previous comments regarding the potential for introduction of *C. shasta* to the polychaete population in the Williamson River (see comment 3.3-76). There is no discussion in the DEIR to support the assertion that Chinook would not congregate in these locations and the DEIR does not recognize that relatively few infected adults salmon can fully seed the polycheate populations (Foott et al. 2016)
3.3-79	3.3.5.6	3-280	Paragraph 3 (on page)		The NMFS and CDFW have jointly proposed reduced production goals at Iron Gate Hatchery and Fall Creek Hatchery. While the DEIR partially recognizes this, the production target for yearling Chinook should be 115,000 not the 1 million fish presented in the DEIR (see NMFS and CDFW 2017 for details). The DEIR needs to be updated to reflect the actual production targets and the impact of these reductions would have on the fisheries of the Klamath River (see Major Issue 2.6).
3.3-80	3.3.5.6	3-281	Paragraph 3		The DEIR states that during the first 8 years after dam removal, hatchery production effects on aquatic resources would be similar to Existing Conditions. While production targets for Coho remain the same as under existing conditions, Iron Gate Hatchery will be producing fewer Chinook. Therefore, the DEIR needs to accurately characterize the effects on aquatic resources and the fisheries that this reduction in hatchery production would have (see Major Issue 2.6).

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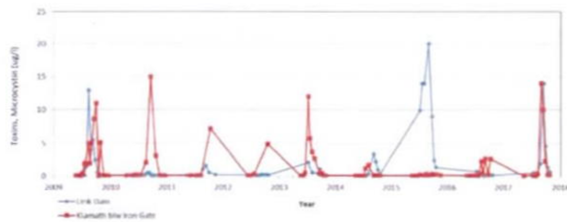
3.3-81	3.3.5.7	3-284	Paragraph 3		The DEIR states "While some microcystin may be transported to downstream reaches of the Klamath River from large blooms occurring in Upper Klamath Lake, the levels would not be nearly as high as those experienced under existing conditions, because seasonal blooms in Copco No. 1 and Iron Gate reservoirs are the primary source of *Microcystis aeruginosa* to the Middle and Lower Klamath River (see Section 3.4.2 Phytoplankton)." It is unclear from the data (see below) what the actual effects of microcystin release from Keno Dam could be on the Klamath River. While in some years releases from Iron Gate Dam are higher in microcystin than those from Keno Dam, this is not the case in all situations. Following implementation of the Proposed Project, Upper Klamath Lake and Keno Reservoir will become the primary source of microcystin in the Klamath River. 
3.3-82	3.3.5.8	3-285	Last Paragraph		The DEIR mistakenly characterizes the miles of stream as salmonid habitat without providing supporting evidence from specific habitat evaluations of the streams in question. A more accurate discussion would present the miles of stream potentially accessible to salmonids and not attempt to characterize them as habitat. There is a large difference between a migratory corridor through which fish simply pass and spawning or rearing habitat. Presenting data as miles of 'habitat' misleads the reader into

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					believing that this area is all useful when in fact it may not be. Most of Fall Creek, for example, is relatively high gradient, has a boulder and large cobble substrate, and is not suitable salmonid spawning habitat.
3.3-83	3.3.5.8	3-286	Paragraph 1		Although cited on page 3-228 as a personal communication, PacifiCorp is not aware of any ongoing work related to improving fish passage at Keno Dam following transfer to the federal government. The last sentence of this paragraph is incorrect. While USBR would take ownership of Keno Dam under the KHSA, and USBR has assessed passage improvements that may be desirable at Keno Dam should the Proposed Project occur, PacifiCorp is not aware of any plans that USBR has to improve fish passage, and such work is certainly not "in the process" of being completed as represented in the DEIR.
3.3-84	3.3.5.8	3-286	Paragraph 3		The DEIR's reference to conclusions from the Maule et al. (2015) study on *C. shasta* effects to fall-run Chinook needs to be updated in light of new information. Chinook salmon are only susceptible to the Type I *C. shasta* genotype, which was not present in the upper Klamath River Basin at the time of the study. Hurst et al. (2012) concluded that after dam removal, adult salmon would transport parasite genotypes (i.e., Type I) from areas downstream of Iron Gate Dam to the upper basin. Thus, in the future, juvenile Chinook will be susceptible to infection from this parasite, which will likely lead to increased mortality.
3.3-85	3.3.5.8	3-286	Paragraph 4		The DEIR recognizes that seasonally poor water quality conditions in Keno Reservoir/Lake Ewauna have the potential to create a barrier to safe, effective, and timely fish passage through this waterbody, as has been recognized by the DOI and the NMFS. Given that the ability of salmonids to migrate to habitat that will be made accessible from the Proposed Project is fundamental to the entire success of the Proposed Project and the logic behind the Proposed Project, the DEIR should assess the effects to the

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					Proposed Project outcome should passage through Keno Reservoir/Lake Ewauna continue to be challenged by water quality conditions. The DEIR should assess what those poor water quality conditions are, how frequently the currently occur, and whether a fish passage barrier at Keno Dam created by poor water quality conditions would result in crowding of fish downstream of the dam that could result in a disease nidus such as is hypothesized to exist downstream of Iron Gate Dam due to high spawner density. This is especially important in light of the fact that the trap and haul fish passage program to address poor water quality conditions in Keno Reservoir is not an element of the Proposed Project and is not, to PacifiCorp's knowledge, planned to be implemented by USBR or other agencies.
3.3-86	3.3.5.9	3-298	Paragraph 3		The DEIR states that the Proposed Project will increase Chinook salmon abundance based on Hendrix (2011) modeling analysis, among others, which is viewed to be the most robust assessment. To be precise, the Hendrix (2011) analysis forecasts that natural Chinook salmon production will increase. The analysis does not present data for hatchery fish returning to Iron Gate Hatchery or Trinity River Hatchery. This distinction is important because as the DEIR states, Iron Gate Hatchery produces about 50,000 adults (see DEIR pg. 3-248). Hendrix (2011) estimates that the Iron Gate Dam to Keno Dam reach would produce 23,000 adult natural origin fall-run Chinook *if there was no harvest* of those adults. This number is approximately 50 percent less than the corresponding number of adult Chinook currently produced by Iron Gate Hatchery. The DEIR notes that one of the reasons that Hendrix (2011) model results are used in the analysis is that it provided variance estimates of uncertainty, yet the results of this uncertainty analysis are not presented in the DEIR. This uncertainly analysis should be described in the DEIR especially since other analyses estimated substantially less Chinook

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					production for the same reach. For example, Lindley and Davis (2011) estimated that adult escapement (after harvest) for the reach extending from Iron Gate Dam to Keno Dam would be less than 1,000 spring Chinook and 1,000 fall Chinook, respectively. Additionally, the results from habitat modeling conducted during FERC relicensing (Oosterhout 2005; PacifiCorp 2005) and the opinion of the Chinook Expert Panel (Goodman et al. 2011) as to potential production compared to current hatchery production of adults should be described in the DEIR. All three of these analyses showed that Chinook production would be similar to, or less than, the number of adults produced by Iron Gate Hatchery. For example, model results for Oosterhout (2005) and PacifiCorp (2005) indicated that if average harvest rates are applied, adult escapement in the Iron Gate to Keno reach is less than 5,000 adult fall-run Chinook. At a minimum, the analyses by PacifiCorp (2005) and Oosterhout (2005) should be described, particularly because these two analyses are thorough, specific to the Klamath River, and provide adult production estimates for every dam removal alternative in the DEIR. These two analyses incorporated actual measurements of stream habitat and water quality for virtually every river mile from Iron Gate Dam to upstream of Upper Klamath Lake. The data for the two analyses were collected by agencies and PacifiCorp staff as part of the FERC relicensing process and data inputs to the models used were reviewed and agreed to by the involved fisheries agencies. In contrast, the Hendrix (2011) model used the much more simplified assumption that habitat quality in the Upper Klamath Watershed is similar to other streams up and down the West Coast that support wild populations of Chinook (even though the Klamath River is like no other stream on the West Coast and has water quality challenges unlike most other watersheds). Thus, the analyses of PacifiCorp (2005) and Oosterhout (2005) are based on basin-specific scientific

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					information in contrast to Hendrix (2011) that uses generic data from the Pacific Northwest, Canada, and Alaska. Overall, the lack of objectivity and balanced presentation of model types, assumptions, applicability, and results creates a biased perspective on the potential salmon production following implementation of the Proposed Project. The DEIR should clearly state that the although the Proposed Project could lead to increase natural production it is highly uncertain that total Chinook production will increase over current conditions. The level of uncertainty surrounding the Hendrix (2011) modeling can be found in tables in that report and the subsequent Hendrix (2012) report. The uncertainty information from these sources should be described in the DEIR.
3.3-87	3.3.5.9	3-298	Paragraph 4		The DEIR mistakenly reports that the Hendrix (2011) analysis provides forecasts of Type I and Type II life history strategies, when in fact, Hendrix (2011) modeled Type III, not Type II. Specifically, the analysis looked at possible adult production for ocean-type and stream-type Chinook with the latter being considered a spring-run Chinook. Thus, the Hendrix analysis is an estimate of total Chinook production for the Proposed Project area. For the Iron Gate Dam to Keno Dam reach, Hendrix (2011) modeled an ocean-type Chinook that is assumed to be a fall-run Chinook.
3.3-88	3.3.5.9	3-299	Paragraph 2		The DEIR states that the Hendrix (2011) model assumes that Iron Gate Hatchery production does not occur under the Proposed Project. This statement is an oversimplification of what Hendrix (2011) modeled. Specifically, the model results from Hendrix (2011) are for natural origin fish only and that hatchery returns to the hatchery are not provided. Further complicating the issue however, is the fact that the production function used in the model to determine harvest levels includes hatchery fish that spawned naturally. Hatchery fish that spawn naturally count

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					toward the 40,700-adult natural escapement goal. Therefore, reduction or elimination of hatchery production in the short term would affect the ability of the resource agency managers to achieve the 40,700-adult natural escapement target since achieving that target relies upon fish production from hatchery fish that spawn naturally. Eliminating hatchery fish from the spawning grounds could increase the productivity of the natural population over time, but this will take many decades to occur.
3.3-89	3.3.5.9	3-299	Paragraph 3		The DEIR indicates that a 43 percent decrease in hatchery juvenile production equates to a 43 percent decrease in adult production. However, this statement is only accurate if the ratio of subyearlings and yearlings released from the hatchery is the same for both Existing Conditions and the Proposed Project which is clearly not the case. Currently the ratio of yearlings to subyearlings is 0.18, over 5 times higher than the ratio of 0.03 in the Proposed Project. Because yearlings have two to three times the survival rate of subyearlings, the resulting adult production is expected to be less under the Proposed Project with the larger reduction in hatchery production of yearling Chinook. The reduction in yearling production is substantially larger (87%) than for subyearlings (33%).
3.3-90	3.3.5.9	3-299	Last paragraph		This paragraph in the DEIR does not accurately reflect the Proposed Project. Please consider the following: 1. As it is written, the reader is unclear if the discussion is focused on outcomes for the Iron Gate Dam to Keno Dam reach or for all habitat upstream of Iron Gate Dam. 2. The assumption that there would be a 43 percent reduction in smolt production and a corresponding and equal decrease in adults is incorrect (see comment 3.3-89 directly above). Because this incorrect

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					assumption is used throughout this analysis, the entire analysis needs to be revised. 3. The DEIR erroneously states that "The elimination of the goal of releasing around six million Chinook salmon smolts and yearlings annually after 8 years..." is incorrect. Please refer to the correct hatchery production targets from NMFS and CDFW 2017 (see comment 3.3-79). According to NMFS and CDFW (2017) the total annual Chinook production target is about 3,515,000 juvenile Chinook, not 6 million as stated in the DEIR. This error affects the entire analysis. 4. Hendrix (2011) analysis results assume active reintroduction starting in 2019 with fry being planted into suitable habitats at levels that that habitat can support them. Because there is no fry stage in the model, Hendrix (2011) predicted stocking to habitat capacity by assuming that the number of adult returns were at or above the unfished equilibrium population size (about 17,000 to 53,691) from 2019 to 2029. For the Iron Gate Dam to Keno Dam reach, Hendrix (2011) simply added in habitat capacity to the lower river population. Thus, the Hendrix (2011) modeling assumes that reintroduction would be immediate, and no other approach would result in quicker reintroduction. The model was not designed to forecast how quickly adult production would increase under a natural recolonization process as assumed for the Proposed Project. The DEIR asserts that a combination of hatchery adult returns and returns from newly accessible habitat upstream of Iron Gate Dam would equate to the active reintroduction stocking levels assumed in Hendrix (2011) yet the DEIR provides no evidence or reasoning to support this conclusion.

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3.3-91	3.3.5.9	3-300	Paragraph 3		The DEIR cites the Hendrix (2011) analysis to claim that fishery closures are less likely under the Proposed Project (dam removal) than Existing Conditions. However, this outcome of less likely fish closures is not described in Hendrix (2011) and it is not clear how the DEIR can support this assertion. Fishery closure information was presented in an earlier draft report but not in the final Hendrix (2011) report and drafts are typically not cited specifically because they can change before becoming final as appears to have been the case here. Regardless, in the draft Hendrix report, a 2.5 percent abundance exceedance value between the two alternatives was used to support the conclusion that fishery closures were less likely with a dams-out scenario. The draft analysis also assumed that the 40,700-adult escapement target would still apply even though spawners were assumed to colonize an additional 59 to 80 miles of habitat between Iron Gate Dam and Keno Dam. For the first few generations during and after dam removal, the DEIR's analysis should more accurately state that the risk of a fishery closure may increase. This conclusion is based on the following assumptions presented in the DEIR: 1. Substantial reduction in hatchery Chinook production at Iron Gate Hatchery. Iron Gate Hatchery fish contribute a substantial number of adults to the Klamath River natural escapement target and about 28,000 fish on average to harvest (CAHSRG 2012). 2. Loss of at least 1-year class of mainstem spawning fall-run Chinook because of dam removal impacts. 3. Unknown/uncertain speed and effectiveness of recolonization, yearly environmental conditions (flow and temperature during and after dam removal), and uncertainty around modeling predictions of adult production.

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					4. The current relatively low abundance of fall-run Chinook salmon throughout the upper Klamath River which limits production and therefore fishery escapement and harvest goals.
3.3-92	3.3.5.9	3-301	Paragraph 2		The DEIR should acknowledge the possibility that the Proposed Project might essentially simply result in the replacement of hatchery Chinook production with natural origin production. The Chinook Expert Panel (Goodman et al. 2011) concluded that natural fall Chinook from the Iron Gate to Keno reach (following dam removal and including implementation of restoration actions associated with the now expired Klamath Basin Restoration Agreement) had the potential to match current adult production from the Iron Gate Hatchery. Additionally, this was the conclusion of detailed fish production modeling undertaken during the FERC relicensing process (PacifiCorp 2005; Oosterhout 2005). See Major Issue 2.6.
3.3-93	3.3.5.9	3-309 3-310	Paragraph 2-3 and 1		The DEIR fails to note that the action that the Expert Panels considered and discussed in their reports is dam removal AND implementation of the Klamath Basin Restoration Agreement. The Klamath Basin Restoration Agreement included an abundance of funding for restoration and long-term management actions that would benefit fish; these are not part of the Proposed Project. Because of this, extrapolating the Expert Panel's determinations to the Proposed Project is not valid. While the DEIR acknowledges the uncertainty reported in the Expert Panel Report on spring-run Chinook recolonization it inaccurately constrains the limitations expressed in Goodman et al. (2011) to just low abundance and productivity of spring-run Chinook. In fact, the other main concern expressed in Goodman et al. (2011) relating specifically to spring-run Chinook was the projected increase in spring (February to July) water temperatures in the

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					Klamath River that could limit upstream movement of adult spring-run Chinook. The DEIR makes an inappropriate comparison between the removal of Condit Dam on the White Salmon River and the Proposed Project as it relates to the recolonization by salmon. Specifically: 1. Condit Dam was located only about 3.3 miles upstream from the confluence of the White Salmon River and the Columbia River, not 190 miles from the Pacific Ocean like on the Klamath River. 2. There is not 120 square-miles of hypereutrophic lake feeding poor quality water into the White Salmon River. According to Allen et al. (2016) the mainstem White Salmon has relatively cold water throughout the year provided by snowmelt and springs. 3. While spring-run Chinook were considered extirpated from the White Salmon River and have since recolonized the river in low numbers as indicated in the DEIR, it is important to have the full context for this statement and understand the differences between this river and the Klamath River. Spring-run Chinook migrate up the Columbia River in substantial numbers; the 10-year average count at Bonneville Dam is over 148,000 spring-run Chinook (FPC 2019) With populations at this size, even minor straying into the White Salmon River could be reasonably expected to occur. This is very different from conditions on the Klamath River where the nearest spring-run Chinook population is a very small one (only 166 spring-run Chinook were counted in 2017; SRRC 2017) on the Salmon River over 123 river miles downstream of Iron Gate Dam. 4. Adult fall-run Chinook salmon were trapped and moved to the river upstream of Condit Dam before removal occurred. This created a population of juveniles that were not directly impacted by removal and

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					ready to migrate downstream and then return from the ocean in a 2-5 years. Upon return, they would home to the areas where they were spawned. This situation is more akin to the conditions assumed in Hendrix (2011).
3.3-94	3.3.5.9	3-311	Paragraph 2		The DEIR states that Upper Klamath Lake may have considerable production potential for Chinook. If so, the DEIR should then make similar statements for the reservoirs under all the alternatives where reservoirs remain in place. Reservoir environmental conditions in the early spring (to June) and fall/winter (October – February) have water quality conditions that would be supportive of Chinook, Coho, and Steelhead rearing (as assumed in the DEIR for Upper Klamath Lake). Thus, the DEIR should assume the reservoirs would have similar rearing value as Upper Klamath Lake. The DEIR also states that most or all spring-run Chinook upstream migrants would be able to pass upstream through the Keno Reservoir/Lake Ewauna area before seasonal water quality reductions would restrict passage. However, the DEIR concludes in Section 4 that spring-run Chinook passage with reservoirs in place would be more restrictive even though environmental conditions are as good or better in the reservoirs than Lake Ewauna and Keno Reservoir. It is unclear how better conditions for passage through Iron Gate and Copco reservoirs equates to poorer passage of fish. The DEIR should correct this analysis and conclusions accordingly.
3.3-95		3-315	Paragraph 2		The CDFW (2014) source cited to support the smolt-to-adult survival rate of 0.99 presented in the DEIR is a decent start but the smolt-to-adult ratio should have been updated to reflect the more recent years of data and increase the accuracy of this prediction.

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3.3-96		3-316	Paragraph 4		The DEIR makes the unsupported assertion that when the hatcheries stop releasing fish, disease rates and resulting mortality would be reduced in outmigrating fish. The DEIR does not explain how this reduction in disease rates would occur since infection is based on spore density in the river and not really abundance of juvenile fish; also, returns of infected adults would continue to infect the polychaete populations. The DEIR also proposes that the reduction in hatchery releases would reduce competition for food and space in the river. There is no evidence to support the claim that competition for space or food is in any way limiting the population of Chinook and Coho.
3.3-97	3.3.5.9	3-316	Paragraph 4		The DEIR suggests that a reduction in hatchery production would result in significantly reduced competition for space and food with natural origin fish. According to the DEIR, this would in turn result in higher growth rates for natural origin smolts, large fish size, and higher survival and adult returns by a rate that would be "...more than the loss of hatchery progeny." There are two main issues with this conclusion: 1. The DEIR implies that food is limiting in the Lower Klamath River, but yet water temperature effects in previous sections of the DEIR are based on criteria where food is not limiting. The DEIR should resolve this apparent contradiction. 2. The discussion regarding reintroduction of fall-run Chinook, the DEIR concludes "...that the Proposed Project would increase the abundance, productivity, population spatial structure, and genetic diversity of fall-run Chinook salmon in the Klamath Basin (Hendrix 2011)." The conclusion that fall-run Chinook productivity would increase was based on the implementation of KBRA actions, which are not included in the Proposed Project. Despite this issue and other issues already raised in these comments with the Hendrix model, the DEIR should explain how

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					this increased natural production does not result in a higher level of competition for food and space than is present with the hatchery releases. If all fall-run Chinook are of natural origin, then spawning and emergence timing would be similar in reaches downstream of Keno Dam, effectively increasing the duration competitive interactions for food and space compared to the existing conditions where hatchery juveniles do not interact with natural origin fish until they are released and that release timing is typically towards the end of the natural-origin fish movement period (late May/early June).
3.3-98	3.3.5.9	3-319	Last paragraph		The DEIR should clarify if the predicted colder fall and winter water temperatures under the Proposed Project would have any effect on salmonid egg incubation survival. For example, Carter and Kirk (2008) concluded that stream temperatures of less than 3°C result in higher egg mortality for Chinook and Steelhead. Carter and Kirk (2008) also reported that the optimal temperature for salmonid egg survival ranges from 6 to 10°C. The DEIR indicates that the Proposed Project would produce mainstem temperatures near or below the 3°C value from December through January in contrast to Existing Conditions where similar conditions occur for a about 10 days in early February (see Figure 3.3-5).
3.3-99	3.3.5.9	3-319	Last paragraph		It is not clear in the DEIR if the earlier outmigration that is discussed only pertains to mainstem spawning Coho or a minor segment of the overall population. The vast majority of the Coho smolts will come from tributaries not affected by mainstem water temperatures, and their migration timing will therefore not be based on mainstem water temperatures.
3.3-100	3.3.5.9	3-337	Paragraph 1		Reference is made to aquatic resource measure AR-6 (Suckers) being included in this alternative. Given that this impact is not considered significant, it is unclear why this measure is included, perhaps it is required

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					for Fish and Game Code 2081.11 under CEQA although CDFW has not made a final determination as to whether this measure meets the standards for take authorization under Fish and Game Code, Section 2081.11. The DEIR is not clear as to what happens if CDFW does not agree that AR-6 meets the conditions for take authorization in the future.
3.3-101	3.3.5.9	3-338	Paragraph 1 (first full paragraph)		The DEIR does not provide the rationale (other than a citation) as to why "Facilitating the movement of anadromous fish presents a relatively low risk of introducing pathogens to resident fish upstream of Iron Gate Dam." The DEIR should explain why this would present a low risk given the previous comments raised about disease (e.g., Major Issue 2.8).
3.3-102	3.3.5.9	3-338	Paragraph 3 (third full paragraph)		The DEIR should be edited to read "However, SSCs [suspended sediment concentrations] would be the result of sediment stored in J.C. Boyle and Copco reservoirs, which is relatively small potential impact (USBR 2012) **because** a large proportion of the adult redband trout population should be already spawning in Spencer or Shovel creeks during the dam removal." Impacts should be characterized in relation to the significance criteria and not described as 'small potential' as is presented in this text. Even a small impact can be significant.
3.3-103	3.3.5.9	3-341	All		The DEIR does not analyze and describe the effects to fish communities in the Klamath River of releasing the entire population of Yellow Perch (*Perca flavescens*) from Copco and Iron Gate reservoirs (likely numbering into the hundreds of thousands) into the lower river during and after drawdown of the reservoirs. Yellow Perch will utilize side channels and off-channel habitat for rearing. These habitat types are also used by Chinook, federally-threatened Coho, and Steelhead as well as native resident fish. If the Yellow Perch are not expected to survive the drawdown, then the DEIR should present the facts supporting this and discuss the likely disposition of carcasses that remain in the reservoir or are released downstream.

