3.10 Greenhouse Gas Emissions

This section focuses on potential greenhouse gas (GHG) and energy effects due to implementation of the Proposed Project. Section 3.9 *Air Quality* of the Lower Klamath Project EIR discusses air quality.

3.10.1 Area of Analysis

Global climate change is not confined to a particular project area and is generally accepted as the consequence of global industrialization over the last 200 years. A typical project, even a very large one, does not generate enough greenhouse gas emissions on its own to influence global climate change significantly; hence, the issue of global climate change is, by definition, a cumulative environmental impact. For this reason, the Area of Analysis for GHG emissions and energy effects includes areas within California and Oregon where construction activities related to removal of the Lower Klamath Project dam complexes would occur (Figure 3.10-1). In addition, these areas may experience impacts from GHG emissions as a result of replacing hydroelectric power produced at the Lower Klamath Project dams on an interim basis with power that may be produced from fossil fuels through other regional sources.