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3.3-104	3.3.5.9	3-345	Paragraph 2 (second full paragraph)		The DEIR states that "The areas downstream of the Trinity River confluence do not currently support *Anodonta spp.* and are unlikely to in the future (Davis et al. 2013)." The DEIR should further explain why the salvage and relocation plan considers these sites.
3.3-105	3.3.5.9	3-352	Paragraph 3		The DEIR states that "the total potential production from redds in Bogus Creek is a low proportion of all the production from the Klamath River Basin for Chinook salmon, Coho salmon, and steelhead." However, the DEIR should note that Bogus Creek production makes up a substantial portion of the natural escapement target for the Klamath River (that target is 40,700 Chinook). Both hatchery and natural origin fish that spawn naturally are counted in the target. Achieving the adult escapement target is important because it affects ocean fisheries that may be closed if the escapement target is not met (Cejnar 2018). Related to this is the extremely small population of Coho presently found in the Klamath River. Applying the same threshold for a significant impact to Coho as Chinook would seem to underestimate the actual potential impact to the Coho population. The status of this population and the potential effects of the Proposed Project are discussed in detail elsewhere (see Major Issue 2.1).
Section 3.4 Phytoplankton and Periphyton					
3.4-1	3.4.2.1	3-393	Paragraph 3		The DEIR muddles the seasonal nature of the information in this long paragraph confusing the reader and leading to inaccurate conclusions. For example, toward the end of this paragraph, the DEIR concludes: "Thus, blue-green algae are able to outcompete diatoms and/or green algae under lower mixing conditions in reservoirs." However, this is only accurate during summer and early fall when water temperatures are warmer. At other times, diatoms and green algae are able to outcompete blue-green algae. The DEIR needs to present a clear discussion of the

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					seasonal succession and relative dominance of the diatoms, green algae, and blue-green algae, and all the factors that determine succession and relative dominance in addition to mixing conditions (such as, temperatures, light levels, nutrient availability/ratios, growth rates).
3.4-2	3.4.2.3	3-410	Paragraph 2		The DEIR refers to PacifiCorp-funded research by Oregon State University to determine the causes of the changes in the presence and amounts of microcystin in Copco and Iron Gate reservoirs (Otten et al. 2015; Otten and Dreher 2015; Otten and Dreher 2017). However, the discussion of this research is overly simplified and incomplete. For example, sequencing of a particular genetic marker (i.e., the cpcBA) indicated that four or five different allotypes (clustered into operational taxonomic units; OTUs) comprised the Klamath River *Microcystis* population (Otten et al. 2015). The dominance in certain years by the only *Microcystis* strain correlated with microcystin production (i.e., OTU 1) raises the possibility that toxin biosynthesis confers some sort of competitive advantage over the other nontoxigenic *Microcystis* strains. It has been suggested that microcystin production provides cells with a competitive advantage during periods of high light or oxidative stress (Paerl and Otten 2013). Otten et al. (2015) speculated that a noticeable reduction in optically active components (i.e., total chlorophyll-*a* and dissolved organic carbon) within the reservoirs in 2010, 2012, and 2013 resulted in higher ultraviolet light exposures in the photic zone, and therefore caused potentially higher amounts of reactive oxygen species (and, hence, microcystin) to be generated. Although the OTU 1 *Microcystis* strain correlated with microcystin production often dominates in Copco and Iron Gate reservoirs, there have been documented periods when the OTU 1 strain was replaced by other *Microcystis* strains that are believed to not generate microcystin (Otten and Dreher 2017). To further address the matter, Otten and Dreher (2017) completed a multiyear assessment using analysis of variance and change

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					point statistics to determine if changes in *Microcystis* population structure (i.e., strain composition) and toxigenicity coincided with specific environmental conditions. Regarding water quality variables that might influence toxicity via altered bloom composition, a number were found to significantly vary seasonally from year–to-year, but none did so in a temporally coherent manner coincident with the *Microcystis* strain succession patterns observed in the reservoirs (Otten and Dreher 2017). However, the assessment suggested that a reduction in light intensity and/or a shift in photosynthetically available radiation toward the red end of the visible light spectrum due to episodic wildfire smoke was a plausible explanation for observed strain turnover events. Because wildfires exert their influence regionally, differences in water chemistry between the reservoirs is largely irrelevant, which may explain why strain succession patterns between reservoirs tend to exhibit similar patterns even though the reservoirs can differ with regard to their physicochemical makeup.
3.4-3	3.4.2.3	3-413	Paragraph 3		The DEIR states that "Nuisance blooms of periphyton have not been documented in the riverine portions of the Hydroelectric Reach. In the J.C. Boyle Peaking Reach, it has been noted that periphyton tends to be absent from the margins of the river that are alternately dried and wetted during peaking operations (E. Asarian, pers. comm., 2011)." The DEIR should clarify the reasons that nuisance blooms of periphyton during summer have not been documented in the riverine portions of the hydroelectric reach. For example, in Keno and J.C. Boyle reservoirs, light limitation is prevalent as highly impaired water released from Keno Dam are turbid, colored, and have notable suspended material limiting periphyton growth, a condition that will persist under the Proposed Project and all alternatives. Downstream of the J.C. Boyle Powerhouse, peaking operations alternatively produce high flows and low flows in the downstream river reach, ranging from about 3,000 cfs to 300 cfs and this

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					environment limits colonization by periphyton. Under the Proposed Project, stable flows will be the norm and the J.C. Boyle Peaking Reach will be colonized with periphyton growth. During summer periods, this will likely cause pH excursions above 9 s.u. throughout the reach and may cause local dissolved oxygen conditions to vary notably through the 24-hour period.
3.4-4	3.4.2.3	3-418	Paragraph 2		The DEIR includes no discussion of the existing, extensive macrophyte growth in the Klamath River reach downstream of Iron Gate Dam. Macrophyte densities are considerable between Iron Gate Dam and the Shasta River, and continue to be present in high densities downstream to the Scott River. These plants have a dominant impact on water quality in terms of pH, dissolved oxygen, nutrient uptake, as well as an autochthonous production of particulate and dissolved organic matter to the Klamath River.
3.4-5	3.4.2.3	3-419	Paragraph 1		Under the Proposed Project, the entire periphyton community will shift. The nitrogen-fixing diatoms noted in the DEIR (*Epithemia sorex, Epithemia turgida*, and *Rhopalodia gibba*, including the blue-green algae *Calothrix sp.*), which currently dominate the lower river in late summer and early fall will probably shift upstream in response to nutrient limitation as a result of nutrient uptake by predominately macrophytes, but also periphyton. Aquatic vegetation, currently absent under the reservoirs and in the J.C. Boyle Peaking Reach will seasonally colonize the stream reaches and convert available nutrients from upstream sources (e.g., Upper Klamath Lake) to aquatic vegetation biomass. As current extent of nitrogen-fixing periphyton shifts upstream, the amount of nitrogen fixation occurring in the river would increase. This would further increase the nutrient loading in the river during summer and early fall periods, impacting water quality in the river as well as the downstream estuary. This critical effect of the

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					Proposed Project on the aquatic system response is absent from the DEIR's analysis and discussion.
3.4-6	3.4.5.1	3-431	Paragraph 3		The DEIR states "Overall, under the Proposed Project, long-term reductions in nuisance and/or noxious phytoplankton blooms in the reservoirs in the Hydroelectric Reach would reduce or eliminate the transport of nuisance and/or noxious phytoplankton species, blooms of these phytoplankton species, and concentrations of algal toxins (e.g., microcystin) into the Middle and Lower Klamath River and would be beneficial." While the reservoirs would no longer support cyanobacteria, there are other suitable habitats in the Klamath River for these and other toxin-producing species that the DEIR does not acknowledge. For example, under existing conditions, backwater areas on the river (e.g., Brown Bear) have had some of the highest microcystin concentrations on the Klamath River (outside of Copco and Iron Gate reservoirs). If these areas still contain backwater habitats and have a supply of nutrients and warm temperatures, there is no reason why high microcystin concentrations will not continue to occur in these areas. The back eddy and slack water habitats of the Klamath River have conditions (water temperature, light levels, flow rates, and nutrient availability/ratios) that make them suitable habitat for cyanobacteria growth and production of associated toxins. Potentially toxigenic cyanobacteria (like *Microcystis*) are common in the Klamath River and other rivers and estuaries around the world where conditions are suitable to support their growth. Some species, like *Phormidium*, are benthic mat-forming species capable of producing toxins, thriving in relatively dynamic river systems (e.g., see work on the unregulated South Fork Eel River by Bouma-Gregson et al. 2017), and have been detected in the Klamath River (Otten 2017a).
Section 3.5 Terrestrial Resources					

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3.5-1	3.5.2.1	3-458	Table 3.5-1 Paragraph 4		Some vegetation type descriptions are missing alliances in Table 3.5-1. Standardize the vegetation type titles and include forest for forest vegetation.
3.5-2	3.5.2.4	3-475	Paragraph 2 bullets		A chart listing positive and negative impacts resulting from the conversion from reservoir to stream habitat would clarify the Proposed Project effects on wildlife species. A description of the existing ecosystem in the reservoir and how it is used by wildlife should be included.
3.5-3	3.5.3	3-514 to 3-515	Paragraph 4 and bullets		There is no definition provided in the DEIR for the term "substantial." The DEIR should provide such a definition to ensure that a) the reader understands exactly what the significance criteria are, and b) the analysis in the DEIR is then clear in terms of how the Proposed Project and alternatives actually effect these resources.
3.5-4	3.5.4	3-515	Paragraph 1 (in 3.5.4)		Effects on the Secondary Area of Analysis are expected to be indirect. This may be the main difference between the Primary and Secondary areas, but the DEIR does not state this clearly.
3.5-5	3.5.5.1	3-518	General comment		The document lacks steps typically found in a revegetation plan such as a planting plan and plant pallet and therefore does not adequately assess impacts to vegetation communities. Mitigation should include a concept of vegetation types after the dams are removed, acres of habitat to be revegetated, and wildlife associations with those habitat types to fully evaluate the effectiveness of the mitigation measures. Without specifics, it is not possible to determine if the mitigation is adequate to offset for the impacts of the Proposed Project.
3.5-6	3.5.5.1	3-519	Paragraph 3 Mitigation Measure TER-1		The DEIR does not address direct disturbance to wetlands where the dam will be physically removed or where construction would place structures into a water of the U.S. (e.g., Fall Creek Hatchery modifications; see

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					comment 3.5-8). There will be no buffer at the dam and accidents such as hazardous spills could take place in a wetland.
3.5-7	3.5.5.1	3-519 to 3-521	General comment		This analysis in the DEIR is contradictory and does not address the impacts to these resources. For example, the DEIR states that "Degradation or removal of wetland and riparian habitat in the areas listed above would be a significant short-term and long-term impact" (DEIR pg. 3-520). The DEIR goes on to analyze the potential effects of revegetation and wetland creation within the reservoir footprints. Ultimately, if all of this work is successful, then perhaps the long-term impact is less than significant, but the short-term impact would appear to remain significant.
3.5-8	3.5.5.1	3-521 and 3-522	Last paragraph		The analysis of impacts to wetland habitats downstream of Iron Gate Dam is inadequate for the following reasons: 1. Implementation of the Proposed Project would result in the release of sediment into the Klamath River downstream of Iron Gate Dam. Not all sediment will be transported all the way to the Pacific Ocean (see Major Issue 2.4). Some of this material will deposit in slack water, eddies, backwaters, and side channels in the 190 miles of river between Iron Gate Dam and the ocean. 2. The Klamath River is a jurisdictional water of the U.S. subject to permitting for placement of fill by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and, because it is navigable, under Section 10 of the Rivers and Harbors Act. The DEIR Significance Criteria requires a significant impact when the Proposed Project would "Result in substantial modifications of federally protected wetlands as defined by Section 404 of the Clean Water Act through direct removal, filling, hydrological interruption, or other means." (DEIR pg. 3-515). The DEIR fails to define the term "substantial."

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					3. The DEIR does not quantify the amount of sediment that will be deposited into the river, the duration of that fill, or the flows necessary to continue transporting it downstream. This is in contradiction to Appendix F of the DEIR which discusses bedload modeling and presents a range of channel elevation changes expected for the Klamath River downstream of Iron Gate Dam (for example see DEIR Figure F-11). 4. Impacts need to consider that sediment would flow from the dam site to the ocean and could cause long-term impacts. The analysis does not evaluate or even attempt to quantify the amount of wetland fill that would occur downstream of Iron Gate Dam as a result of the Proposed Project. It is hard to understand how the deposition of some fraction of the millions of cubic-yards of material that will be released is not a substantial modification of federally-protected wetlands. The conclusion that this impact is less than significant is not supported by the information in the DEIR. The discussion of impacts needs to consider sedimentation resulting from large-scale changes such as wildfires that remove stabilizing vegetation. The DEIR fails to describe the impacts that will occur, what the flood cycle would be like following implementation of the Proposed Project, how USBR would operate Upper Klamath Lake for flood control, and the effects that would have on sediment transport and jurisdictional wetlands. The DEIR does not describe how the present vegetation and wildlife would be impacted by short and long-term changes resulting from this high amount of sedimentation and that it may take more than 1 year for the sediment to be washed out of the system.
3.5-9	3.5.5.2	3-524	Paragraph 1 (fourth line)		The DEIR states that "Project activities including construction as well as reservoir drawdown would result in population-level impacts to culturally significant plant species or substantial degradation or removal of wetland

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					and riparian habitat; therefore, there would be a significant short-term and long-term impact on culturally significant species." Mitigation Measure TER-1 is an avoidance measure only. It does not prevent impacts to culturally significant species affected by construction outside of wetlands, or for indirect impacts to species within wetlands (e.g., from desiccation as groundwater is removed). The DEIR is required by CEQA to include mitigation that actually mitigates for impacts of the Proposed Project. Such a measure would include a detailed plan to address culturally significant plants, with a list of species and a schedule for implementation to substantiate the claim that long-term and short-term impacts will not occur. Short- and long-term impacts to culturally significant species must be defined. Without these specifics, the DEIR is deferring mitigation.
3.5-10	3.5.5.2	3-524	Paragraph 2		We recommend that the new mitigation measure recommended above (see comment 3.5-9) include a statement that culturally significant species will be collected from local seed and propagation material.
3.5-11	3.5.5.3	3-525	Paragraph 3		Using the terminology 'Recommended Terrestrial Measure 1" the DEIR creates confusion about mitigation measure numbering. In addition, the description in the DEIR lacks understandable transitions through the discussion of the restoration process. Some parts are handled under the Plant Mitigation and Monitoring Plan and others in the Final Restoration Plan. It is unclear what resources would be mitigated for under which plan and how these two plans are related. The DEIR is required to clearly present mitigation measures including and a discussion of how these plans would be designed to survive the natural flood cycle and describe the scope of revegetation in the riparian habitat.
3.5-12	3.5.5.3	3-527 to 3-530	Entire		The DEIR does not address long-term impacts to Western Pond Turtles. Because the Western Pond Turtle relies on open water, implementation of the Proposed Project will remove a substantial amount of occupied

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					Western Pond Turtle habitat, a long-term impact that the DEIR fails to address. Mitigation needs to be proposed for this significant impact.
3.5-13	3.5.5.3	3-534	Bulleted list		"No pets will be allowed in the construction areas" should be added as a sixth bullet under Recommended Terrestrial Measure 5: Requirements for Construction Personnel.
3.5-14	3.5.5.3	3-547 through 3-550	General comment	Table 3.5-8	Table 3.5-8 and subsequent text lack discussion of how dam removal will affect bat feeding habitat by species. The DEIR description does not adequately justify a no impact for sensitive bat species. This justification for why the Proposed Project would not degrade bat habitat is required; especially because Proposed Project impacts, including removal of buildings, would eliminate bat nesting habitat and by removing the reservoirs, the Proposed Project would permanently alter the feeding habitat by removing open water areas.
3.5-15	3.5.5.3	3-563	Paragraph 3		The DEIR analysis of Proposed Project impacts on wildlife as a result of conversion of open water to riverine habitat is overly simplified. For example, there is no description of how present species utilize the reservoirs and how, or if, those species would or would not use the river after the Proposed Project is completed. Assuming that dabbling ducks, for example, would simply go elsewhere to forage assumes that there is suitable habitat nearby to support those species, an assumption that is not supported in the DEIR. The DEIR does not even reference the results of other dam removal projects to discuss how aquatic-habitat focused wildlife species composition changed after removal. The conclusion that the impacts to these species would be less than significant is unsupported.
Section 3.6 Flood Hydrology					

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3.6-1	3.6.2.4	3-624	Paragraph 4		Inundation maps are available for areas downstream of Copco Reservoir as well as the J.C. Boyle and Iron Gate facilities that are mentioned in the DEIR.
3.6-2	3.6.5.1	3-626	Paragraph 3		The DEIR states that "Existing conditions do not allow these reservoirs to assist in flood prevention in this manner." Flood control is not a primary purpose of how PacifiCorp operates the Klamath Hydroelectric Project, although the Klamath Hydroelectric Project nonetheless provides limited flood control benefits. Klamath Hydroelectric Project. There are occasions where reservoirs are drawn down prior to predicted high runoff events to allow for storage of high flows and modification of peak flows. The statement in the DEIR that "existing conditions do not allow" is not really correct. A more accurate statement would be "PacifiCorp does not currently operate Iron Gate and Copco reservoirs for flood control purposes."
3.6-3	3.6.5.1	3-626 3-627	Paragraph 5 and 1		The discussion of drawdown of J.C. Boyle Reservoir is unclear as presented in the DEIR. The powerhouse would be offline, thereby removing the power canal as a conveyance avenue for water. Drawdown would have to happen via releases from the spillway or the low-level outlets. During periods of cold weather (e.g., single digit overnight low temperatures), PacifiCorp currently operates J.C. Boyle Powerhouse continuously to keep ice from forming on the power canal. Icing is discussed in the DEIR, but the potential for an ice dam to form on the low-level outlets is discounted because of "surface ice would melt and be reduced because moving water mixes temperatures between the air and the ground...." Based on PacifiCorp's experience in the area, this is an overly optimistic assertion that could have implications for dam safety and flood control.
3.6-4	3.6.5.1	3-628	Last		The normal water surface elevation in Iron Gate Reservoir is about 2,326.5 ft above mean sea level (msl) and the crest of the spillway is at 2,328.0 ft

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					msl. If the water surface elevation were at 2,331.3 ft msl as reported in the DEIR, about 3 ft of water would be spilling into the spillway.
3.6-5	3.6.5.2	3-634	Paragraph 3		Climate change is projected to change the frequency and magnitude of high flow events (USBR 2011). There is no discussion of the sensitivity of the Proposed Project's flood risk-related impacts with regard to climate change, which is anticipated to reduce winter snowpack and increase winter flows as more precipitation falls as rain.
Section 3.10 Greenhouse Gas Emissions					
3.10-1	3.10.5	3-727	Paragraph 2 and below (under Replacement of Hydroelectric Energy)		The DEIR fails to address the impacts to greenhouse gas emissions resulting from removing an existing carbon-free power source (see Major Issue 2.5). The qualitative analysis in the DEIR identifies the possible replacement of hydroelectric power with nonrenewable energy sources as an indirect impact. The impacts of power replacement should be quantified to determine if the impacts are significant and to determine feasible mitigation to offset the impacts. State climate change policy adherence is inadequately addressed. The DEIR does not address California's policies set forth in Senate Bill (SB) 100 (De León), which increases California's renewable portfolio standard (RPS) to 60 percent by 2030 and establishes a state policy whereby renewable and zero-carbon resources supply 100 percent of retail sales to California end-use customers by December 31, 2045. Any loss of a zero-carbon resource will make this standard more costly and difficult to meet. Oregon and Washington are considering climate change bills impacting the electric sector in 2019 legislative sessions. Oregon is considering the adoption of a cap-and-trade program that will link with California's while Washington is considering both a cap-and-trade program and a proposal that would require utilities in Washington to achieve 100 percent carbon

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					neutral energy portfolios by 2030. Carbon-dioxide emissions calculations for the complete removal, rather than only those portions within California, are needed to support findings that the impacts of power replacement would be offset by mitigation.
3.10-2	3.10.5	3-727	Paragraph 6		The DEIR states that "Removal of the reservoirs associated with the Lower Klamath Hydroelectric Project dam complexes would also result in a reduction in methane (CH4) production," and "As previously described, CH4 emissions from the reservoirs range from 4,000 to 14,000 MTCO2e per year." The DEIR should make it clear that there have been no measurements of methane emissions from the Klamath Hydroelectric Project reservoirs and that these estimates are speculative. Estimates of methane emissions from Klamath Hydroelectric Project reservoirs (in DEIR Appendix N) are based on estimates from observations on reservoirs elsewhere in the U.S. These estimates indicate that such emissions from Klamath Hydroelectric Project reservoirs would be a very small percentage of replacement power emissions. See Major Issue 2.5.
Section 3.11 Geology, Soils, and Mineral Resources					
3.11-1	3.11.5	3-774	Paragraph 2		Contrary to the statement in the DEIR, the mouth of the Klamath River is routinely closed by a sandbar. If this happens during the dam removal year, this would increase slack-water in the estuary and increase the rate at which fine materials are deposited into the estuary. The statement that "If dam removal occurs during a low flow year, there may be relatively small volumes of sediment deposited in these areas" is completely unsupported in the DEIR.
Section 3.12 Historical Resources and Tribal Cultural Resources					
3.12-1	Introductio n to 3.12	3-781	Paragraph 2		The definition of Tribal Cultural Resources from PRC Section 210749(1)(a) in this paragraph of the DEIR has a typo that could lead to

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					misinterpretation. The definition currently states (emphasis added) "…or included in a local register **or** historical resources." The word "or" should be changed to "of" per the following excerpt from PRC 210749(1)(a): "Tribal Cultural Resources (TCRs) are defined consistent with Public Resources Code section 21074(1)(a) which includes sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either included or determined to be eligible for inclusion in the California Register of Historical Resources, or included in a local register **of** historical resources, or as determined by the lead agency under the criteria for listing."
3.12-2	3.12.2.3	3-806	Paragraphs 1 and 2		DEIR states that the KRRC conducted a records search in 2017 and that the KRRC search "compliments" [*sic*] record searches from 2012. Best practice in the industry is to complete a new or supplemental records search every 2 years because new cultural/tribal/historical resources may have been identified since the records searches were last completed. In an area with such high levels of archaeological and tribal sensitivity, there is a risk that additional cultural/tribal/historical resources may be present and have been identified since the 2017 (or earlier) records searches. Additional information may exist that could inform the Proposed Project and the assessment of impacts. A records search of the entire Project area should have been conducted in 2017. If the referenced 2017 records search does not cover the entire Klamath Hydroelectric Project area, a supplemental records search should be conducted before considering approval of the Proposed Project. It is unclear if the KRRC work was included in the preparation of the DEIR. This information should be included in the analysis.
3.12-3	3.12.2.3	3-808		Table 3-12.1	This table includes a column for National Register of Historic Places (NRHP) Eligibility but does not include eligibility for the California Register of

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					Historical Resources (CRHR). It is not clear if any of these resources have been evaluated or listed on the CRHR but not the NRHP. The State Water Board appears to assume that NRHP status should also be assumed for the CRHR status. If a formal determination of eligibility was made under Section 106, then the resource is automatically listed in the CRHR. This should be clarified.
3.12-4	3.12.2.3	3-809	Paragraph 3		Updated tribal cultural resources information provided by the Shasta Indian Nation as part of the State Water Board Assembly Bill 52 (AB 52) consultation should be included in this section. Specifically, the number of new tribal cultural resources identified along with the total number of tribal cultural resources identified should be provided. Without information on the types and number of sites identified and the source of that information, the analysis of impacts to tribal cultural resources is not substantiated in the DEIR. Obviously, confidential information should not be shared, but simple reference to a confidential appendix is not sufficient to understand the impact analysis or assess the adequacy of proposed mitigation measures.
3.12-5	3.12.2.3	3-809	Paragraph 6 (second-to-last sentence)		Describing the location of villages as is done in the DEIR may be disclosing confidential site location data. This sentence should be deleted or revised to maintain confidentiality and avoid the potential for site desecration by vandals.
3.12-6	3.12.3	3-813 and 3-814	Entirety of Section 3.12.3		Paragraph 1 seems to indicate that the significance criteria presented in this section were developed specifically for the Proposed Project; however, the DEIR needs to clarify that the actual criteria are specific to the Proposed Project and do not reflect the significance language presented in Appendix G of the CEQA guidelines.

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3.12-7	3.12.4.1	3-815	Paragraph 4		A source citation is needed in the following sentence to clarify whether it reflects a statement and understanding from the State Water Board or data as presented in Lenihan et. al. 1981: "When a river with a long history of cultural use is dammed and water is impounded, the cultural landscape is adversely affected through direct impacts to the archaeological or historical sites themselves and to the relationships of these properties to their environment and to each other on local and broader scales."
3.12-8	3.12.2.3	3-813	Paragraph 3		Given that research is underway at local repositories, the impact analysis for the Proposed Project is incomplete. The DEIR may be missing valuable information about potential historic built environment resources and historic period archaeological sites. Without this information, an accurate impacts analysis cannot be conducted and appropriate mitigation cannot be formulated. This could lead to a situation where the State Water Board incorrectly determines the magnitude of an impact or mitigation may be deferred and not enforced.
3.12-9	3.12.4.1	3-815 to 3-816	General comment		More recent studies exist regarding the impacts of reservoir drawdowns on archaeological sites in the Pacific Northwest and broader western U.S. than are presented in the DEIR. More region-specific and Project-relevant examples exist than the Puebloan archaeological sites in the southwestern U.S. cited under Haynes (2008) and the Lenihan et. al. (1981) study conducted by the National Park Service in the Southwest Cultural Resources Center. More recent analysis should be used for the impact study as it relates to inundation, wave action, and freeze-thaw disturbance once archaeological sites are exposed. Disturbance from freeze-thaw events for newly exposed archaeological sites is not mentioned.
3.12-10	3.12.4.1	3-816	Paragraph 2		The concluding sentence "The results of these surveys on lands exposed from natural drawdown at Lake Mead, a man-made reservoir, are directly applicable to the proposed drawdown of the reservoirs along the Klamath

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					River" is the opinion of the State Water Board. Other, more recent research has been conducted on reservoir drawdowns in California and Oregon that are equally as applicable if not more relevant, among them reservoir drawdown studies in California, Oregon, and Washington undertaken by the U.S. Army Corps of Engineers Portland District, Seattle District, Walla District, and Sacramento District. By not using the best available information, the State Water Board is providing an inadequate analysis in the DEIR.
3.12-11	3.12.5.1	3-816	General comment		Regarding mitigation measures presented in this section, many of the measures consist of mitigation appropriate for compliance with Section 106 of the NHPA. For example, Mitigation Measure TCR-1 requires preparation of a Historic Properties Management Plan (HPMP) and states that "The KRRC shall propose the HPMP for FERC's approval as a term of the license surrender order." This measure may be appropriate for the federal process and is enforceable by the federal lead agency in the NEPA/permitting process; however, it is inconsistent with CEQA, not enforceable by the CEQA lead agency, and likely indefensible.
3.12-12	3.12.5.1	3-820	Item #9, MM TCR-1		The DEIR states "The TCRMP shall state a range of appropriate measures, and a protocol to select from such range." The mitigation statements in this section are general and do not include sufficient detail to demonstrate that the measure will reduce potential impacts. This in turn defers mitigation and is not enforceable by the CEQA lead agency. It is PacifiCorp's understanding that a discussion of impacts and mitigations for specific TCRs and historic period archaeological sites known at the time the DEIR was released should therefore be included. Appendix B includes substantial information about the known resources and resource-specific impacts. This information and corresponding mitigation should be included in the body of the DEIR.

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3.12-13	3.12.5.2	3-846 to 3-854	Potential Impacts 3-12-12, 3-12-13, 3-12-14		Mitigation measures TCR-1 through TCR-8 are specific to TCRs. It is inadequate to refer to these mitigation measures for Potential Impacts 3.12-12, 3.12-13, 3.12-14 that are specific to historic-period archaeological sites. The mitigation measures for TCRs in Section 3.12.5.1 are specific to TCRs and are not written to be adopted for resources other than TCRs. Because the application of these mitigation measures to historic-period cultural resources and archaeological sites is inappropriate, the DEIR needs to be updated for these resources to discuss them at the same level of detail, assess the effects of the Proposed Project, and identify appropriate mitigation measures as required pursuant to CEQA.
3.12-14	3.12.5.2	3-847	Last paragraph		The statement that "...the inclusion of documentation measures in conformance with the Secretary of the Interior's guidance would lessen the impact to the resource, the impact to the Klamath Hydroelectric Historical District under the Proposed" is misleading. The DEIR should acknowledge that any documentation implemented as mitigation would not actually lessen the impact of proposed demolition of contributing features of the Historical District. Rather, the documentation would only mitigate to some degree the loss of the historic resource. Therefore, the impact finding is not substantiated and the impact may remain significant after mitigation is applied.
3.12-15	3.12.5.2	3-846 to 3-854	General Comment regarding Impacts and Mitigation Measures for Historic-Period Resources		CEQA requires that mitigation measures prioritize preservation in place (CEQA Guidelines Section 15126.4). The mitigation measures in this section say little about the feasibility of preservation in place for all of the different types of historical resources (e.g., historic-period built environment, historic-period archaeological sites). Data recovery is only a suitable mitigation option after detailed analysis and documentation demonstrates that data recovery is the only feasible mitigation. It does not appear that

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					this detailed analysis has been conducted in such a manner that would allow this determination to be made.
Section 3.15 Agriculture and Forestry Resources					
3.15-1	3.15.2.1	3-889	Last paragraph		The DEIR does not present adequate information to allow for evaluation of how widespread the resource is within the potential area of impact; simply including the percentage of Area of Analysis that contains agricultural resources would clarify this analysis.
3.15-2	3.15.2.1	3-893		Figure 3.15-2	Add the Area of Analysis to this figure to provide a visual perspective of the amount and distribution of agricultural and forestry resources within the area of potential impact.
3.15-3	3.15.2.4	3-894	Paragraph 4		The DEIR does not present adequate information to allow for evaluation of how widespread the resource is within the potential area of impact; simply including the percentage of Area of Analysis that contains forestry resources would clarify this analysis.
3.15-4	3.15.2.4	3-895		Table 3.15-2	This table as presented in the DEIR does not provide context for the reader relative to the Area of Analysis. At a minimum, the table should include upland tree habitat information within the Area of Analysis and discuss the importance of providing the information for the expanded mapping area.
3.15-5	3.15.3	3-895 3-896	All		The list of significance criteria uses the descriptor "substantial" to indicate the threshold of a significant impact (e.g., substantial conversion, substantial adverse environmental impact, substantial loss). The DEIR needs to define the term 'substantial' as it relates to each of these different criteria.
3.15-6	3.15.5	3-896	Last paragraph		The DEIR fails to address the impacts of diversions from Bogus and Fall creeks for hatchery operations in Section 3.15. Discuss how these diversions affect agriculture or forestry resources land and how any

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					changes to these diversions under the Proposed Project would affect agriculture or forestry resources.
Section 3.17 Public Services					
3.17-1	3.17.3	3-912	All		The list of significance criteria uses the descriptor "substantial" to indicate the threshold of a significant impact (e.g., substantial increase, substantial adverse effect). The DEIR needs to define the term 'substantial' as it relates to each of these different criteria.
3.17-2	3.17.5	3-919	Significance statement		The significance statement should be "Significant and unavoidable impact with mitigation" for Potential Impact 3.17-2 because the State Water Board cannot ensure implementation of the mitigation. Potential Impact 3.17-1 makes the same determination and the significance statement is "Significant and unavoidable impact with mitigation" on p 3-915.
Section 3.18 Utilities and Service Systems					
3.18-1	3.18	3-925	Paragraph 1		The first part of the first sentence of this section is missing, possibly omitting important information regarding what is addressed in this section.
3.18-2	3.18	3-925	Paragraph 1		This section does not describe the baseline condition concerning electric utilities, the power generated by the hydroelectric dams, and the impacts from removing those dams and associated power transmission facilities. This section is also about the ability to deliver utilities. While the Proposed Project likely will not result in new needs for power, it will eliminate existing power sources at the hydroelectric dams. The impact analysis should address the removal of these utilities and how those utilities will be replaced and the impacts of that replacement (See Section 3 Thematic Comments).

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3.18-3	3.18	3-925	Paragraph 1		This section does not address impacts to other utilities, including phone lines, fiber optic lines, and natural gas service. This section should identify buried and overhead utilities and provide mitigation to minimize impacts to existing utilities.
3.18-4	3.18.2.1	3-926	Paragraph 3		The DEIR states that temporary sanitary facilities required by the Proposed Project will be determined by the number of workers onsite, but fails to incorporate information from other areas of the DEIR. Specifically, the number of workers is estimated in Section 3.22.5 Transportation and Traffic (pg. 3-1069; see Table 3.22-5). This number should be used to estimate the quantity of portable chemical toilets required during construction and any associated spill prevention and containment measures or other mitigation.
3.18-5	3.18.2.3	3-926	Paragraph 5		The Water Supply section description does not mention Yreka's water supply pipeline. The text does refer to Section 3.8 Water Supply/Water Rights; however, Section 3.18 should acknowledge that the City of Yreka's water source and the infrastructure to deliver that water are located within the Area of Analysis. This section should also reference where in the DEIR additional information on Yreka's water supply pipeline can be found (including the impact analysis and mitigation to address impacts from temporary disconnections or service interruptions).
3.18-6	3.18.3	3-927	Paragraph and bullets		The list of significance criteria indicates that significant effects to utilities and service systems include new wastewater or stormwater facilities that would cause significant environmental impacts. The DEIR should fully define the threshold of change that would be considered a significant environmental impact. PacifiCorp recognizes that CEQA allows the SWRCB to establish its own significance criteria. However, this question from Appendix G should also

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					be included because the Proposed Project requires surface water diversions for operations at the Fall Creek and Iron Gate hatcheries: "Would the project: … d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?" (See CEQA Appendix G XVI Utilities and Service Systems.)
Section 3.19 Aesthetics					
3.19-1	Section 3.19 Aesthetics		General Comment		Section 3.19 lacks clarity around the baseline condition. While the alternatives analyses seem to acknowledge the environmental baseline to be current conditions (i.e., the four dams, reservoirs, and associated structures), the analysis for the Proposed Project seems to generally reference a previously existing condition in which there were no hydroelectric facilities and instead free-flowing river. This previously existing condition also seems to be considered in defining the return to "more natural river, canyon, and valley vistas" as de facto beneficial. Unless the State Water Board has specifically defined multiple baselines for analysis, the DEIR should analyze the impacts of the Proposed Project in relation to baseline conditions, which are those at the time the NOP was issued in 2016.
3.19-2	Section 3.19 Aesthetics		General Comment		The DEIR fails to provide an individual analysis of the aesthetic impacts of removing each facility. For example, the removal of Copco No. 2 would have very small long-term impacts related to the loss of open water vistas as compared with the larger facilities visible by larger numbers of viewers. While noted in some of the alternatives discussions, the analysis in the DEIR would be better substantiated with a clear discussion of impacts related to each facility.

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3.19-3	3.19.2.1	3-937 to 3-938	Paragraph 3 to the end of page 3-938		As cited in the PacifiCorp (2004c) *Land Use, Visual, and Aesthetic Resources Final Technical Report*, almost all of the facilities are in areas designated as Class III under the Bureau of Land Management's (BLM) Visual Resource Management (VRM) system. However, while some facilities have been designated as such in a BLM resource management plan (RMP) (BLM 1993), the balance of the facilities are designated Class III in the DEIR "because the area has not been given a specific VRM class by BLM." The DEIR must provide analysis as to why the areas outside of RMP coverage are considered to be in this category because the impacts are later analyzed against the level of change acceptable to Class III areas. Further, as detailed on DEIR page 3-938, if the criteria from the baseline Visual Resource Inventory in the 2012 KHSA EIS/EIR (DOI and CDFW 2012) are considered, all of the Proposed Project area "...could be classified as VRM Class II, based on Class A distinctive scenic quality of high visual sensitivity as viewed from a foreground/middleground distance zone, from an inventory context." However, impact analysis in Section 3.19 is based on Class III acceptable change criteria (not Class II) with no reasoning presented for this difference. Overall, this difference in assigned verses functional VRM class creates an analysis in the DEIR that underestimates the degree of impact from the Proposed Project because more substantial changes are permitted in a Class III area with impacts remaining less significant than are permitted in a Class II area.
3.19-4	3.19.2.1	3-938	Last paragraph		The conclusion of the discussion that the Proposed Project area would be considered Class II if BLM's Visual Resource Inventory Matrix was applied is that "If Class II objectives are applied, the changes due to the Proposed Project would be ***even more beneficial because they will return the areas to a more natural character***, and would not change the significance of potential aesthetic impacts discussed in this section" (emphasis added). This statement refers to a more "natural" baseline prior to the

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					hydroelectric complex, which is different than the existing conditions/environmental baseline established at the time the NOP was issued as required in CEQA. Aside from the observation that the DEIR does not establish multiple baseline conditions, this conclusion is inaccurate because the significance threshold differs with different VRM classifications (see comment 3.19-3).
3.19-5	3.19.4	3-952	Paragraph 1		The DEIR states that the impact analysis is built on the general premise that the removal of human-made elements and restoration to more natural conditions would have beneficial effects in light of the significance criteria. However, the criteria consider factors like contrast and degree of change. The significance criteria are not well defined (e.g., terms like "substantial adverse change," "moderate," and "substantially degrade" are not defined), and the DEIR presents no evidence to support the assertion that a majority of viewers would consider removal and restoration beneficial as opposed to simply changed. PacifiCorp realizes that the magnitude of impact to visual resources is in part subjective and based on what a viewer considers important (e.g., restored river versus open water lake views); however, based on the stated visual resources assessment methodology (BLM's Visual Resource Management Process), the significance criteria are not consistent with that process and therefore do not allow for an objective evaluation of change related to the baseline conditions.
3.19-6	3.19.5	3-955	Paragraph 3		The DEIR states that "Furthermore, although the reservoirs could be considered scenic resources in their own right, they are in general not consistent with the Class III VRM designation, because their creation changed the character of the natural landscape and they dominate the view from many public view locations." This does not assume a baseline

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					condition with the reservoirs in place as required by CEQA, but rather assumes an earlier baseline prior to the reservoir's creation.
3.19-7	3.19.5	3-956	Paragraph 4		In discussing changes to flow and channel morphology, the DEIR notes that "...some aggradation of the channel immediately downstream of the dams is expected with the return to natural sediment loads. However, this would represent a return to natural conditions and is considered desirable." This conclusion is based on the premise that the millions of cubic-yards of sediment that will be released during dam removal is both a more natural condition and is beneficial visually. In this analysis it appears that the DEIR has muddled the impacts of the Proposed Project from the release of sediment with the Project objectives. The Proposed Project objectives include improving long-term water quality, advancing restoration of fish populations, restoring fish passage, and reducing disease rates in salmonids. The accumulation of sediment is an impact of the Proposed Project and should not be confused with the conditions the DEIR assumes are more desirable. Instead, this may be a localized change with less desirable visual (and other) effects depending on the viewpoint and those features that may be buried with sediment.
3.19-8	3.19.5	3-957	Paragraph 4		The basis for the determination of a weak to moderate contrast from existing conditions with regard to the visual impacts of turbidity is not defined in the DEIR. Comparisons to the sediment load normally carried in winter or past examples should be provided in this analysis.
3.19-9	3.19.5	3-959	Second Full Paragraph 2		The exposure of previously inundated areas is determined to represent a moderate contrast only in comparison to the existing condition under the VRM system. While arguments are presented to support this conclusion, it is somewhat subjective and could be considered a more severe impact by users that value open-water more than restored riverine views.

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					Additionally, while this analysis is comparing the Proposed Project impact to the existing dammed river condition, it is inconsistent with other portions of the analysis that consider the pre-dam condition as a baseline.
3.19-10	3.19.5	3-960	Paragraph 1		As stated previously, the argument here is that the facilities are inconsistent with VRM Class III, which assumes a baseline prior to the existing conditions.
3.19-11	3.19.5	3-964 and 3-965	Paragraph 4 and 1		With regard to the removal of recreational facilities, construction of new facilities, and other infrastructure improvements the DEIR says "Construction activities and equipment would be seen during construction but would be temporary and would occur in already heavily disturbed areas. Therefore, they would not degrade the existing visual character of the sites or their surroundings. Similar to the other short-term potential visual impacts from construction this is considered less than significant." The DEIR makes the presumption that the hydroelectric facility areas are heavily disturbed (by the simple existence of the dams and associated facilities themselves regardless of how well established in the landscape they may be), many of the facilities are remote recreational facilities or roads/bridges in rural settings which may not be commonly considered "heavily disturbed." While the impacts are short-term in nature and CEQA does not generally view temporary impacts as significant, the basis for the impact determination is subjective and the duration of construction would be temporary though it may not be short-term.
Section 3.20 Recreation					
3.20-1	3.20.2.1	3-976		Table 3.20-4	Lower Klamath Hydroelectric Project Reservoir data appear to be from 2007 and should be updated to reflect data from the 2015 PacifiCorp Licensed Hydropower Development Recreation Report cited in the Definite Plan for the Lower Klamath Hydroelectric Project (Appendix Q – Draft Recreation Plan of Appendix B in the DEIR).

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3.20-2	3.20.2.2	3-985	Paragraph 3 and 4		The DEIR presents out of date information (from 2007 or 2011) on whitewater boating data in the Hell's Corner Reach. Annual whitewater boating use data for the Hell's Corner Reach are available from the Bureau of Land Management, Klamath Falls Resource Area Office.
3.20-3	3.20.2.2	3-989	Paragraph 1		The statement "Data collected by USDA Forest Service and BLM...." is misleading when one considers there are approximately 190 river miles from Iron Gate Dam to the mouth and approximately 25 river miles (not including flatwater) between Iron Gate Dam and J.C. Boyle Dam. It is inappropriate to compare boating use numbers without normalizing the data in some fashion. For example, if a use-per-mile metric were developed, then perhaps an accurate statement about boating use levels in the two reaches could be made.
3.20-4	3.20.2.2	3-989	Paragraph 1 last sentence		By failing to update the use data, the DEIR is possibly misrepresenting the impacts of the Proposed Project. Specifically, whitewater boating use is described as "...decreased somewhat..." from 2000-2003 and 2005-2009 or "...in recent years." Updated rafting data should be included from 2009 onward, and an evaluation completed in the DEIR to assess if the boating has changed.
3.20-5	3.20.2.2	3-989	Paragraph 2	Table 3.20-9	Salmon harvest information is provided from 2001-2015; however, the DEIR text refers only to data from 2001-2010 when making the statement that "...angler success for Chinook salmon varied annually, but was generally greater in the first half of the decade than the latter half." This is a misleading statement because it is inappropriate to compare harvest numbers without normalizing the data for the effort made to harvest those fish. If a catch-per-unit effort metric were developed, then an accurate statement about harvest levels could be made. Some of the total harvest data presented is inaccurate, possibly leading to incorrect conclusions in the DEIR. A comprehensive review of the data and an update of this table

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					with data through at least 2017 (including the angler day data) is necessary. The best source of information is the CDFW Megatable for fall-run Chinook salmon on the Klamath (available at the link below). https://nrm.dfg.ca.gov/documents/ContextDocs.aspx?cat=KlamathTrinity
3.20-6	3.20.2.3	3-991		Table 3.20-11	The DEIR is relying on outdated recreation annual use data for the J.C. Boyle Reservoir developed recreation facilities, calling into question the accuracy of the analysis and conclusions (sources used in the DEIR are from 2001/2002). More recent data should be provided in the DEIR and an evaluation completed if Estimated Facility Use is still considered below capacity. Annual use data for the Topsy Recreation site are available from the Bureau of Land Management, Klamath Falls Resource Area Office. Recreation use data for the recreation facilities managed by PacifiCorp were submitted to FERC as recently as April of 2015 (FERC Form-80 Recreation Use Report).
3.20-7	3.20.2.3	3-990 through 3-994	All sections		A reevaluation of use versus capacity at each recreation facility is necessary because the DEIR is using outdated information in the analysis calling the accuracy of the analysis and conclusions into question. Currently the DEIR provides facility information for each reservoir using 2001/2002 data. At a minimum, this should be updated to reflect data provided in the April 2015 FERC From-80 Recreation Use Report and/or the PacifiCorp Licensed Hydropower Development Recreation Report used for the Definite Plan for the Lower Klamath Hydroelectric Project (Appendix Q is the Draft Recreation Plan within the Definite Plan which is Appendix B in the DEIR).
3.20-8	3.20.2.4	3-997	Paragraph 2		The DEIR states that "Copco No. 1 and Iron Gate reservoirs serve as the major sources of large seasonal phytoplankton blooms." While PacifiCorp does not dispute the fact that the Klamath Hydroelectric Project reservoirs support populations of cyanobacteria and other algae, the sources for the

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					nutrients that drive those populations are Keno Reservoir and Upper Klamath Lake (see comments on DEIR Section 3.2 and comment 4.5-2). Operation of the intake barrier curtain in Iron Gate Reservoir has resulted in improved water quality downstream of Iron Gate Dam (Watercourse 2016; PacifiCorp 2017b). The statement in the DEIR is an oversimplification of a complex process to which the Klamath Hydroelectric Project reservoirs contribute, but are not solely responsible (see comment 3.2-9).
3.20-9	3.20.2.4	3-998	Last paragraph		Again, the DEIR fails to update the data with readily available information. See comments 3.20-3, 3.20-4, and 3.20-5.
3.20-10	3.20.2.4	3-999	Paragraph 2		This paragraph is full of unsupported and undocumented assertions about how the Klamath Hydroelectric Project affects the fishery resources in the Klamath River downstream of Iron Gate Dam. This section of the DEIR should leave the detailed discussions of sediment transport, geomorphology, fish production, and habitat to the sections where that is most appropriate and include by reference those conditions that are directly applicable to the Wild and Scenic River designation and changes from the baseline condition that would be created by the Proposed Project.
3.20-11	Potential Impact 3.20-2	3-1007 through 3-1009	General comment		As noted in previous comments (see comments 3.20-6 and 3.20-7), information regarding use at existing recreation facilities is outdated throughout Section 3.20 and a reevaluation is required to adequately analyze the recreational impacts of the Proposed Project. The statement that the PacifiCorp recreation facilities are operating "below capacity" is not substantiated in the DEIR because the data used in the analysis are 10 years out of date. If recreation use numbers in the past 10 years indicate the facilities are operating at a much higher capacity, an evaluation would be needed to ensure that surrounding recreational facilities have adequate capacity for similar activities (e.g., boating and

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					camping) and can handle the loss of recreational activities resulting from the Proposed Project. The DEIR is lacking the level of analysis necessary to substantiate a finding of No Significant Impact.
Section 3.21 Hazards and Hazardous Materials					
3.21-1	3.21	3-1029	General comment		The DEIR does not address the potential for hazardous materials impacts related to leaving potential contaminants in place (No Project Alternative).
3.21-2	3.21	3-1029	General comment		Without completing the Phase 1 and 2 assessments and accurately evaluating the presence of any hazardous materials known and inventoried, the DEIR impact analysis cannot adequately evaluate the potential for public or environmental exposure, ensure applicable risk minimization plans address actual risk pathways, or definitively determine that mitigation measure implementation will reduce the impact to a less-than-significant level. The KRRC has been working on a Phase 1 and Phase 2 and this information should be included in this analysis as appropriate.
3.21-3	3.21	3-1029	General comment		The analysis of the Proposed Project finds "no significant impact with mitigation" for all but the last three impacts analyzed. In most cases, this conclusion was reached with the implementation of mitigation measure HAZ-1. This mitigation measure presumes that the Final Hazardous Materials Management Plan will address all of the potential impacts discussed, coordinate the elements of the overall Health and Safety Plan, and sufficiently reduce potentially significant impacts to a less than significant level. This essentially defers development of specific mitigation and therefore, the sufficiency of the final plan as mitigation cannot be analyzed in this DEIR. Complicating the matter is that many of the specific risk pathways cannot be known without a complete Phase 1 and possibly Phase 2 Site Assessments, neither of which is referenced in the DEIR (see comment 3.21-2).

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3.21-4	Section 3.21 and Section 4.4	3-1029, 4-99	General comment		Sections such as 4.4 (Continued Operations with Fish Passage Alternative) are unclear about what potential hazardous materials would still be transported. The overall amount and quantity of hazardous waste being removed and transported offsite could potentially be much less than the Proposed Project but are found to be significant and unavoidable as enforceable compliance and risk management plans cannot be guaranteed. Overall, the alternatives analyses (Chapter 4) do not adequately describe the specific hazardous materials that would or would not be disturbed, removed, or transported as compared to the Proposed Project.
Section 3.22 Transportation and Traffic					
3.22-1	3.22.1	3-1057	Paragraph 3		In explaining which roadways were considered for analysis, the DEIR states that analysis "...excludes other local roads...because those local roads would not be used for transportation of construction equipment or workers." This claim requires substantiation or further explanation that the use of other local roads would be prohibited per the traffic management plan. See comment 3.22-2 below on Figure 3.22-1.
3.22-2	3.22.1	3-1058		Figure 3.22-1	The DEIR does not clearly present the roads included or excluded from the analysis. The local road network should be included in the figure and those roads within the traffic analysis should be clearly indicated. If transportation routing plans have not been completed for use in the DEIR's analysis, mitigation requiring the preparation of these plans prior to approval of construction permits should identify the allowed construction routes and measures to prohibit use of other local roads.
3.22-3	3.22.2.3	3-1063	Bullets		The scale of the maps that show the four work locations is too regional to identify where the road, bridge, and culvert construction would occur. Add a more appropriately scaled map that clearly presents the locations of the

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					road, bridge, and culvert construction to provide a visual perspective on the distribution of this construction across the Area of Analysis.
3.22-4	3.22.3	3-1067	Bullets 2 through 6		The list of significance criteria uses the descriptor "substantial" and the term "increased risk" to indicate the threshold of a significant impact (e.g., substantial conflict, substantial increase, substantial safety risks, increased risk of harm to the public). These specific terms must be quantitatively defined in the DEIR.
3.22-5	3.22.4	3-1067	Last		The DEIR incorrectly states that "Once the construction-related activity is complete there will be no traffic generated directly related to the Proposed Project." In reality, there will be traffic related to the Proposed Project through the restoration and monitoring period that follows the construction work. What the DEIR likely meant to say was that there would be no construction-related traffic. The post-construction traffic should be compared to Existing Conditions to allow for an evaluation of long-term impacts that is missing in this section of the DEIR.
3.22-6	3.22.4	3-1068	Last paragraph		Delete the final sentence from this paragraph. The DEIR analyzes the Proposed Project's effect on or compatibility with applicable resources, policies, plans, etc. The DEIR does not analyze the effect of a Regional Transportation Plan on the Proposed Project.
3.22-7	3.22.5	3-1070	Paragraph 2		The term "recreational day" requires definition. The text states "…there is no information on the peak number of recreational trips from recreational use." This analysis should include baseline data from the recreational operators in the area (see comment 3.20-7).
3.22-8	3.22.5	3-1070	Paragraph 2		The DEIR fails to provide any substantiation for the assumption that peak recreational trips are double the average. A more conservative estimate of impacts would assume more intense impacts (i.e., assuming peak trips are

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					more than double the average daily trips). A 20 percent increase in trips is a *less* conservative estimate than a 100 percent increase in trips.
3.22-9	3.22.5	3-1070		Table 3.22-6	The method for calculating VT per Day results should be provided in the DEIR. For example: Total VT / Peak Duration / 30. Using Copco No. 1 as an example, 2,426 / 7 / 30 = ~12 VT per Day, not 15.
3.22-10	3.22.5	3-1072	Second-to-last paragraph		Revised text regarding FERC licensees only being required to comply with state and local requirements "where possible," remove "where possible."
3.22-11	3.22.5	3-1074 3-1075 3-1076 3-1077	Significance statements		Change the significance statement to "Significant and unavoidable impact with mitigation" for Potential Impacts 3.22-1 through 3.22-5 because the State Water Board cannot ensure implementation of the mitigation.
3.22-12	3.22.5	3-1077	Paragraph 1		The threshold for what constitutes "an unacceptable level of risk" should be defined.
3.22-13	3.22.5	3-1077	Paragraph 1		Revised text regarding FERC licensees only being required to comply with state and local requirements "where possible," remove "where possible."
3.22-14	3.22.5	3-1072	Paragraph 2		The DEIR analyzes the Proposed Project's effect on or compatibility with applicable resources, policies, plans, etc. The DEIR does not analyze the effect of a General Plan on the Proposed Project; therefore, delete "...does not contain measures or programs that would conflict with the Proposed Project in a manner that would adversely affect the environment."
Section 3.24 Cumulative Effects					
3.24-1	3.24.3	3-1162	Paragraph 5 (last paragraph)		The DEIR does not provide a specific discussion of the cumulative effects of the Proposed Project on suckers or Redband Trout in the upper Klamath River.

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3.24-2	3.24-11	3-1197	Paragraph 4		Potential Cumulative Impact 3.24-47 Short-term and/or long-term historical and tribal cultural resources effects from the Proposed Project in combination with development projects: The terminology included in the section "Significant and unavoidable short-term ground-disturbing construction-related impacts on archaeological and non-archaeological tribal cultural resources (TCRs)..." implies that impacts from ground disturbance are short-term. The DEIR should be revised to reflect the fact that ground disturbance, regardless of the duration, causes permanent impacts to TCRs, historic-period archaeological sites, and historic resources.
3.24-3	3.24.15	3-1202	Last paragraph		The DEIR requires clarification to describe if the cumulative impact analysis addresses effects from the combination of the Proposed Project and wildfire.
3.24-4	3.24.17	3-1205	Paragraph 1		A map of pertinent reasonably foreseeable projects should be included and should depict the Proposed Project area.
3.24-5	3.24.18	3-1206	Paragraph 1		Because the City of Yreka's water supply infrastructure is within the Area of Analysis, mention the pipeline here and specify that the City's water supply infrastructure is addressed in Water Supply.
3.24-6	3.24.19	3-1208	Paragraph 2		The summary of Proposed Project impacts reiterates several conclusions from the Proposed Project analysis that have been previously commented on in Section 3.19, including the use of BLM VRM Class III as the assumed condition of the Area of Analysis for Aesthetics when Class II may be more appropriate and conservative. The cumulative discussion needs to be updated to reflect edits made in the main DEIR discussion.
3.24-7	3.24.19	3-1208 and 3-1209	Paragraph 3		The paragraph refers to cumulative impacts from projects not already considered in the utilities and service systems resource area effects and should be deleted.

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3.24-8	3.24.19	3-1209	Paragraph 1		Overall, this section is confusing and should be rewritten. The aesthetics significance criteria should be the same for potential cumulative impacts as for the Proposed Project and this does not appear to be the case.
3.24-9	3.24.19	3-1209	Potential Cumulative Impact 3.24-57		As was stated previously (see comment 3.19-1) the conclusion of this analysis again assumes the change from open water vistas to more "natural river, canyon, and valley vistas" is not significant because it is beneficial and visual quality for the public would not be substantially degraded. In making this conclusion, the DEIR assumes everyone would find the natural river and canyon views equal or more positive than the existing open water views, a position that the DEIR fails to substantiate. Further, even if beneficial, the degree of change may still be significant for even Class III VRM lands, let alone Class II. It could also be considered that other reasonably foreseeable projects with scenic-vista effects (other than just the loss of open water) could create cumulative effects but were not discussed here (an example would be timber harvest within the viewshed of a reservoir).
3.24-10	3.24.19	Entire section	General comment		The significance criteria applied to the cumulative impact analysis of aesthetics and the potential impacts analyzed in this section do not mirror the Proposed Project analysis. The analysis brings in elements not previously considered and seems to focus on only a few types of foreseeable projects. The cumulative analysis should consider the residual effects of the Proposed Project in conjunction with other reasonably foreseeable projects to evaluate the contribution of the Proposed Project to overall change. For example, Potential Cumulative Impact 3.24-58 does not focus on flow and channel morphology, but rather on impacts from other restoration, flow, and water quality projects.

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3.24-11	3.24.19	3-1209 and 3-1210	Potential Cumulative Impact 3.24.58 general comment		This section states "Other projects (Table 3.24-1) have the potential to alter river channel morphology and result in a cumulative impact." However, this analysis discusses only the visual impacts related to suspended sediment and does not list or analyze the impacts from any other projects except to mention that other restoration projects would help reduce nutrient loading and seasonal algal blooms. Further, this section of the DEIR repeats the unsubstantiated conclusion that visual quality impacts related to suspended sediment will be weak to moderate. With 30 to 50 percent of the estimated 15.1 million cubic yards accumulated sediment flushing during reservoir drawdown, and possibly more with other actions such as the 2017 United States District Court-ordered flushing flows, additional information is needed to support this opinion.
3.24-12	3.24.19	3-1210	Paragraph 1 under Potential Cumulative Impact 3.24-59		The discussion of other projects with the potential to create substantial areas of bare sediment and rock should not be constrained to the reservoir footprints but should be considered across the entire aesthetics Area of Analysis.
3.24-13	3.24.22	3-1217	Last paragraph		The text indicates the I-5 has an ADT (correct to AADT) of 391 vehicles. That number is incorrect. Page 3-1060 states that I-5 Exit 789 has AADT levels of 20,900 vehicles (peak) and 17,200 vehicles (average). The mainline of I-5 cannot have an AADT less than its off-ramps.
Section 4 Alternatives					
4.1 Alternatives Selection/Overview					
4.1-1	4.1.1.1	4-3	Paragraph 1		In this paragraph, the DEIR explains why the No Project Alternative analysis addresses only short-term effects (up to 5 years). The reason given in the DEIR is that there is significant uncertainty about the long-term conditions in the basin that could affect the No Project Alternative, such as USBR's

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					operation of the Klamath Irrigation Project, adaptive management of existing projects, and planned restoration activities. The DEIR's decision not to assess long-term effects for this alternative because of such uncertainty should be applied equally to all alternatives and to other information is used in the DEIR, including information that is used to assess long-term effects of the Proposed Project and other alternatives. For example, the DEIR makes extensive use of the total maximum daily loads (TMDLs), including for modeling results and development of significance criteria for water quality. This is the case even though the DEIR itself states that "...the mechanisms for implementation and the timing required to achieve future TMDL compliance are currently speculative" (DEIR pg. 3-66). The DEIR relies on and makes use of other foreseeable but uncertain information such as that related to potential future salmon production and specific future climate change effects in the basin.
Section 4.2 No Project Alternative					
4.2-1	4.2.1.1	4-18	Paragraph 2		The DEIR states: "...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." Based on the information in the DEIR, it appears that deep flushing flows would occur significantly more often for No Project conditions compared to the Proposed Project. Because it is theorized that deep flushing flows will decrease effects of disease related to *C. shasta*, the DEIR analysis should assume that any alternative that incorporates deep flushing flows will have a greater positive effect on disease than those that do not (such as the Proposed Project). This conclusion is not present in the DEIR analysis of alternatives.
4.2-2	4.2.2	Entire section			The DEIR includes many references to "existing adverse conditions." The DEIR should remove the undefined characterization of "adverse" as the discussion is limited to changes from "existing conditions."

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4.2-3	4.2.2	4-25	Paragraph 1		The DEIR states "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 Temperature." Because the No Project analysis does not include long-term effects, the DEIR should clarify that this conclusion, and other conclusions throughout this section, relate only to effects in the short term.
4.2-4	4.2.2	4-25	Paragraph 2		The DEIR states "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." This is incorrect. While the diurnal range may be larger under the No Project Alternative (largely a function of the daily minimum temperature being low in response to J.C. Boyle Powerhouse not operating for some period of the day and dominance of relatively cold spring flow through this reach during this period), the maximum daily water temperature is not predicted to be appreciably higher under the No Project Alternative than the Proposed Project. Peaking flows are high volume and have short transit times. Under the Proposed Project, the flow volumes will be smaller and travel time longer than under the No Project Alternative during the principal heating daytime hours. Even with spring inflow dilution, the maximum daily temperature will not be significantly different. The DEIR fails to identify one of the clear environmental benefits of the No Project Alternative in the J.C. Boyle Bypass Reach. Under No Project Alternative, the water temperatures at the downstream end of the bypass reach rarely exceed 15°C because most of the water comes from a large spring complex that starts less than a mile downstream from J.C. Boyle Dam. With J.C. Boyle Dam removed and the full flow of the Klamath River passing through this reach, maximum daily water temperatures in summer

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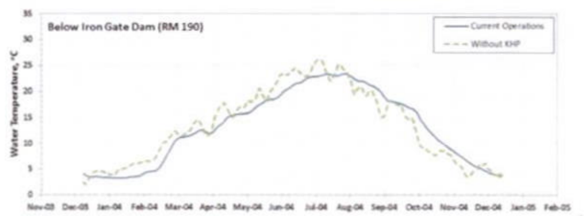
					will be on the order of 22°C to 23°C, that is 7 to 8°C warmer than under the No Project Alternative. Currently, the bypass reach forms a reach-scale thermal refugia spanning several miles of river channel. Dilution of this refugia will probably reduce it to a quarter mile or less without J.C. Boyle Dam in place.
4.2-5	4.2.2	4-25	Paragraph 3		The DEIR describes adverse conditions, but not beneficial conditions under the No Project Alternative. For example, the 7DADMax temperatures (as per USEPA 2003) will be notably cooler under No Project in the reach downstream of Iron Gate Dam from later winter to mid-summer than would occur under the Proposed Project. For example, the graph below shows modeled annual time-series of 7DADMax water temperatures (in °C) in the Klamath River downstream of Iron Gate Dam (RM 190.1) for the model year 2004, which was a "moderate" hydrological year (adapted from PacifiCorp 2014). The graph shows model results for two scenarios that represent: (1) existing operations of the Klamath Hydroelectric Project (Current Operations); and (2) the hypothetical absence of Klamath Hydroelectric Project facilities (without Project), which is akin to the Proposed Project. 
4.2-6	4.2.2	4-26	Paragraph 2		The DEIR states "Overall, there would be no change from existing, adverse conditions for water temperature in the Hydroelectric Reach, the Middle

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					and Lower Klamath River, the Klamath River Estuary, or the Pacific Ocean nearshore environment…" The word "adverse" should be deleted from this statement, and other similar statements throughout this section, because water temperature conditions are not adverse at most times and locations. Also, water temperature is simply water temperature, and may create "adverse" conditions for a receptor sensitive to changes in water temperature, but there is no such thing as "adverse conditions for water temperature."
4.2-7	4.2.2	4-26	Paragraph 4		The DEIR states "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…" The word "small" should be deleted from this statement. These decreases, particularly in phosphorous from a biostimulatory perspective are notable. Nutrient retention in Iron Gate and Copco reservoirs has been calculated and the actual data should be used in the evaluation of the Proposed Project and its alternatives (see Asarian and Kann 2005; Kann and Asarian 2007). The process wherein the reservoirs result not only in retention of nutrients, but also increased passage time so that many nutrients leave the reservoir late in or after the primary production season is not addressed in the DEIR.
4.2-8	4.2.2	4-30			The DEIR states "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)." This statement does not consider that dissolved oxygen conditions upstream of the Klamath Hydroelectric Project are generally worse than water quality

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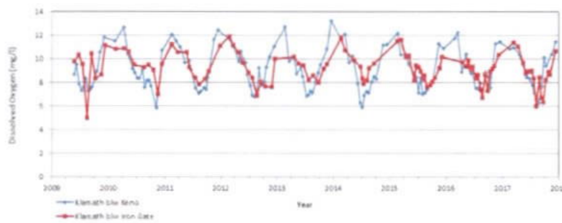
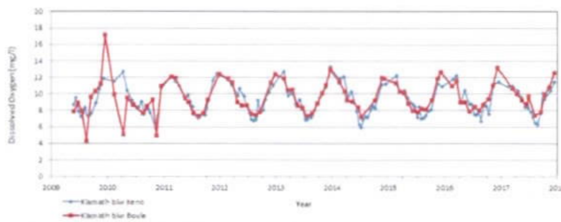
					conditions downstream of J.C. Boyle Dam and Iron Gate Dam. See data below taken from Interim Measure 15 monitoring results, which indicate dissolved oxygen downstream of these dams is generally better than or no worse than upstream water quality conditions.  
4.2-9	4.2.2	4-32	Paragraph 4		The DEIR states "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)." The DEIR goes on to state "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

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					the Middle and Lower Klamath River, with the most extreme pH exceedances typically occurring from Iron Gate Dam to approximately Seiad Valley." The DEIR should explain that the Klamath River is weakly buffered, a condition that is largely a function of watershed geology, not reservoir dynamics. Even modest amounts of primary production will create conditions both with and without the Proposed Project, where elevated pH would occur throughout much of the Klamath River, particularly the river upstream of Seiad Valley, during summer. Because there is a large contribution of nutrients from upstream sources (e.g., Upper Klamath Lake, Keno Reservoir), primary production will occur at levels sufficient to generate pH values that exceed Basin Plan targets. Contrary to what is stated in the DEIR, phytoplankton blooms washing out of Iron Gate Reservoir are not a major contribution to elevated pH downstream. While they may appear extensive, they are small compared to, for example, blooms washing out of Upper Klamath Lake (see chlorophyll-*a* figure below for conditions downstream of Link River Dam and Iron Gate Dam). Modeling has indicated that phytoplankton contributions to the river are minor compared to periphyton and macrophytes (Deas 2000). Finally, algae speciation data indicate that river samples are often dominated by species associated with the upstream periphyton and not necessarily reservoir species.

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					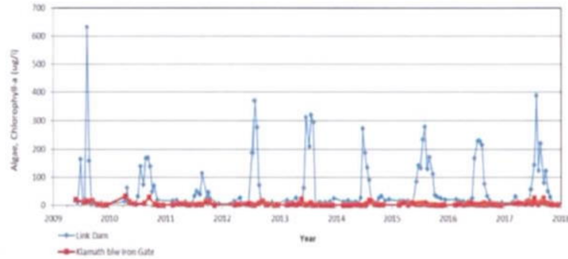
4.2-10	4.2.2	4-34	Paragraph 3		The DEIR states "Downstream of Iron Gate Dam, chlorophyll-*a* and algal toxin trends generally would be similar to existing conditions under the No Project Alternative, with releases of chlorophyll-*a* and algal toxins (i.e., microcystin) in the Lower Klamath Hydroelectric Project reservoirs to the Middle and Lower Klamath River, and eventually the Klamath River Estuary." The DEIR fails to acknowledge that in 2015 PacifiCorp installed and continues to test a barrier curtain to reduce releases of blue-green algae from Iron Gate Dam to downstream Klamath River reaches (see Watercourse 2016; PacifiCorp 2017b). While PacifiCorp is still testing this prototype curtain and operational refinements are ongoing, there are a range of conditions where water quality monitoring indicates that the barrier curtain does successfully segregate surface waters in Iron Gate Reservoir and result in retention of blue-green algae in the reservoir. Testing and refinement of curtain design and operations is ongoing.
4.2-11	4.2.3.1	4-38	Paragraph 5		The DEIR states "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." PacifiCorp is not aware of any actions contemplated under the TMDL implementation plans that are reasonably

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					projected to bring water temperatures downstream of Keno Dam into compliance with water temperature standards. Further, the TMDL requires further reductions in water temperature standards when anadromous fish have access to Keno Reservoir, which will further challenge attainment of water quality standards. Water quality improvements to achieve TMDL requirements are not reasonably certain to occur and thus the DEIR should not rely upon them as assumed future conditions (see Section 3 Thematic Comments).

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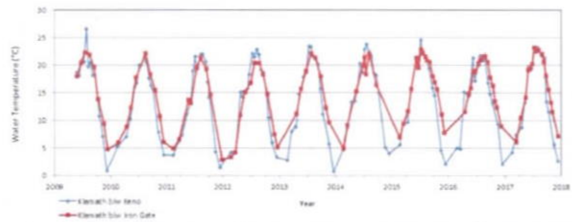
4.2-12	4.2.3.1	4-38	Paragraph 5		The DEIR states "The river's thermal regime downstream from the reservoirs would continue to be out of phase with the natural temperature regime (Hamilton et al. 2011)." The DEIR should consider actual water quality monitoring data, which does not support this statement. See below water quality monitoring data collected under Interim Measure 15, which compares water temperatures downstream of Keno Dam to water temperatures downstream of Iron Gate Dam. While Iron Gate Dam and Reservoir may contribute to a temperature lag, the overall river water temperatures downstream of Iron Gate are aligned with water temperatures upstream of the Klamath Hydroelectric Project that fish would encounter if dams are removed. 
4.2-13	4.2.3.1	4-39	Paragraph 2		The DEIR states "Bartholow et al. (2005) and PacifiCorp (2004b) showed that the reservoirs delay seasonal thermal signatures by 18 days." This is an oversimplification or misrepresentation of what the PacifiCorp source indicates. PacifiCorp model results (see PacifiCorp 2004a, 2008, 2014) show that the delay is actually 18 days or less in the river from Iron Gate Dam to the confluence with the Shasta River (RM 176). The effects of the Klamath Hydroelectric Project reservoirs on water temperatures downstream of Iron Gate Dam (RM 190) progressively diminish until

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					reaching a downstream location where effects are absent. The DEIR should clarify this statement accordingly.
4.2-14	4.2.3.1	4-40	Paragraph 2		In this paragraph, the DEIR indicates that "the No Project Alternative would result in continued substantial deleterious effects on salmon because of fish disease and parasites." This statement is referring to the reach "below Iron Gate Dam." However, the reach "below Iron Gate Dam" is not specifically defined in this section of the DEIR, and therefore the DEIR is erroneously leading the reader to conclude that the reach extends to the ocean (see Major Issue 2.8). Data presented in Bartholomew and Foott (2010) show that polychaete numbers and infection rates are low for the Iron Gate Dam to just above the Shasta River reach; the mainstem reach that has the highest number of adult spawners. Thus, in relation to stream reaches downstream of the Shasta River, polychaetes are not abundant nor does the river reach from Iron Gate to the Shasta River produce high infection rates. The DEIR should clarify and correct this point.
4.2-15	4.2.3.1	4-42	Paragraph 4		The DEIR states "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," and then states "These interacting factors could decrease the viability of Chinook and Coho salmon populations in the future." Aside from the observation that the DEIR previously indicated that the analysis of long-term effects was too uncertain to evaluate, the assumption that continued Project operations could decrease the viability of Chinook stocks in the future from disease is not supported by any data or analysis. The Hetrick et al. (2009) and Hamilton et al. (2011) references cited to support these statements only provide speculative and anecdotal information on this topic. Further, this analysis is supposed to be reviewing the potential effects of the No Project Alternative on Essential Fish Habitat (EFH), yet

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					there is no discussion of the important elements of EFH, how the No Project Alterative would affect those elements.
4.2-16	4.2.3.2	4-44	Paragraph 2		For both the No Project and Continued Operation with Fish Passage alternatives, the DEIR analysis mistakenly assumes that flow variability would be less than the Proposed Project. PacifiCorp currently operates Iron Gate Dam in such a manner that flows can and do change daily based on direction from USBR and various upper basin hydrologic conditions. In addition, when daily target flows are relatively steady, PacifiCorp runs a diurnal fluctuation program at Iron Gate powerhouse that fluctuates flows within the day. Discharges from Iron Gate Dam could be adjusted to create conditions that attract adults into fish passage facilities or, provide a wider range of daily flows for potential use in scouring or desiccating polychaete habitat. Several other measures or adaptive management components could be incorporated into future dam operations alternatives as evidenced by the FERC (2007) EIS for the Klamath Hydroelectric Project.
4.2-17	4.2.3.2	4-55	Impact 4.2.3-13		The DEIR should describe the existing losses of Shortnose and Lost River suckers and that according to the USFWS (2013) these are "sink" populations that contribute little to the overall population status and recovery. This will help make the linkage to the conclusion presented. The reference to PacifiCorp (2013) is incorrect and it is not clear from the DEIR what the source of the statements are regarding either loss of suckers through turbine entrainment or via stranding downstream of J.C. Boyle Powerhouse as a result of peaking operations.
4.2-18	4.2.3.2	4-55 to 4-56	Impact 4.2.3-14		The DEIR is missing a discussion of the status of the Redband Trout population and how (or if) it would change under the No Project Alternative. The existing Redband Trout populations in the Project area continue to be a valuable, wild, self-sustaining resource. In fact, the J.C. Boyle peaking reach trout fishery has been designated as an "Outstandingly Remarkable Value" (ORV) under the Wild and Scenic Rivers

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					Act, in recognition of the "exceptional trout fishery," with a catch rate among the highest in the states of Oregon and California. The Redband Trout population in the J.C. Boyle peaking reach supports a high-quality recreational fishery (PacifiCorp 2004b). Annual angler catch rates in the Oregon portion of the peaking reach from 1979 to 1984 averaged 0.77 Redband Trout per hour. These catch rates are comparable to or exceed those of other high-quality trout streams in Oregon including the Deschutes and Metolius rivers (City of Klamath Falls 1986). Annual angler catch rates in the California portion of the peaking reach were slightly lower, averaging 0.59 rainbow trout per hour during 1974 to 1977, 1981, and 1982. CDFG (2000) reported that the upper Klamath River Wild Trout Area had the highest overall catch rate among the wild trout rivers it monitors in California. Although somewhat dated, the above sources are still appropriate for characterizing the recreational fishery in the J.C. Boyle peaking reach because basic supporting conditions (e.g., physical habitat, flow, and water quality) are unchanged. More recent information suggests that the upper Klamath River, including the J.C. Boyle Peaking Reach, remains a high-quality Redband Trout fishery (Mueller 2011). The DEIR's failure to analyze the substantial benefits to Redband Trout fishery from existing operations (No Project) is particularly notable given the DEIR's characterization of the "adverse" existing conditions ascribed to the Klamath Hydroelectric Project, and suggests a conclusion-oriented bias in the DEIR's alternatives analysis.
4.2-19	4.2.3.2	4-55	Paragraph 2 of Impact 4.2.3-14		The DEIR states that "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." However, the DEIR provides no evidence to support the assertion that there is any effect from restricted habitat connectivity. If this is a documented limiting factor for Redband Trout in this system, the

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					DEIR needs to provide that information. As described in the previous comment above (see comment 4.2-18), the existing Redband Trout populations in the reach from Copco No. 1 Reservoir upstream to J.C. Boyle Dam continue to be a valuable, wild, self-sustaining resource, and support a high-quality recreational fishery (PacifiCorp 2004b; CDFW 2000; Mueller 2011).
4.2-20	4.2.3.2	4-56	Paragraph 1 of Impact 4.2.3-14		The DEIR states that "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." However, the DEIR does not accurately present a reference for NMFS 2006a such that this assertion can be verified nor does the document indicate how many of these entrained fish are Redband Trout. The DEIR needs to support the assertion that entrainment is a documented limiting factor for Redband Trout in this system.
4.2-21	4.2.3.2	4-56	Paragraph 2 of Impact 4.2.3-14		The DEIR states that "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." The DEIR fails to present any evidence to support the assertion that the health and productivity of the population is or has been affected. The DEIR asserts only that factors thought to be related to trout health and productivity are affected by the Lower Klamath Hydroelectric Project. If all of the assertions in this section were true, there would be no Redband Trout in the J.C. Boyle Peaking or Bypass reaches. In fact, the reach from Copco No. 1 Reservoir upstream to J.C. Boyle Dam supports a valuable, wild, self-sustaining Redband Trout population, which provides a high-quality recreational fishery (PacifiCorp 2004b, CDFW 2000, Mueller 2011). It is also unclear from the DEIR why there is such an extensive discussion of conditions upstream of the Oregon/California border. The DEIR's unsubstantiated conclusion of an

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					adversely impacted red trout fishery from existing operations (No Project) ascribed to the Klamath Hydroelectric Project, and suggests a conclusion-oriented bias in the DEIR's alternatives analysis which fails to adequately inform decision-makers and the public about the actual existing conditions and potential impacts associated with the Proposed Project.
4.2-22	4.2.3.2	4-56	Paragraph 2 of Impact 4.2.3-14		With respect to the J.C. Boyle peaking reach, the DEIR states that "All of these conditions could result in substantial declines in redband trout abundance in this reach." The analysis for the No Project Alternative is limited to 0 to 5 years, and it is unclear how existing conditions would result in a substantial decline in Redband Trout abundance over this short timeframe. There is no documentation of any decline of the fishery (in fact, the opposite appears to be the case, see previous comments).and therefore the DEIR misrepresents the effects of continued operations.
4.2-23	4.2.3.2	4-56	Paragraph 3 of Impact 4.2.3-14		The DEIR seems to be missing a word or phrase for clarity "Under the No Project Alternative, diversion of water at continue to alter flows downstream, as occurs under existing conditions." Assume this may be "at Copco 2" between 'diversion of water' and 'continue'.
4.2-24	4.2.3.2	4-56	Paragraph 4 of Impact 4.2.3-14		The DEIR states that "Reduced redband trout abundance and distribution upstream of Iron Gate Dam attributable to Lower Klamath Hydroelectric Project features and operations would continue under the No Project Alternative." The Redband Trout population would be reduced relative to what, historical conditions? As with this entire impact discussion there is no evidence presented to support this assertion. Also, analysis of the effects of the alternative should be made in comparison to baseline conditions which are those present in 2016 when the NOP was published, not some poorly defined pre-dam condition as seems to be the assertion in this discussion.

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4.2-25	4.2.3.2	4-56	Paragraph 4 of Impact 4.2.3-14		The DEIR states that "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)." As described in previous comments, the existing Redband Trout populations in the reach from Copco No. 1 Reservoir upstream to J.C. Boyle Dam continue to be a valuable, wild, self-sustaining resource, and support a high-quality recreational fishery (PacifiCorp 2004b; CDFW 2000; Mueller 2011). The existing Redband Trout caught in the J.C. Boyle Bypass Reach tend to be smaller than those caught in the upstream Keno Reach and the downstream J.C. Boyle Peaking Reach (PacifiCorp 2004b; Tinniswood and Smith 2003; Starcevich et al. 2006). Nonetheless, average condition factor and relative weight indicate that trout in the J.C. Boyle Bypass Reach are average to above-average in condition and plumpness relative to other populations (PacifiCorp 2007). PacifiCorp (2004b) assessed condition factor of fish in the Klamath Hydroelectric Project reaches. Gamperl et al. (2002) report that average condition factors for studied Redband Trout populations in southeastern Oregon were 1.03 to 1.10. While some seasonal variation was present, PacifiCorp (2004) found that condition factor values averaged 1.3 for Redband Trout in the J.C. Boyle Peaking Reach (and 1.2 in the J.C. Boyle Bypass Reach) during all seasons, indicating average to above average (i.e., healthy) robustness or physiological condition compared to other populations in southeastern Oregon. Similar to condition factor, Tinniswood and Smith (2003) assessed relative weight of Redband Trout in the J.C. Boyle Peaking Reach. As with condition values, the relative weight values calculated by Tinniswood and Smith (2003) indicate that Redband Trout in the peaking reach are average to above average in condition compared to other populations. The DEIR should be revised to reflect the actual status of this Redband Trout population. (see comment 3.3-39).

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4.2-26	4.2.6	4-68	Paragraph 2		The DEIR states, "...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)." This statement is incorrect. J.C. Boyle Reservoir does provide storage, which is relied upon to support hydropower peaking operations and to reregulate flows from the upstream Keno Dam. It appears that the DEIR intended to state that Keno Dam provides no storage and operates in spill mode. There is no powerhouse at J.C. Boyle Dam, yet capacity is limited by the flow rate through the power canal to about 2,800 cfs, not the 6,000 cfs listed in the DEIR. Because J.C. Boyle Development is operated as a power peaking facility, there is often some available storage in J.C. Boyle Reservoir. On the other hand, Keno Reservoir is typically operated for agricultural supply to within a tenth of a foot, greatly limiting the available storage to approximately 250 acre-feet.
4.2-27	4.2.6	4-68	Paragraph 3		Total storage in J.C. Boyle, Copco, and Iron Gate reservoirs is only about 109,000 acre-feet. Even including Keno Reservoir (not part of the lower Klamath Hydroelectric Project), the 169,000 acre-feet of storage presented in the DEIR is simply not possible.
4.2-28	4.2.6	4-68	Paragraph 3		The DEIR states that "The dams are inspected regularly and the probability of failure has been found to be low." The DEIR is correct in that PacifiCorp routinely evaluates facility conditions as required by FERC and the California Division of Safety of Dams; however, PacifiCorp does not analyze the probability of failure for these facilities.
Section 4.3 Partial Removal Alternative					
4.3-1	4.3.1.2	4-83	Paragraph 1		The DEIR states that for the Partial Removal Alternative that "...unless otherwise indicated, use the same definitions of short term and long term as described for each resource area analyzed for the Proposed Project." This approach contrasts with the No Project Alternative analysis, which

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					addresses only short-term effects (up to 5 years). The DEIR should clarify why this approach was taken for this alternative but not the other, since the same uncertainty about the long-term conditions in the basin that the DEIR claims to affect the No Project Alternative would also seem to affect the Partial Removal Alternative. This arbitrary limitation for the No Action Alternative generates confusion and will mislead the public and decision-makers as they compare the relative effects of the alternatives or verify the determinations made by the lead agency.
4.3-2	4.3.3.2	4-85	General comment		The discussion of impacts to aquatic resources for the Partial Removal Alternative would be the same as Proposed Project relative to resident fisheries (particularly Redband Trout, endangered suckers, and reservoir fish). Please see comments made in reference to the Proposed Project analysis of Aquatic Resources in DEIR Section 3.3.
4.3-3	4.3.12	4-92	Paragraph 2		This section concludes with the statement "Therefore, potential impacts and beneficial effects on these resources and any associated mitigation measures under the Partial Removal Alternative would be the same as those described for the Proposed Project." Without a quantification of the number of historical resources (e.g., tribal, archaeological, and historic built environment), it is difficult to assess the relative level of impact between reasonable alternatives. While the Partial Removal Alternative will still have a significant impact, it may be that a much smaller number of historical resources will be adversely affected by the Proposed Project. This discussion should be clarified to allow the reader to understand the magnitude of difference between the alternatives.
Section 4.4 Continued Operations with Fish Passage Alternative					
4.4-1	4.4.1.2	4-102	Paragraph 4		The DEIR states that for the Continued Operations with Fish Passage Alternative "the potential impacts for each environmental resource area are analyzed both in the short term and the long term, and unless

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					otherwise indicated, use the same definitions of short term and long term as described for each resource area analyzed for the Proposed Project." This approach contrasts with the No Project Alternative analysis, which addresses only short-term effects (up to 5 years). The DEIR should clarify why this approach was taken for this alternative but not the other, since the same uncertainty about the long-term conditions in the basin that the DEIR claims to affect the No Project Alternative would also seem to affect the Continued Operations with Fish Passage Alternative. The confusion that this generates regarding conclusions leaves the reader unable to compare the relative effects of the alternatives or verify the determinations made by the lead agency.
4.4-2	4.4.2	Entire Section	General comment		The DEIR includes many references to "existing adverse conditions." The DEIR should remove the biased term "adverse" and limit discussion to changes from "existing conditions."
4.4-3	4.4.2.1	4-102	Paragraph 2		The DEIR states "...there are three actions under the Continued Operations with Fish Passage Alternative that would potentially modify water temperatures in the Klamath River and the Lower Klamath Hydroelectric Project reservoirs relative to existing conditions in both the short term and long term: 1) increased minimum flows in the J.C. Boyle Bypass Reach and limited peaking operations at J.C. Boyle Powerhouse; 2) increased minimum flows for the Copco No. 2 Bypass Reach; 3) and implementation of a Reservoir Management Plan." Subsequently, the DEIR's analysis concludes "There is currently no reasonable proposal to achieve the temperature allocations in the Klamath TMDLs with the Lower Klamath Hydroelectric Project dams remaining in place, despite the modest improvements achieved to date through implementation of the Reservoir Management Plan" (DEIR pg. 4-106). There are a couple of issues with these statements:

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					1. The DEIR should recognize that the Reservoir Management Plan was prepared as a draft document and has not been finalized or implemented. PacifiCorp assumes the Reservoir Management Plan would receive considerable additional work if pursued in the future including considerable additional consultation needed with the State Water Board and other stakeholders. Therefore, it would be reasonable for the DEIR to assume that the final Reservoir Management Plan will incorporate reservoir operations and technologies sufficient to meet State Board approval. Such reservoir operations and technologies are described in the current draft Reservoir Management Plan but have not been fully evaluated and designed. However, studies to date and other Klamath Hydroelectric Project analogues indicate that such reservoir operations and technologies are available to be designed and implemented, and would be very effective and feasible. 2. With regard to the Klamath River TMDL, there is a robust record suggesting that the Klamath River TMDLs are technically flawed (as explained in comment 3.2-34). Because of this the TMDL does not accurately reflect existing conditions or likely results of aggressive reservoir management for temperature, dissolved oxygen, nutrient loading, or other water quality concerns. 3. In light of the known and well-documented flaws with the TMDLs and the uncertainties about the effects of the Reservoir Management Plan, the DEIR cannot accurately or definitively say that there is "no reasonable proposal to achieve the temperature allocations." The DEIR is inconsistent in how it deals with uncertain future conditions in the alternatives analysis (see comment 3.3-66) and with respect to the Proposed Project.

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4.4-4	4.4.2.1	4-103	Paragraph 1		The DEIR inconsistently discusses the magnitude of the water temperature change in the J.C. Boyle Bypass Reach across alternatives, and the detail and accuracy of the discussions are inconsistent. Currently, the DEIR implies that thermal refugia benefits would be relatively equal for each alternative. This is not the case. Modeling results show substantive differences in water temperature in the J.C. Boyle Bypass Reach between the No Project and Proposed Project alternatives. These differences are evident in modeling performed for the Existing Conditions scenario (that includes the Klamath Hydroelectric Project) and a Without-Project (WOP) scenario (that assumes the Klamath Hydroelectric Project is absent). Results from this modeling are shown in the figure below and fairly represent the No Project and Proposed Project alternatives as assumed in the DEIR. As can be seen in the modeling results, water temperature under the Existing Condition scenario (which is representative of the DEIR's No Project Alternative) would be on average much cooler than the WOP scenario (which is representative of the DEIR's Proposed Project) in most months (middle panel in figure). Water temperature under the Existing Condition scenario (which is representative of the DEIR's No Project) also would have lower daily temperature variability (top panel), and would have cooler 7DADMax values (bottom panel). Under Existing Conditions (which is representative of the DEIR's No Project Alternative), the J.C. Boyle Bypass Reach would continue to provide over 4 miles of thermal refugia for both juvenile and adult fish. According to the DEIR, thermal refugia under the Proposed Project would be located only around the areas where springs actually enter the channel in the upstream end of the reach. Additionally, under Existing Conditions, water temperatures would continue to be more protective for USEPA 7DADMax temperature criteria for salmon/trout core juvenile rearing, egg

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					incubation, Steelhead smoltification, and adult holding. Therefore, the J.C. Boyle bypass reach will be important as a thermal refuge for maintaining anadromous fish production in the basin given the expected effects of climate change and uncertainty of achieving TMDLs. The DEIR needs to standardize the discussion of water temperature outcomes for each alternative and make those evaluations in comparison to standards and thresholds presented in USEPA (2003) and Carter (2008). **Modeling Results Figure**

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4.4-5	4.4.2.1	4-103	Paragraph 1		The DEIR states "Results from testing of a powerhouse intake barrier/thermal curtain in Iron Gate Reservoir under Interim Measure 11 indicate that modest water temperature improvement is possible using this technique." Previously, on page 3-23, the DEIR states "Results from the intake barrier/thermal curtain indicate that modest 1–2°C (1.8–3.6°F) water temperature improvement is possible (PacifiCorp 2017b)." The DEIR should define the term "modest" in this context, as an improvement of up to 2°C is significant when considered relative to water temperature objectives and aquatic biota preferences.
4.4-6	4.4.2.1	4-103	Paragraph 5		The DEIR states that "Areas adjacent to the coldwater springs in the Bypass Reach would continue to serve as thermal refugia for aquatic species because the springs themselves would not be affected by the Continued Operations with Fish Passage Alternative." While thermal refugia would remain, the size and temperature condition in this refugia would be altered. The DEIR does not state any thermal refugia criterion, but if minimum flows downstream of J.C. Boyle Dam are increased, water temperatures in the bypass would increase several degrees Celsius (see comment 4.4-4). The DEIR should state quantitative values for temperature and assess the potential impact in relation to those values taking into account how dilution can affect the refugia.
4.4-7	4.4.2.1	4-104	Paragraph 2		The DEIR states "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." The DEIR further states "Of the seven water quality improvement actions described in the Reservoir Management Plan,

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					selective withdrawal and intake control is most focused on water temperature improvements. With respect to this approach, PacifiCorp has estimated that the maximum useable cool water volume in Copco No. 1 Reservoir in summer (approximately 3,100 acre-feet at less than 14°C and 4,800 acre-feet at less than 16°C) (PacifiCorp 2014b), which if selectively withdrawn from the reservoirs, would decrease water temperatures immediately downstream of Copco No. 1." This statement is incorrect for Copco 1 Reservoir as discussed in this alternative. Because there would be a change in Klamath River inflow temperature under this alternative, the thermal stratification in Copco 1 Reservoir would be different than in the cited source material. Currently, Copco 1 Reservoir receives a wide range of inflow temperatures over the course of a 24-hour period. The cold inflows that traverse the reach overnight are largely made up of spring inflow and warmer inflows are associated with daytime peaking. Each flow has a unique density with colder flows being denser than warmer flows. The DEIR does not evaluate the change in thermal structure of Copco 1 Reservoir or the potential associated impact on thermal stratification, time of turnover, primary production, outflow temperatures, or other water quality conditions. This dynamic is likely to have a notable effect on the coldwater pool estimates for release to the Klamath River downstream of Copco 1 Dam.
4.4-8	4.4.2.1	4-104	Paragraph 3		The DEIR states "As for the J.C. Boyle Peaking Reach, elimination of any artificial temperature signal in the Copco No. 2 Bypass Reach under existing conditions would better conform with the California." This statement is unclear and appears to be missing words.
4.4-9	4.4.2.1	4-105	Paragraph 3		The DEIR states "The anticipated increases in water temperatures due to climate change would occur over a timescale of decades and would act in opposition to improvements expected from actions taken in furtherance of TMDL implementation throughout the Upper Klamath Basin, such as

<table>
<tr><th>Comment Number</th><th>Section Number</th><th>Page Number</th><th>Paragraph Number</th><th>Table or Figure Number</th><th>Comment</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>increased riparian shading and decreased diversion from cold springs (ODEQ 2010)." The DEIR should clarify how "increased riparian shading and decreased diversion from cold springs" in Oregon in the Upper Klamath Basin apply to the Klamath Hydroelectric Project area in California and include temperatures downstream of Iron Gate Dam. Additionally, the DEIR should recognize that the ODEQ (2010) temperature TMDL was withdrawn and is currently being revised by ODEQ, so this policy may not be an appropriate source for predicting future upstream water quality.</td></tr>
<tr><td>4.4-10</td><td>4.4.2.1</td><td>4-105</td><td>Paragraph 3</td><td></td><td>The DEIR states "While full implementation of the Klamath TMDLs is anticipated to result in late summer/fall reductions in water temperature in the range of 2–10°C immediately downstream from Iron Gate Dam (North Coast Regional Board 2010)." This statement is misleading. In the table below are the monthly average water temperature targets downstream of Iron Gate Dam from the Klamath River TMDL (North Coast Regional Board 2010, Table 5-4 pg. 5-18). None of these targets are 10°C lower than existing conditions (from year 2000 TMDL simulation).
Table 5.4: Temperature numeric targets for Iron Gate and Copco Reservoir tailrace waters
<table>
<tr><th></th><th>May</th><th>June</th><th>July</th><th>August</th><th>September</th><th>October</th></tr>
<tr><td>Copco 1&2</td><td>14.8 °C
58.7 °F</td><td>18.5 °C
65.3 °F</td><td>19.7 °C
67.5 °F</td><td>19.3 °C
66.8 °F</td><td>15.4 °C
59.7 °F</td><td>10.5 °C
50.9 °F</td></tr>
<tr><td>Iron Gate</td><td>15.1 °C
59.1 °F</td><td>18.7 °C
65.6 °F</td><td>19.9 °C
67.9 °F</td><td>19.5 °C
67.1 °F</td><td>15.5 °C
60 °F</td><td>10.6 °C
51 °F</td></tr>
<tr><th></th><th>November</th><th>December</th><th>January</th><th>February</th><th>March</th><th>April</th></tr>
<tr><td>Copco 1&2</td><td>3.5 °C
38.3 °F</td><td>2.2 °C
35.9 °F</td><td>2.9 °C
37.3 °F</td><td>5.9 °C
42.7 °F</td><td>9.4 °C
48.9 °F</td><td>11.7 °C
53 °F</td></tr>
<tr><td>Iron Gate</td><td>3.4 °C
38.2 °F</td><td>2.1 °C
35.8 °F</td><td>2.9 °C
37.2 °F</td><td>5.9 °C
42.6 °F</td><td>9.4 °C
48.9 °F</td><td>11.5 °C
52.7 °F</td></tr>
</table>
The DEIR states "…there is currently no reasonable proposal to achieve the temperature allocations in the Klamath TMDLs with the Lower Klamath Project dams remaining in place." However, as PacifiCorp has previously noted the temperature allocations in the Klamath TMDLs are questionable because of the error in heat budget assumption in the riverine section of</td></tr>
</table>

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					the TMDL models. Should the shortcomings of the Klamath TMDL be addressed and an accurate temperature load allocation for Iron Gate Reservoir be determined, PacifiCorp is confident that a revised detailed Reservoir Management Plan would be developed to achieve the TMDL target.
4.4-11	4.4.2.1	4-106	Paragraph 3		The DEIR states "One of the purposes of the curtain is to isolate warmer, less dense near-surface waters while withdrawing cooler, denser, and deeper waters from the reservoir for release to the Klamath River downstream (PacifiCorp 2018c). The other purpose is to isolate surface waters that have high concentrations of blue-green algae (cyanobacteria) such that extensive summer and fall blooms are not readily released downstream to the Middle and Lower Klamath River (see further discussion in Potential Impact 4.2.2-4)." The DEIR should clarify that the principal purpose of the curtain is to isolate surface waters with blue-green algae (cyanobacteria) and reduce their release into the Klamath River downstream. The isolation or warmer surface waters and release of cooler water is a beneficial but secondary purpose of the curtain.
4.4-12	4.4.2.2	4-111	Paragraph 1		The DEIR acknowledges that nutrient reduction measures in response to the Klamath River TMDLs "necessary to achieve significant reductions are, at this point, unknown" and that reductions and subsequent effects "are likely to require decades to achieve." The DEIR should also point out that, even under the full-compliance TMDL scenario, very large fluxes of organic matter would still be periodically released into the river from Upper Klamath Lake (ODEQ 2002, 2019; Walker 2001). According to studies upon which the Upper Klamath Lake TMDL analysis was based, very large fluxes would still occur 2 out of every 8 years after the TMDL measures are achieved (ODEQ 2002). These large nutrient and organic matter fluxes from Upper Klamath Lake are not considered in the DEIR's analysis.

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4.4-13	4.4.2.2	4-111	Paragraph 1		The DEIR indicates that nutrient reduction measures in Oregon and California TMDLs could decrease algal-derived (organic) suspended material in Copco No. 1 and Iron Gate reservoirs by decreasing nutrient availability. However, in the next sentence, the DEIR states that these nutrient reduction measures "...are, at this point, unknown and reductions and subsequent effects on the Lower Klamath Project reservoirs are likely to require decades to achieve." This paragraph illustrates an important shortcoming with the DEIR's analyses, namely that uncertainty is a critical consideration, especially related to the potential for significant water quality improvements given that the main nutrient source of the Klamath River is Upper Klamath Lake, and Upper Klamath Lake is hypereutrophic, a condition that will not change for decades if ever. The DEIR does not consistently address how this uncertainty is addressed (in this alternative and others as has been noted in other comments).
4.4-14	4.4.2.2	4-111	Paragraph 2		The DEIR states "...continued seasonal phytoplankton blooms in Copco No. 1 and Iron Gate reservoirs that subsequently die and settle to the bottom, would continue to build up nutrients and organic matter in the reservoir sediments. This layer of nutrients would continue to be recycled into the water column (through internal nutrient loading, see Figure 3.2-2) during periods of stratification and low dissolved oxygen and would continue to stimulate large seasonal phytoplankton blooms in the reservoirs that are then released to the Middle and Lower Klamath River." The DEIR erroneously assumes that mixing from the bottom of the reservoir into the epilimnion is somehow occurring during periods of stratification when mixing is the least likely to occur. This error is then magnified by the unsubstantiated conclusion in the DEIR that downstream releases of nutrients could occur that can lead to phytoplankton blooms in the river. Late in the year when destratification does occur and deeper waters can mix throughout the water column, release of nutrients to the river has a

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					low chance of generating an algal bloom. This is because complete destratification and a return to isothermal conditions typically occurs in Iron Gate Reservoir during November or December, after the growth season for phytoplankton.
4.4-15	4.4.2.3	4-114	Paragraph 1		The DEIR states "Other Reservoir Management Plan studies have included consideration of in-reservoir oxygenation systems for Keno, J.C. Boyle, and Iron Gate reservoirs (MEI 2007, PacifiCorp 2014, 2018); however, results of the aforementioned studies do not indicate that these approaches, either individually or in combination, would allow the reservoirs to meet Klamath TMDL targets for nutrients (TP and TN) for the tailraces of Copco No. 2 and Iron Gate dams, where these targets numerically interpret the narrative biostimulatory substances objective for the Klamath River (see Section 3.2.3.1 Thresholds of Significance – Nutrients)." It is unrealistic for the DEIR to presume that in-reservoir activities need to be sufficient to meet TMDL targets. It should be obvious that in-reservoir activities would have to be supported by TMDL compliance efforts elsewhere in the Klamath River Basin, most of which are not the responsibility of PacifiCorp. Such compliance efforts elsewhere, particularly in the Upper Klamath Basin and Upper Klamath Lake (in Oregon), would be crucial given the enormous nutrient and organic matter loads emanating from those sources. In this context, the DEIR should further describe that Upper Klamath Lake water quality impairments are of such magnitude that it is uncertain if or when TMDL compliance will be achieved, a fact acknowledged by ODEQ (2002) in the TMDL for Upper Klamath Lake.
4.4-16	4.4.2.3	4-115	Paragraph 2		The DEIR states that "There is currently no reasonable proposal to achieve the Klamath TMDLs targets for nutrients (TP and TN) for the tailraces of Copco No. 2 and Iron Gate dams..." In reality, there is "currently no reasonable proposal to achieve the Klamath TMDLs targets for nutrients (TP and TN)" at any location upstream of the Klamath Hydroelectric Project

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					in the Klamath Basin in California or Oregon, or for that matter, downstream of Iron Gate Dam, even should the Klamath Hydroelectric Project dams be removed. Thus, this statement is gratuitous, has no useful basis for comparison of alternatives, and appears designed to mislead decision-makers and the public by mischaracterizing the effects of the Klamath Hydroelectric Project on existing water quality conditions in the Klamath River Basin.
4.4-17	4.4.2.4	4-116	Paragraph 1		The DEIR indicates that no reservoir management method to date has succeeded in improving dissolved oxygen in Lower Klamath reservoirs and in discharge from those reservoirs. However, the DEIR should recognize that PacifiCorp's Reservoir Management Plan was prepared as a draft document and has never been finalized or implemented. This means that none of the actions potentially capable of supporting higher dissolved oxygen concentrations in the reservoirs have been implemented. It would be logical for the DEIR to assume that the Reservoir Management Plan would receive considerable additional work if pursued in the future including considerable consultation with the State Water Board and other stakeholders. Therefore, it would be reasonable for the DEIR to assume that the final Reservoir Management Plan will incorporate reservoir operations and technologies sufficient to meet State Water Board approval. Such reservoir operations and technologies are described in the current draft Reservoir Management Plan but have not been fully evaluated and designed. However, studies to date and other Klamath Hydroelectric Project analogues indicate that such reservoir operations and technologies are available to be designed and implemented, including for oxygenation, and would be very effective and feasible. For example, proven oxygenation technologies have demonstrated substantive saturation of hypolimnetic dissolved oxygen in at least three dozen projects where anoxia had previously prevailed (Cooke et al. 2005;

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					Singleton and Little 2006; Beutel and Horne 1999; Gantzer at al. 2009; Singleton et al. 2007; Mobley et al. 2012).
4.4-18	4.4.2.4	4-117	Paragraph 2		The DEIR states that "Overall, while results from the Reservoir Management Plan feasibility investigations of in-reservoir oxygenation and deployment of an intake barrier/thermal curtain suggest that improvement in dissolved oxygen is possible in the reservoirs (PacifiCorp 2017b, 2018b), these studies have not resulted in water quality improvements at Copco No. 1 or Iron Gate reservoirs that meet TMDL requirements for dissolved oxygen in the reservoirs, nor have they otherwise sufficiently improved Lower Klamath Project impacts to dissolved oxygen in the Middle Klamath River immediately downstream of Iron Gate Dam." The DEIR should clarify two things: 1. Because of the KHSA and implementation of the elements associated with that agreement, forward progress on finalization of the Reservoir Management Plan and actual implementation of that plan, including reservoir oxygenation, was not necessary. To say that PacifiCorp has not implemented any of the Reservoir Management Plan elements is an oversimplification. 2. The barrier curtain is a prototype and testing continues as initial results show promise. Elsewhere throughout the DEIR, Klamath TMDL implementation has been presumed to achieve water quality improvement even though specific TMDL measures and actions are not defined let alone having been subjected to a feasibility analysis like reservoir oxygenation. The DEIR should be consistent in its assumptions and analysis and therefore also assume that reservoir water quality management actions can be implemented and be effective for improving dissolved oxygen in the reservoirs and the river downstream of Iron Gate Dam.

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4.4-19	4.4.2.5	4-120	Entire section		Regarding the DEIR discussion in "4.4.2.5 pH," the DEIR should clarify that the seasonal (summer and fall) pH challenges are geologic in nature and going to occur whether there is a reservoir or river in place for reaches upstream of Iron Gate Dam where macrophytes and periphyton can grow. The DEIR omits any mention of this important fact: long-term pH condition cannot be reduced or mitigated, and existing pH conditions will be exacerbated by climate change. See comments 3.2-5, 3.2-23, 4.2-9.
4.4-20	4.4.2.5	4-124			The DEIR states "Warmer water temperatures under climate change would further exacerbate seasonal phytoplankton blooms in the Hydroelectric Reach, which would then be transported downstream, and overall there is currently no reasonable proposal to achieve TMDL targets and meet applicable water quality standards for water temperature, nutrients and dissolved oxygen, which would also continue to result in elevated chlorophyll-*a* concentrations and periodically high algal toxin concentrations in the surface waters of Copco No. 1 and Iron Gate reservoirs during summer and fall months." Aside from the generally confusing sentence structure, the DEIR should clarify that in-reservoir compliance with TMDL targets would have to be supported by TMDL compliance efforts elsewhere in the Klamath River Basin, most of which are not the responsibility of PacifiCorp. Such compliance efforts elsewhere, particularly in the Upper Klamath Basin and Upper Klamath Lake, would be crucial given the enormous nutrient and organic matter loads emanating from those sources. In this context, the DEIR should further describe that Upper Klamath Lake water quality impairments are of such a magnitude that it is uncertain if or when TMDL compliance will be achieved. That said, elsewhere throughout the DEIR, Klamath TMDL implementation has been presumed to achieve water quality improvement even though specific TMDL measures and actions are not defined. Thus, the DEIR should be consistent and also assume that water quality management actions can be

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					implemented in the Klamath Hydroelectric Project area and be effective for improving chlorophyll-*a* concentrations and periodically high algal toxin concentrations in the reservoirs and the downstream river.
4.4-21	4.4.3.2	4-126	Paragraph 2		The DEIR's statement regarding the 2017 United States District Court order to USBR that addresses flushing flows is lacking detail. Although stating the flows are incorporated into the Continued Operations with Fish Passage Alternative, the DEIR does not appear to have included any modeling of these flows. The DEIR also does not analyze the effectiveness of these flows to reduce polychaete abundance. The DEIR should indicate whether these Court ordered flows have achieved their objectives and been effective to date because this information would be important in accurately assessing the relative effects of alternatives to the Proposed Project. The Court ordered flows are based on the best available information regarding the amount of flow required to mobilize substrate. The DEIR should clarify where these flows would be the same, higher in volume, and address the frequency of these flows under the Proposed Project as comparted to this and other alternatives.
4.4-22	4.4.3.3	4-127	Paragraph 2		The DEIR states that a portion of the fall-run Chinook upstream migration would be limited unless they travel in a narrow band of temperature and dissolved oxygen that exist in the upper 10 meters of the reservoirs. The temperature data cited in Appendix C show that such a band exists in the reservoirs in most years. As they do in the lower Klamath River, adult Chinook would migrate at night when temperatures are cooler and take advantage of thermal refugia provided by Fall Creek and other tributaries. The DEIR's analysis should be consistent in discussing the fishery consequences of thermal refugia for all alternatives. The DEIR should also remove the discussion of spring-run Chinook from this paragraph because

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					spring-run Chinook are no longer found upstream of the Salmon River in the Klamath Basin.
4.4-23	4.4.3.3	4-128	Paragraph 1		The DEIR should clarify that spring temperatures are cooler under the Continued Operations with Fish Passage Alternative than the Proposed Project, these cooler temperatures provide benefits to fish.
4.4-24	4.4.3.4	4-129	Paragraph 2		The DEIR does a poor job explaining the different factors that affect *C. shasta* and leaves much to inference. To address this, the DEIR should include a discussion that provides the differences in factors that affect *C. shasta* in regard to nidus formation. For example, a table could provide the level and frequency of flushing and dilution flows, and deep flushing flows produced under the Proposed Project compared to Court ordered flows produced under the different alternatives. Such a table would allow the readers of the DEIR to see the likelihood of the effectiveness of the flows. The Court ordered deep flushing flows (11,200 cfs) to occur at least once between February 15 to March 31. The February 15 date was set to avoid scouring redds and incubating eggs. This assumes that the majority of emergence has occurred prior to this date; however, the emergence timing information for Chinook, Coho, and Steelhead in Section 3.3 of the DEIR indicates that significant numbers of eggs and alevins will still be in the gravel through May (dependent on species). As such, the DEIR should discuss the risk to mainstem spawners from deep flushing flows where appropriate. It is also worth noting that the assumption that the deep flushing flow would continue to be required is not reflected in the USBR's proposed action (USBR 2018a) nor are these flows that can be artificially created on a desired schedule with existing water control facilities on the Klamath River let alone those that would remain after implementation of the Proposed Project.

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4.4-25	4.4.3.4	4-129	Paragraph 4		The DEIR states that the disease nidus is anticipated to continue to occur to some degree under this alternative. The DEIR should ensure that this assumption is incorporated into all of the alternatives. This is particularly warranted, because earlier in this same paragraph the DEIR states that flow and dilution requirements alone have not been successful at eliminating the nidus. When this observation is connected with that by Bartholow and Foott (2010) who noted that a low number of infected adult salmon (>3,000) are sufficient to maintain high infection prevalence in polychaetes and the fact that polychaetes are distributed throughout the river, it is reasonable to expect that *C. shasta* will be found anywhere there are Chinook and Coho in the Klamath River.
4.4-26	4.4.3.5	Entire Section			The DEIR includes many references to "existing adverse conditions." The DEIR should remove the biased term "adverse" and limit discussion to changes from "existing conditions."
4.4-27	4.4.3.6	4-131	Paragraph 2		The DEIR's discussion on activities currently underway to recover salmonid and sucker populations is useful but does not appear in other alternatives (e.g., Sections 4.2, 4.3, etc.). The DEIR should treat this information equally in all alternatives.
4.4-28	4.4.3.6	4-131	Last paragraph of section		The DEIR refers to "Implementation of the Coho Enhancement Fund under the No Project Alternative..." This should be "under the Continued Operations with Fish Passage Alternative..."
4.4-29	4.4.3.7	4-133	Paragraph 1		The DEIR states that assumed trap and haul survival rates for aquatic species is not different than for volitional fish passage systems. The DEIR should clarify whether this means that the trap and haul system has a 21 percent mortality rate as defined for volitional fish passage, or whether assumed trap and haul survival rates are the same as survival rates assumed for a single ladder and collection system. This clarification is

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					needed in the DEIR because it would make little sense to implement a trap and haul system that had the same survival rate as a volitional system through four dams and reservoirs. The assumptions reported in the DEIR for the trap and haul system should be corrected. The assumed survival rate for juveniles trapped at J.C. Boyle Dam and transported to the river downstream of Iron Gate Dam averaged 81 percent and ranged from 67 to 95 percent (Option 1C in Oosterhout 2005). Adult survival rates for fish transported from Iron Gate Dam to J.C. Boyle Reservoir was 79 percent (range 70 to 89 percent, Tables 2 and 6 in Oosterhout 2005). Note that Oosterhout (2005) incorporated delayed mortality for adults transported in trucks in the estimate and cites the literature estimate (7 to 22 percent) used in the analysis. Oosterhout (2005) estimated that fall-run Chinook spawner abundance for the volitional passage and trap and haul scenario (Option 1C in Oosterhout 2005) were within a couple of thousand fish (29,754 and 28,539 under a no harvest assumption). Both options produced about 12,000 less adults than the four-dam removal option. Because Iron Gate Hatchery produces approximately 50,000 fall-run Chinook adults, total production under volitional and trap and haul scenarios is significantly higher than the four-dam removal. The Oosterhout (2005) and Ecosystem Diagnosis Testing (EDT) Habitat modeling results (PacifiCorp 2005) provide analyses that can be used to show the expected difference in adult fall Chinook production for alternatives in the DEIR. The EDT analysis has data for Chinook, Coho, and Steelhead. PacifiCorp's recent work on a trap-and-haul program on the Lewis River (WA) has indicated survival of adult salmon and Steelhead approaches 100 percent (PacifiCorp and Public Utilities District No. 1 of Cowlitz County 2016). This indicates that the mortality assumptions included in prior work evaluating trap and haul alternatives were high relative to those experienced in current practice.

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					The DEIR should clarify the findings of Lusardi and Moyle (2017). Lusardi and Moyle (2017) did not perform a literature review of prespawn mortality rates for volitional, natural, and trap and haul passage systems. They presented findings showing that trap and haul systems can have high adult prespawn mortality rate and therefore can pose a risk to reintroduction efforts. Specifically, the 20 percent adult mortality figure came from one Coho program on the Toutle River in Washington. In contrast to this, PacifiCorp has been moving salmon and Steelhead, both adults and juveniles, past the Lewis River dams with very little mortality (PacifiCorp and Public Utilities District No. 1 of Cowlitz County 2016). The issues associated with juvenile trap and haul programs discussed are most frequently related to programs on the Columbia River that barge juvenile salmonids for hundreds of miles. As Lusardi and Moyle (2017) note, there are substantial differences in survival based on the species, run, distance fish are moved, method of movement, water quality, and so on. There is no basis, let alone substantial evidence, to assume that trap and haul survival is similar to survival from passage via ladders and screens without substantially more detailed research and evaluation. The DEIR should have addressed these complexities. Data collected by the Wild Fish Conservancy (2008) show that prespawn mortality can be as high as 100 percent for streams in the Pacific Northwest. The environmental conditions present in the stream have a substantial effect on prespawn mortality rates. Thus, in order to determine if trap and haul has a higher prespawn mortality rate than the volitional passage system, the DEIR needs to define the rates for both, which it does not. The DEIR should have defined these rates for all alternatives.
4.4-30	4.4.3.7	4-133	Last paragraph of section		The DEIR's assumption that effects of passage through trap and haul facilities would be equivalent to volitional passage for other migratory species may be reasonable for Redband Trout but is unsupported for other

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					species such as lamprey and suckers if they were also subject to trap and haul.
4.4-31	4.4.3.7	4-134	Paragraph 4		The DEIR's analysis should be more precise when defining the reach referred to as downstream of Iron Gate Dam. The DEIR should be specific as to whether this reach extends to the Shasta River, estuary, or just a few miles downstream of the dam. The DEIR states that "there is currently no reasonable proposal to achieve water quality standards important to Coho salmon within or downstream of the Hydroelectric Reach." The DEIR should list all proposals considered in regard to this statement and the specific justification for why they are not reasonable
4.4-32	4.4.3.7	4-138	Paragraph 2		The DEIR states that predation on outmigrating juveniles is expected to be low but fails to provide a value for this metric. On page 4-137, the DEIR indicates that juvenile passage mortality through the hydroelectric reach is expected to be 58 percent, but the source of this mortality is not clear. The Oosterhout (2005) analysis used a survival value for volitional fish passage for fish arriving downstream of Keno Dam to downstream of Iron Gate Dam of about 77 percent. For trap and haul, the juvenile survival value was 81 percent. If this type of information is provided for one alternative, the DEIR should provide the same type of information for all alternatives, including the Proposed Project.
4.4-33	4.4.3.7	4-139	Paragraph 1		The DEIR describes effects of dissolves oxygen under the Continued Operations with Fish Passage Alternative on fall-run Chinook. The DEIR states that oxygen levels will range from less than 85 percent saturation to 90 percent saturation. The effects to Chinook from these oxygen levels are not discussed. Carter (2005) reviewed oxygen effects to salmon and showed that effects are expressed in concentrations of dissolved oxygen in mg/l. Expressing dissolved oxygen values as percent of saturation is

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					consistent with the Basin Plan, but because the actual values can vary based on elevation and water temperature, they are difficult to interpret in terms of effects to fish. The resulting oxygen values for the months cited should be reported and compared to a published metric so that the public and decision-makers can understand likelihood and scale of effect to salmonids.
4.4-34	4.4.3.7	4-139	Paragraph 5		The DEIR includes a summary statement for the Continued Operations with Fish Passage Alternative indicating that there would be no impact (no change relative to existing conditions) for fall-run Chinook salmon in the short term (i.e., less than 5 years) timeframe. The DEIR should ensure that each summary section of effects for all alternatives should have a conclusion statement as to whether the alternative achieves the identified objectives of the Proposed Project for natural fish populations. As previously stated on page ES-4 of the DEIR, the objective is as follows: "Advance the long-term restoration of the natural fish populations in the Klamath Basin, with particular emphasis on restoring the salmonid fisheries used for subsistence, commerce, tribal cultural purposes, and recreation." The level of advancement sought in this objective is not defined in the DEIR. Thus, while the scale of the advancement may vary between alternatives, it appears that all alternatives achieve the objective to some extent.
4.4-35	4.4.3.7	4-142	Paragraph 3		The DEIR states that "...poor water quality in reservoirs is expected to have minor effects on this species, and only at the early and late ends of migration periods, outside peak migration times." Given that there are no spring-run Chinook upstream of the Salmon River, the DEIR needs to clarify why the early portion of the spring-run Chinook adult migration would be negatively affected by the reservoirs before and during April. The DEIR should further clarify why this same statement is not made for the Keno Reservoir. The water quality parameters that the DEIR assumes would

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					negatively affect adult spring-run Chinook migrating through reservoirs before and during April should be identified and applied equally through the river and within the DEIR.
4.4-36	4.4.3.7	4-143	Paragraph 1		Given that there is not a population of spring-run Chinook upstream of the Salmon River, the DEIR needs to explain why there is an analysis of effects to spring-run Chinook. The DEIR notes that spring-run Chinook could recolonize habitat upstream through straying. However, Iron Gate Hatchery data indicate that spring-run Chinook have not been collected at Iron Gate Hatchery for decades. This is likely because the nearest spring-run Chinook population is about 130 river miles downstream of Iron Gate Dam in the Salmon River. The Salmon River spring-run Chinook population is also very small, thereby reducing the number of adults likely to stray. Therefore, the DEIR should account for the actual population data and state that it is highly unlikely spring-run Chinook would recolonize existing habitat by straying from the Salmon River in any reasonable timeframe. The DEIR should not speculate about spring-run Chinook recolonization, but at a minimum should indicate that if straying from the Salmon River does occur, it likely would take decades (or longer) before substantial spring-run Chinook production occur upstream of Iron Gate Dam. This same statement should be added to all alternatives.
4.4-37	4.4.3.7	4-143	Paragraph 4		Previous comments related to prespawn mortality rates apply here (see comment 3.2-43 and 3.3-70). The DEIR should clarify that, although temperature effects from the dams do not extend downstream of Clear Creek (RM 95), summer temperatures downstream of Clear Creek can be naturally high enough to impair adult salmon migration and survival. This is a condition that would persist independent of the Proposed Project or any alternatives.
4.4-38	4.4.3.7	4-150	Paragraph 2		The DEIR should state that juvenile Steelhead survival rate may be higher than the smaller juveniles produced by fall-run Chinook. Because juvenile

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					Steelhead rear for a longer amount of time in freshwater and juvenile Steelhead are larger than juvenile Chinook which imparts a higher survival rate.
4.4-39	4.4.3.7	4-156	Paragraph 1		The DEIR indicates that aquatic resource measure AR-6 (Suckers) is not included in this alternative because measures under AR-6 are not possible to implement in this alternative. The elements included in AR-6 are possible, but likely unnecessary because the existing reservoirs would remain. However, if suckers were encountered in fish passage facilities developed for this alternative, then genetic testing for hybridization, followed by sucker salvage and release would be possible and perhaps reasonable to implement.
4.4-40	4.4.3.7	4-156	Paragraph 1		The DEIR incorrectly concludes that there would be no impact for Lost River and Shortnose sucker populations in the long term. As the DEIR notes, volitional passage could allow hybrid suckers to move into Upper Klamath Lake but aside from citing work cautioning against allowing hybrid suckers to reach Upper Klamath Lake, the DEIR makes no effort to evaluate the potential for this affect to be a substantial effect on the sucker populations in Upper Klamath Lake. The DEIR reasonably asserts that "Overall, it is speculative to determine whether increased access to spawning habitat outweigh the increased risk of hybridization, or vice-versa." Just because something is speculative does not mean there is no impact, and the DEIR certainly speculates about many other topics throughout the document. The DEIR correctly concludes that there are no significant impacts for Shortnose and Lost River suckers in the short term although that conclusion should probably be restricted to the population in the Klamath Hydroelectric Project reservoirs and not those in Upper Klamath Lake.

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4.4-41	4.4.3.7	4-156 to 4-157	Entire section of Impact 4.2.3-14		Other species have a discussion in the DEIR of trap and haul as it differs from volitional passage. That discussion is missing for Redband Trout and the DEIR either needs to add such a discussion or explain to the reader why it was not included.
4.4-42	4.4.4.1	4-163	Paragraph 1		The DEIR states that "Continued Operations with Fish Passage Alternative would result in no change from existing adverse conditions in the short term and long term for these reaches." The DEIR should remove the biased term "adverse" and limit discussion to changes from "existing conditions."
4.4-43	4.4.12	4-173	Paragraph 2		The description of work for the Continued Operations with Fish Passage Alternative indicates that "Under the Continued Operations with Fish Passage Alternative, construction activities to install fish ladders would occur at all four Lower Klamath Project dam complexes." Considering that this work may be conducted within the Klamath Hydroelectric Historic District or directly impact the four individual/contributing dams and reservoirs (J.C. Boyle Dam, Copco No. 1 Dam, Copco No. 2 Dam, Iron Gate Dam) and all associated hydroelectric facilities, an analysis of impacts resulting from the installation of fish ladders is warranted here. Table ES-1 (Summary of Impacts and Mitigation Measures) indicates that this alternative would have "No Significant Impacts" to the Historic District or the four individual/contributing dams and reservoirs but it is not clear from the DEIR how this finding was reached.
4.4-44	4.4.22	4-179	Last paragraph		This section includes a significance statement, while other sections do not, and the reader is left to interpret the text, possibly leading to different conclusions than the DEIR authors intended. These sections should be organized similarly with consistent significance statements.

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Section 4.5 Two Dam Removal Alternative					
4.5-1	4.5.2.1	4-189	Paragraph 3		The DEIR incorrectly states that "J.C. Boyle Reservoir would not alter water temperature in the J.C. Boyle Peaking Reach from the Oregon-California state line to Copco No. 1 Reservoir." However, under the Two Dam Removal Alternative, a steady state flow from J.C. Boyle Powerhouse would produce a different diurnal temperature signal than the Proposed Project or No Action Alternative. This condition would occur because water would be released to the bypass reach and through the J.C. Boyle Powerhouse. Travel times through these areas differ and waters would heat at different rates if they were conveyed through the power canal or the bypass reach to the J.C. Boyle Powerhouse location. The DEIR does not accurately reflect conditions that would occur as a result of this alternative.
4.5-2	4.5.2.2	4-191	Paragraph 4		The DEIR states that "The long-term increases in mineral (inorganic) and algal-derived (organic) suspended material due to the lack of interception by the dams would be a less than significant impact under the Proposed Project as only a small amount of sediment and suspended material is delivered from upstream of J.C. Boyle Dam." This statement is dangerously incorrect and reflects a serious misunderstanding of water quality dynamics in the Klamath River. There are very large seasonal loads (especially organic matter) conveyed from reaches "upstream of J.C. Boyle Dam," including notably Keno Reservoir and Upper Klamath Lake. The loss of retention in Iron Gate and Copco reservoirs under the Two Dam Removal Alternative would lead to additional available nutrients to support macrophyte and periphyton growth in the free-flowing reaches of the Klamath River, which in turn will impact water quality, particularly pH and dissolved oxygen. The loss of retention in Iron Gate and Copco reservoirs would also result in reduced travel time, translating to

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					conveyance of organic matter to downstream reaches (all the way to the estuary) over a much shorter timeframe. Travel time from J.C. Boyle Dam to the estuary would be reduced from several weeks under existing conditions to approximately 5 days. Organic material that used to settle and/or break down in reservoirs would be delivered to the lower Klamath River and estuary, which would increase organic matter oxygen demand as well as the associated nutrients bound to the organic matter. The DEIR does not address the impacts of the conditions that would result from this alternative on water quality in the lower river and estuary.
4.5-3	4.5.2.4	4-197	Paragraph 4		The DEIR states that "Accordingly, existing large summertime variations in dissolved oxygen in J.C. Boyle Reservoir, especially at depth, would still occur and could continue to influence dissolved oxygen concentrations in the California portion of the Hydroelectric Reach in the same manner as under existing conditions (see also 3.2.2.5 Dissolved Oxygen)." The DEIR should recognize that the modified operation of J.C. Boyle from a peaking facility to a run-of-river system would change the sub-daily flow regime in the reservoir from one of release-then-store to a continual flow. This modification would likely impact the settling rate, intermittent thermal stratification, algal assemblage, and other water quality conditions in the reservoir. The DEIS should analyze these potential impacts (or benefits) in the reservoir and from releases downstream.
4.5-4	4.5.2.7	4-204	Last bullet		The DEIR states that "…no impact (no change from existing adverse conditions)." The DEIR should remove the biased term "adverse" and limit discussion to changes from "existing conditions."
4.5-5	4.5.3.3	4-205	Paragraph 1		The DEIR alludes to the "poor water temperature conditions that occur downstream of the larger Lower Klamath Project reservoirs (Iron Gate and Copco No. 1 reservoirs) under existing conditions." This discussion should

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					be revised to reflect the actual conditions that could occur under the alternative and how those conditions relate to the significance criteria.
4.5-6	4.5.3.3	4-205	Last paragraph of section		The DEIR alludes to "removing Iron Gate, Copco No. 1, and Copco No. 2 reservoirs and converting the reservoir areas to a free-flowing river under this alternative..." However, Copco No. 2 Reservoir would remain under this alternative. This should be corrected.
4.5-7	4.5.3.8	4-220	Paragraph 3 of Impact 3.3-13		The DEIR indicates that aquatic resource measure AR-6 (Suckers) is included in this alternative. Given that this impact is not considered significant, it is unclear why this measure is included, perhaps it is required for Fish and Game Code 2081.11 under CEQA although CDFW has not made a final determination as to whether this measure meets the standards for take authorization under Fish and Game Code, section 2081.11.
4.5-8	4.5.3.8	4-220	Last paragraph of Impact 3.3-14		The DEIR alludes to "...restored habitat access of anadromous salmonids that would not differ between the Proposed Project and the Two Dam Removal Alternative." In actuality access would differ because of the small amount of mainstem habitat inundated by Copco No. 2 and a larger amount by J.C. Boyle Reservoir, and the downstream most portion of Spencer Creek that is inundated by J.C. Boyle Reservoir. The DEIR should be corrected to accurately reflect the alternative.
4.5-9	4.5.3.8	4-221	Paragraph 1 of Impact 3.3-14		The paragraph discussing the effects of sediment release on Redband Trout is confusing. Under the Two Dam Removal Alternative, J.C. Boyle and Copco No. 2 dams remain but most of this paragraph focusses on the Proposed Project. The DEIR should actually evaluate the impact on Redband Trout of removing Copco No. 1 and Iron Gate dams.

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4.5-10	4.5.3.8	4-221	Paragraph 3 of Impact 3.3-14		The DEIR should clarify that the "long-term substantial increase in redband trout habitat quality and quantity" would presumably be relative to the No Project Alternative.
4.5-11	4.5.3.8	4-222	Paragraph 1 of Impact 3.3-19		The DEIR states that "The areas downstream of the Trinity River confluence do not currently support *Anodonta spp.* and are unlikely to in the future (Davis et al. 2013)." If this is the case, then the DEIR should clarify why the salvage and relocation plan considers these sites.
4.5-12	4.5.3.8	4-222	Paragraph 1 of Impact 3.3-19		In this paragraph, the DEIR concludes that there would be a "...significant impact to the *Anodonta spp.* population under the Two Dam Removal Alternative in the short term." However, this seems to conflict with the DEIR conclusion in the following paragraph that "impacts would be not significant with for *Anodonta spp.* in the short term." The DEIR needs to be revised to indicate if this impact is significant or not in the short term.
4.5-13	4.5.3.8	4-223	Significance of Impact 3.3-19		Only short-term effects are discussed in the text leading up to this conclusion, yet a conclusion is drawn for long-term impacts for which there is no discussion.
4.5-14	4.5.12	4-236	Paragraph 2		There is no specific discussion in this section for how the Two Dam Removal Alternative would impact historic-period archaeological sites. Construction activities and a new day use area at Copco No. 2 Dam may impact known and as yet unknown historic period archaeological sites. The statement "However, installation of upstream and downstream fish passage at Copco No. 2 Dam and a new day use area near Copco No. 2 Dam, including all associated construction activities, may impact known, or as yet unknown, tribal cultural resources to a similar degree as that described for the Proposed Project" could also apply to historic-period archaeological resources. The DEIR does not currently reflect the potential impacts from this alternative.

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4.4-15	4.5.23	4-245	Last paragraph		This section includes a significance statement, while other sections do not. The alternatives analysis sections should be organized similarly so that the public and decision-makers can make an informed and meaningful comparison of the relative effects of the various alternatives analyzed.
Section 4.6 Three Dam Removal Alternative					
4.6-1	4.6.2.7	4-267	Sentence 1 (end of last bullet on page 4-266)		The DEIR states "...no impact (no change from existing adverse conditions)." The DEIR should remove the biased term "adverse" and limit discussion to changes from "existing conditions."
4.6-2	4.6.3.3	4-267	paragraph 4		The DEIR appears to be missing text. Assume the DEIR should read "Potential impacts of changes in water quality on aquatic resources in California..."
4.6-3	4.6.3.8	4-282	Paragraph 3		The DEIR indicates that aquatic resource measure AR-6 (Suckers) is included in this alternative. Given that this impact is not considered significant, it is unclear why this measure is included, perhaps it is required for Fish and Game Code 2081.11 under CEQA although CDFW has not made a final determination as to whether this measure meets the standards for take authorization under Fish and Game Code, section 2081.11.
4.6-4	4.6.3.8	4-283	Paragraph 1		It appears the DEIR is missing a word in this sentence "...impacts of sediment release on redband trout that would occur under the Three Dam Removal Alternative would be substantially less under the Proposed Project." Given that the Proposed Project would remove J.C. Boyle Dam and presumably this is where most of the impacts to Redband Trout would originate, PacifiCorp suspects that this sentence should read "...substantially less ***than*** under the Proposed Project."

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4.6-5	4.6.3.8	4-283	Paragraph 3 of Impact 3.3-14		The DEIR should clarify that "long-term substantial increase in redband trout habitat quality and quantity" would be relative to the No Project Alternative. Considered as a whole, there would actually be slightly less of an increase than the Proposed Project because J.C. Boyle Dam and Powerhouse would remain, but in California the effects of this alternative would be the same as the Proposed Project.
4.6-6	4.6.3.8	4-285	Paragraph 1 of Impact 3.3-19		The DEIR states that "The areas downstream of the Trinity River confluence do not currently support *Anodonta spp.* and are unlikely to in the future (Davis et al. 2013)." The DEIR should clarify why the salvage and relocation plan considers these sites.
4.6-7	4.6.3.8	4-284	Paragraph 1 of Impact 3.3-19		In this paragraph, the DEIR concludes that a "...significant impact to the *Anodonta spp.* population under the Three Dam Removal Alternative in the short term." However, this seems to conflict with the DEIR conclusion in the following paragraph that "impacts would be not significant with for *Anodonta spp.* in the short term." The DEIR needs to be revised to indicate if this impact is significant or not in the short term.
4.6-8	4.6.3.8	4-285	Significance of Impact 3.3-19		Only short-term effects are discussed in the text above (see comment 4.6-7), yet a conclusion is drawn for long-term impacts. The DEIR needs to be consistent in how the long-term effects of the different alternatives are analyzed.
4.6-9	4.6.12	4-294	Paragraph 2		There are no data or analyses presented to support the DEIR statement that "The potential for flood disturbance further downstream along the Klamath River would not be different under this alternative from that described for the Proposed Project (Potential Impact 3.12-3) since Copco No. 1, Copco No. 2, and Iron Gate dams would still be removed." Known quantifiable data associated with each alternative, study area, or resource type (e.g., tribal, historic period archaeological, historic built environment) are missing from this discussion.

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Section 4.7 No Hatchery Alternative					
4.7-1	4.7.3	4-304	Last paragraph		See other comments (see Major Issue 2.8 and comment 3.3-28) related to *C. shasta* and the infectious zone downstream of Iron Gate Hatchery.
4.7-2	4.7.3	4-305	Paragraph 3		The DEIR asserts that there are adverse effects from competition of hatchery Chinook with natural origin fish yet provides no information to support this claim (see comment 3.3-92).
4.7.3	4.7.3	4-306	Paragraph 1		The DEIR indicates that aquatic resource measure AR-6 (Suckers) is included in this alternative. Given that this impact is not considered significant, it is unclear why this measure is included, perhaps it is required for Fish and Game Code 2081.11 under CEQA although CDFW has not made a final determination as to whether this measure meets the standards for take authorization under Fish and Game Code, section 2081.11.
4.7-4	4.7.3	4-310	Paragraph 2		Most recent and best available information regarding spawning Coho downstream of Iron Gate Dam does not support the DEIR's assertion that Coho have a wide distribution in the tributaries (see MKWC 2016, 2017, 2018). The data indicates that there perhaps less than 1,000 adult Coho annually in the mainstem and the tributaries from Portuguese Creek to Iron Gate Dam including the Scott and Shasta rivers (see Major Issue 2.1).
4.7-5	4.7.3	4-310	Paragraph 3		See Major Issue 2.1 as it relates to the upper Klamath Coho population, hatchery production, etc. The DEIR acknowledges that hatchery Coho have made up over 50 percent of the upper Klamath population, but does not characterize the loss of this integrated population as a significant impact.
4.7-6	4.7.3	4-311	Paragraph 2		The DEIR states that hatchery Coho are somehow of less value than natural origin fish even though the hatchery is managed as an integrated part of the Coho population through the HGMP (CDFW and PacifiCorp 2012). Because this hatchery program is integrated with the upper Klamath

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					population, the loss of the hatchery program should be given appropriate consideration. The DEIR makes the assertion that returning hatchery adults do not contribute to the sustainability of the naturally reproducing population after previously stating that adult hatchery Coho stray into Bogus Creek and the Shasta River at relatively high percentages [about 50 percent according to the data (see Chesney and Knechlte 2017 and Knechtle and Giudice 2918a)], presumably to spawn naturally and contribute to the natural-origin populations.
4.7-7	4.7.15	4-320	Paragraph 2		Diversions from Bogus and Fall creeks that would not occur under the No Hatchery Alternative should be addressed here. Text should describe how the restoration of those diversions to their respective creeks would affect resources including aquatic and agricultural resources.
4.7-8	4.7.20	4-321 to 4-322			The discussion of fish production as it relates to retention of recreational fisheries following removal of hatcheries in the upper basin is overly optimistic and not supported by the record. Iron Gate Hatchery currently provides on average 28,000 fall-run Chinook for the recreation and tribal fisheries (CASHRG 2012). Under the Proposed Project fall-run Chinook production would be reduced, but still contribute to these fisheries although at a reduced rate. Under the No Hatchery Alternative, it is unlikely that the habitat upstream of Iron Gate Dam would generate this same number of fish in any reasonable timeframe (see comment 3.3-42) such that there would not be a substantial reduction in adult fall-run Chinook available for harvest or even a season during which to harvest these fish. The DEIR should present an actual analysis of this alternative in relation to potential adult returns and their availability for harvest.

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Section 5 Other Required CEQA Discussion and Consideration of Social and Economic Factors					
Section 5.4 Social and Economic Factors Under CEQA					
5.1	5.4.1	5-4	Paragraph 1		Benefits and costs should be listed separately instead of together in one list. Mixing benefits and costs is confusing. Additionally, some benefits are placed in the list while others are cited in the DEIR text.
5.2	5.4.1	5-4	Paragraph 1		The DEIR presents a list of benefits for a variety of topics from a USBR (2012) study and includes "Hydroelectric energy costs" on that list when in fact, "Hydroelectric energy costs" are not on the USBR (2012) list. Instead, the USBR (2012) study includes costs associated with the loss of hydropower benefits as "Foregone Hydropower Benefits" and are discussed under costs. The DEIR needs to clarify the source for its "Hydroelectric energy costs" or clarify the terminology.
5.3	5.4.1.1	5-6	Paragraphs 1 and 2		The DEIR states "USBR (2012) reported that the removal of the dams and associated facilities would likely increase the viability of the SONCC coho ESU in the Klamath Basin." The DEIR also states, "Following dam removal, harvests would be larger because of increased abundance of salmon, which would, in turn, increase commercial fishing revenues." The DEIR also states "The USBR (2012) quantitative economic analysis relied heavily on the Evaluation of Dam Removal and Restoration of Anadromy (EDRRA) model." Although not explicitly cited in this section of the DEIR, it appears that the referenced EDRRA modeling is as presented by Hendrix (2011). Several issues have been raised in these comments with the Hendrix (2011) EDRRA modeling (see Major Issue 2.6, comments 3.3-66, 3.3-76, and 3.3-86 to 3.3-97). These issues call into question the abundance and productivity estimates of salmon derived from the Hendrix (2011) EDRRA modeling that are used in the USBR (2012) quantitative economic analysis cited in the DEIR.

Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
5.4	5.4.1.1	5-6	Last paragraph		The statement "dam and facilities removal was estimated by USBR (2012) to provide an additional 11 to 218 commercial fishing industry jobs within the five management areas" is confusing in stating the number of jobs created as it implies that this is a range of the total number of jobs created. The sentence should be revised in a manner consistent with the USBR (2012) study, which shows the following jobs for each of the five management areas: • San Francisco Management Area: 218 • Fort Bragg Management Area: 69 • KMZ-CA: 19 • KMZ-OR: 11 • Central Oregon Management Area: 136 See page 2-7 of the *Benefit Cost and Regional Economic Development Technical Report* (USBR 2012b).
5.5	5.4.1.1	5-6	Last paragraph		The annual net revenue benefit estimate of $267,131 is not shown in Table 1.1-2 of the USBR document (USBR 2012b) for the KMZ-CA portion. That document shows a value of $381,396 for this management area. This number needs to be corrected or the DEIR needs to otherwise explain how this other value was developed. See page 1-13 of the *Benefit Cost and Regional Economic Development Technical Report* (USBR 2012b).
5.6	5.4.1.1	5-7	Paragraph 1		The DEIR states the following conclusions: "For the reasons discussed in this EIR in Section 3.3.5 Aquatic Resource Impacts, the KRRC's Proposed Project would be beneficial for populations of fall-run Chinook salmon (Potential Impact 3.3-7), spring-run Chinook salmon (Potential Impact 3.3-8), and coho salmon (Potential Impact 3.3-9). Although some aspects of the KRRC's Proposed Project are different from the dam removal

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					scenarios analyzed in the USBR/DOI economic analyses, the primary assumptions regarding the effects of dam removal on coho and Chinook salmon have remained the same, such that the prior economic indication of the benefits of dam removal to commercial fisheries also informs consideration in this EIR that dam removal would advance the long-term restoration of natural fish populations in the Klamath Basin, including having a significant beneficial effect on commercial fisheries and an associated significant beneficial economic impact on the coastal commercial fishing industry." These conclusions are incorrect in that the dam removal scenarios analyzed in the USBR (2012b) economic analysis included in the analysis one fundamental assumption regarding the effects of dam removal on Coho and Chinook salmon that is no longer valid. Specifically, the Proposed Action dam removal scenario in the USBR (2012b) analysis included not only dam removal but also the entirety of the KBRA programs and actions as a fully connected action. However, the KBRA expired in 2015 due to inaction in the U.S. Congress. The Upper Klamath Basin Comprehensive Agreement (UKBCA) also was inactivated due to the absence of funding that resulted from the KBRA's expiration. The expiration of the KBRA caused uncertainty in moving forward with the KHSA and UKBCA, which prompted the KHSA Parties to renegotiate and sign an amended KHSA in April 2016. The fact that the KBRA is expired and unlikely to be resuscitated indicates that a key assumption of the USBR (2012b) analysis regarding the effects of dam removal on Coho and Chinook salmon is no longer applicable. Because this key assumption of the USBR (2012b) analysis is no longer valid, the findings for the USBR (2012b) economic analysis regarding the effects of dam removal on Coho and Chinook salmon lack accuracy to support of DEIR conclusions.

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Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
5.7	5.4.1.3	5-8	Paragraph 1		The second sentence beginning with "USBR (2012) qualitatively assessed dam removal ..." is not explicit in stating that the short-term declines in real estate values were those associated with properties adjacent to J.C. Boyle, Copco, or Iron Gate reservoirs. Given the potential effects on property values around the reservoirs, this section should be revised. See page 1-42 of the *Benefit Cost and Regional Economic Development Technical Report* (USBR 2012b).
5.8	5.4.1.3	5-8	Paragraph 1		The sentence "For other parcels downstream of Iron Gate Dam, USBR (2012) indicated that improvements of water quality could lead to increased real estate values in the long term" needs to be explicit that it is talking about riverine parcels and that the water quality improvements are detectable and important to property owners. See page 1-42 of the *Benefit Cost and Regional Economic Development Technical Report* (USBR 2012b).
Appendix B Definite Plan for the Lower Klamath Project					
B.1	Appendix L of Appendix B, Cultural Resources Plan for the Definite Plan for the Lower Klamath Project	33	Paragraph 3		According to the following paragraph from the DEIR, an updated records search was conducted in 2018: "In response to the delineation of a preliminary APE, KRRC initiated an expanded records search in 2018 for an area encompassing a 0.5-mile wide zone on either side of the Klamath River from below Humbug Creek to the mouth of the river at the Pacific Ocean, in California. KRRC will incorporate results of the 2018 expanded records search for California into future reports and are not reflected in the discussion and tables provided below." The DEIR only includes records search data from 2017 (see DEIR pg. 3-806). The 2018 data are available on known cultural resources (e.g., tribal, historic-period archaeological, historic built environment resources), and any other relevant findings from the recent KRRC studies may provide additional detail on significant impacts to cultural resources and allow for

Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
					the identification and development of specific mitigation measures. This information should be included in the DEIR and the cultural resources impact analysis should be amended.
B.2	Appendix L of Appendix B, Cultural Resources Plan for the Definite Plan for the Lower Klamath Project	50	Paragraph 2		The following excerpt suggests that an archaeological inventory covering 100 percent of the designated areas will be conducted: "Any archaeological inventory to be conducted for the Project will include 100 percent, intensive-level survey of designated areas. The inventory will employ a standard systematic pedestrian survey following the appropriate Oregon and California survey and reporting standards, tailored if appropriate to meet any specific federal land management agency guidelines." Archaeological inventories typically represent a sample survey where archaeologists walk systematic intervals and/or excavate systematic shovel scrapes/shovel tests as part of a sample inventory effort. Given the scale of the Proposed Project, a commitment to survey and inventory 100 percent of designated area(s) would be very costly and may not be completed in compliance with state standards. Because this inventory may not be possible to conduct in compliance with state standards, the identification of potential impacts to cultural resources is not complete and the proposed investigations necessary to develop appropriate mitigation are not feasible.
B.3	Appendix L of Appendix B, Cultural Resources Plan for the Definite Plan for the Lower	59	Paragraph 1		Under federal law, a Programmatic Agreement (PA) can defer nearly all aspects of identification, evaluation, assessment of effects, and mitigation; however, this is not an acceptable approach for CEQA because it defers making a determination of significance and committing to adopt mitigation measures to reduce the significance of the impact. According to the following statement in DEIR Appendix L, the PA and Historic Properties Management Plan (HPMP) are intended to support compliance with CEQA: "KRRC will produce a number of management plans and agreements to support the Project's Section 106, CEQA, and AB-52's compliance efforts.

Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
	Klamath Project				The documents currently planned include a HPMP, Programmatic Agreement, Inadvertent Discovery Plan, Plan of Action for the treatment of human remains, and a Cultural Resources Monitoring Plan."
Appendix E An Analysis of Potential Suspended Sediment Effects on Anadromous Fish in the Klamath Basin					
E.1		E-1	Paragraph 1		The introduction makes the same unsupported assertions as the body of the DEIR in stating that 80 percent of the reservoir sediments are expected to reach the Pacific Ocean (see Major Issue 2.4 and comment ES.3 and 2.16).
E.2		E-1	Paragraph 1		The assertion that the 2013 BiOp flows are 'sufficiently similar' to the 2010 BiOp flows and the KBRA flows as related to modeling results from USBR (2012a) is not adequately supported (see Major Issue 2.2 and comment 3.3-46).
E.3		E-1	Paragraph 3		The DEIR states that "The implication for this analysis is that predictions of impacts may be slightly higher than would occur with the faster drawdown rate under the Proposed Project." The USBR (2012) modeling does not take sediment jetting into account which may raise suspended sediment concentrations. The analysis should be updated to reflect the actual Proposed Project and hydrology conditions that can be reasonably expected to exist (e.g., 2013 BiOp or perhaps even 2019 BiOp flows) (see Major Issue 2.4 and comment USBR-2012-C).
E.4	E.2.2	E-4	Paragraph 3		The DEIR states that (emphasis added) "The model was used to predict the magnitude and duration of SSCs for discrete calendar-year periods corresponding to each species' life history stages. *These periods could not overlap in order to avoid erroneously accounting for an event's impact on two separate life stages of a cohort at the same time, which is impossible (e.g., a pulse of suspended sediment in March cannot simultaneously affect rearing juveniles and outmigrating smolts of the same cohort, but can*

Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
					simultaneously affect different life history stages of different species such as adult migrants of one species and smolts of another. For predicting potential SSC impacts to species identified above, the model evaluated each species and its life history stages separately." The italicized sentence is an oversimplification of fish life cycles. Not all members of a cohort behave the same, some may migrate others may not. In the example provided, the March sediment pulse could impact both migrants and resident life stages. The modeling of suspended impacts on fish needs to be updated to more accurately reflect the life stages effected and the hydrology present.
E.5	E.2.2.1	E-5	All		These scenarios are reasonable but should be expressed simply as 10th, 50th, and 90th exceedance scenarios only. Using terms like 'mild' and 'extreme' is a judgement and modifies the readers perception of effects. Even the median conditions discussion states that these are "conditions that most often occur for each species and life stage..." but in reality, the median simply represents an equal probability that conditions will be different in either direction, not conditions that occur most often.
E.6	E.3.1.1	E-12	Paragraphs 1-2		The data used to describe the distribution of different life history strategies for fall-run Chinook is from 2000. At the very least this information should be verified to ensure that the timing still represents the population and if it does not the DEIR should be updated to reflect any shifts in timing.
E.7	E.3.1.3	E-18	Paragraph 2		It is not unreasonable to expect that hatcheries have an influence on populations near the hatchery (e.g., hatchery fish straying into Bogus Creek or the Shasta River from Iron Gate Hatchery). However, Coho spawning surveys in tributaries downstream of Iron Gate Dam have found one hatchery Coho carcass in 4 years of surveys (MKWC 2016, 2017, 2018, 2019 in progress).

Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
E.8		E-19	Paragraphs 1-2		It is extremely difficult to follow the discussion of juvenile Coho rearing and outmigration life history patterns as presented in the DEIR. This is important because these are the Coho life stages especially susceptible to impacts from suspended sediments generated by the Proposed Project.
E.9		E-20	Paragraph 2		Coho rearing in off-channel habitats of the Klamath River would be impacted by suspended sediments, it appears that the DEIR is referring to off-channel rearing in the tributaries.
E.10		E-29	Paragraph 1		The DEIR states that "After the first year following dam removal, the flow will be confined within the historical main channel and no longer be able to access the remaining fine sediment left on the floodplain, unless an extremely high flood event is to occur." This is a confusing statement. It appears to reference the stream channel within the former reservoir areas. While the assumption may be true, the analysis does not seem to allow for increased erosion from winter rains on the reservoir sediments (which would seem likely to erode at a higher rate than adjacent soils even following revegetation), high-flow scour, bank failure, or shifts in channel alignment within the former reservoirs. The DEIR states that increases in suspended sediment concentrations as a result of higher flow events that may erode reservoir deposits would be insignificant, but does not offer any justification for this conclusion.
E.11		E-35	Paragraph 1		The DEIR text incorrectly refers to December 15 as the start of the drawdown.
E.12	E.3.1.3 E.3.2.3	E-18 E-36		Table E-4 Table E-10	The DEIR does not present a clear discussion of why sediment impacts on the age 1+ outmigrating Coho would be less under the Proposed Project than existing conditions. These fish would be arriving in the mainstem Klamath River from tributaries early in 2021, the year in which drawdown would be occurring and sediment loads would be at their highest levels.

Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
					The DEIR indicates that about 44 percent of Coho migrate from February-March with the remainder migrating from April-June. While the DEIR clearly states that Coho smolts were assumed to migrate during periods of lowest suspended sediment, it does not indicate if those relative percentages of the population that migrate were shifted into periods of relatively lower suspended sediments loads throughout the entire migration window or just within their relative timeframe. In other words, did the analysis assume that all 44 percent of those early migrating smolts wait until April or May or did they migrate during periods of lower suspended sediment loads in their normal migration window? If they waited until April or May, where did they reside, what was the impact of that delayed migration on their overall survival? If they waited for periods of relatively lower sediment loads during their normal migration window, how much lower were those sediment loads and what were the impacts to those fish? By using percentages of the population affected by the Proposed Project, the DEIR obscures the actual impact to Chinook and Coho from the Proposed Project. There is a wealth of downstream migrant trapping data for Chinook and Coho from the mainstem Klamath River that could be used to improve this analysis and connect the impacts of the Proposed Project to actual numbers of fish. These two tables and the two tables associated with Chinook would be vastly improved if they were connected to actual fish numbers like was done for the Steelhead tables (see Table E-12, for example).
Appendix F An Analysis of Potential Bedload Sediment Effects on Anadromous Fish in the Klamath Basin					
F.1	F.5.1.2	F-9		Figure F-4	This figure (and all of the following ones) have the wrong date range on the x-axis. Drawdown and removal is scheduled for 2021 under the currently Proposed Project.

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Comment Number	Section Number	Page Number	Paragraph Number	Table or Figure Number	Comment
F.2	F.5.1.2	F-13	Paragraph 4		The DEIR states that "Spring-run Chinook salmon would likely extend their range in response to dam removal and benefit from this action in the same manner as fall-run Chinook salmon." This statement is completely unsupported and unlikely to occur because the population of spring-run Chinook in the Salmon River is extremely small and strays are unlikely to occur in sufficient number to colonize habitat upstream of Iron Gate Dam. The Salmon River is also about 124 river miles downstream of Iron Gate Dam, further reducing the likelihood of straying. See comments 3.3-93 and 4.4-36.
F.3	F.5.1.2	F-13	Paragraph 6		The DEIR states that summer Steelhead would recolonize the areas upstream of Iron Gate Dam and that juvenile Steelhead could benefit from improved pool habitat downstream of Iron Gate Dam. These statements are made without considering the time of year at which Steelhead may be using this habitat, the potential effects of water temperature, streamflow, or gravel and sediment deposition on habitat suitability for Steelhead. The DEIR should be revised to more accurately present the range of conditions faced by summer Steelhead in the upper Klamath River after implementation of the Proposed Project.
F.4	F.5.2.1	F-15, 16	Paragraphs 3,1		While stream power increases downstream of Cottonwood Creek (Figure F-10) this logic also indicates that material transported past Cottonwood Creek would remain in transit until stream power declined (perhaps between Horse Creek and the Scott River) or in smaller areas (backwaters, eddies, etc.) that are not represented in the DEIR discussion. This deposition further downstream is not discussed in this appendix nor is the impact evaluated in the DEIR.
F.5	F.5.2.3	F-21	Paragraphs 3, 4		The discussion surrounding the impacts of fine sediment on Chinook underestimates the importance of the reach downstream of Iron Gate Dam for spawning Chinook. By equating this 8-mile reach to only 4 percent

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					of the total Klamath River length, the reader is led to believe that because the Proposed Project only affects 4 percent of the spawning habitat, impacts to Chinook are small. The only way this oversimplification is accurate is if the entire Klamath River is suitable spawning habitat, which it is not. An accurate analysis would quantify the spawning habitat in this reach and compare that to the spawning habitat in the area used by Chinook in the Klamath River. Regardless of this scenario, 2 years of fine sand deposition on what is known to be Chinook spawning habitat would eliminate a 1-year class of mainstem spawners (those Chinook that spawn in fall 2020) and possibly those that spawn the following fall (2021). Add the fine sand deposition to the downwelling and entrainment of suspended sediment into spawning riffles (see Major Issue 2.4), and impacts to mainstem spawning Chinook habitat become even more substantial and extend for a longer period of time because it will take a period of years with suitably high flows to wash the accumulated fine material out of the spawning gravels. As part of their proposed action for the reconsultation that they are undertaking for operations of the Klamath Irrigation Project, USBR is including a release of just over 6,000 cfs (see USBR 2018a). The DEIR should include an analysis of this event because it is likely to occur and would affect bedload transport under the Proposed Project and all alternatives.
Appendix H Rare Natural Communities Documented in the Project Vicinity					
H.1		H-1		Table H-1	All sensitive plant communities should be converted to Sawyer alliances (Sawyer et al. 2009). Use of the Holland standard does not meet current national vegetation analysis standards and does not allow the reader to understand how to identify sensitive natural communities.

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Additional Comments on Sediment Transport Modeling Documented in USBR (2012c)					
USBR-2012-A					Regarding the model used in USBR (2012), the complete range of fine sediment (<63 micron) is represented in the model by only a single representative particle and the properties of that representative particle are not listed. This is a coarse representation of how the complete range of fine particles behave. In reality, very small particles like clay, behave much differently than larger silt particles but they are treated the same in the model. This model simplification may affect the sediment transport results described in USBR (2012) and as relied upon in the DEIR and in prior analyses to characterize sediment transport and associated impacts to aquatic resources.
USBR-2012-B					The cohesive erosion function in the USBR (2012) model assumes linear rates of erosion. Field measurements of cohesive erosion rates typically show nonlinear behavior. The cohesive erosion rate exponent is typically between 1.2 and 1.4.
USBR-2012-C					The USBR (2012) model does not include slump failures of the bank sediments that could be a first-order erosion process, potentially contributing equal or greater sediment mass to suspended sediment concentrations compared to direct erosion. This is especially important because reservoir drawdown rates under the Proposed Project are twice those used in the model, likely increasing the rate of bank failure. Related to this, the use of sediment jetting to mobilize sediments in the reservoirs during drawdown is likely to increase the potential for slump failures and increase overall amount of sediment delivery to the river, and these impacts have not been assessed.
USBR-2012-D					The USBR (2012) report does not describe model validation, or any form of a reasonableness check on the model predictions.

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USBR-2012-E					The cohesive and noncohesive load are simulated separately in the USBR (2012) model without any consideration of the interaction between the type classes of sediment. In reality, the erosion of noncohesive sediment, which is bound in the cohesive sediment, would be controlled by the behavior of the cohesive fraction.
USBR-2012-F					The DREAM model only simulates noncohesive sediments, which comprise just 15 percent of the sediments in the reservoir. The DREAM model also assumes that the presence of fines would have no impact on noncohesive transport. In reality, the abundant presence of cohesive sediment would have a strong influence on the behavior of the noncohesive fraction, and the effect of this interaction is not modeled or evaluated in the DEIR.

Exhibit B – Literature Cited

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Exhibit C – Data and Reports Submitted Electronically

PacifiCorp is providing the following information electronically (on the included DVD) to the State Water Board's for their use as appropriate in addressing our comments. All files are either portable document format (pdf) or Microsoft Excel. If there are problems with any of them, please do not hesitate to contact PacifiCorp.

DVD Folder	Information
A_CDFW Reports and Data	Annual reports for Iron Gate Hatchery, Bogus Creek monitoring, Scott River monitoring, Shasta River monitoring, that relate to populations of Coho, Chinook, and Steelhead in the Middle Klamath River.
B_Coho HCP Reports	Annual implementation reports from 2012 through 2017 prepared by PacifiCorp for the *Interim Operations Habitat Conservation Plan for Coho Salmon*.
C_Coho HGMP and Spawning Surveys	The final *Hatchery Genetics and Management Plan for Iron Gate Hatchery Coho Salmon* prepared by CDFW and PacifiCorp along with the Coho spawning survey reports for 2015 through 2017 spawning years.
D_KHSA IM15 Reports and Data	Updated KHSA Interim Measure 15 data sets and annual reports from 2009 through 2017.
E_IGD Intake Barrier	The 2016 and 2017 reports evaluating the performance of the intake barrier curtain deployed in Iron Gate Reservoir.
F_Other	Brookes 2019 – Review of sediment transport modeling Oosterhout 2005 – Salmonid population modeling PacifiCorp 2014 - Section 401 Water Quality Certification Application PacifiCorp 2018 – KHSA implementation report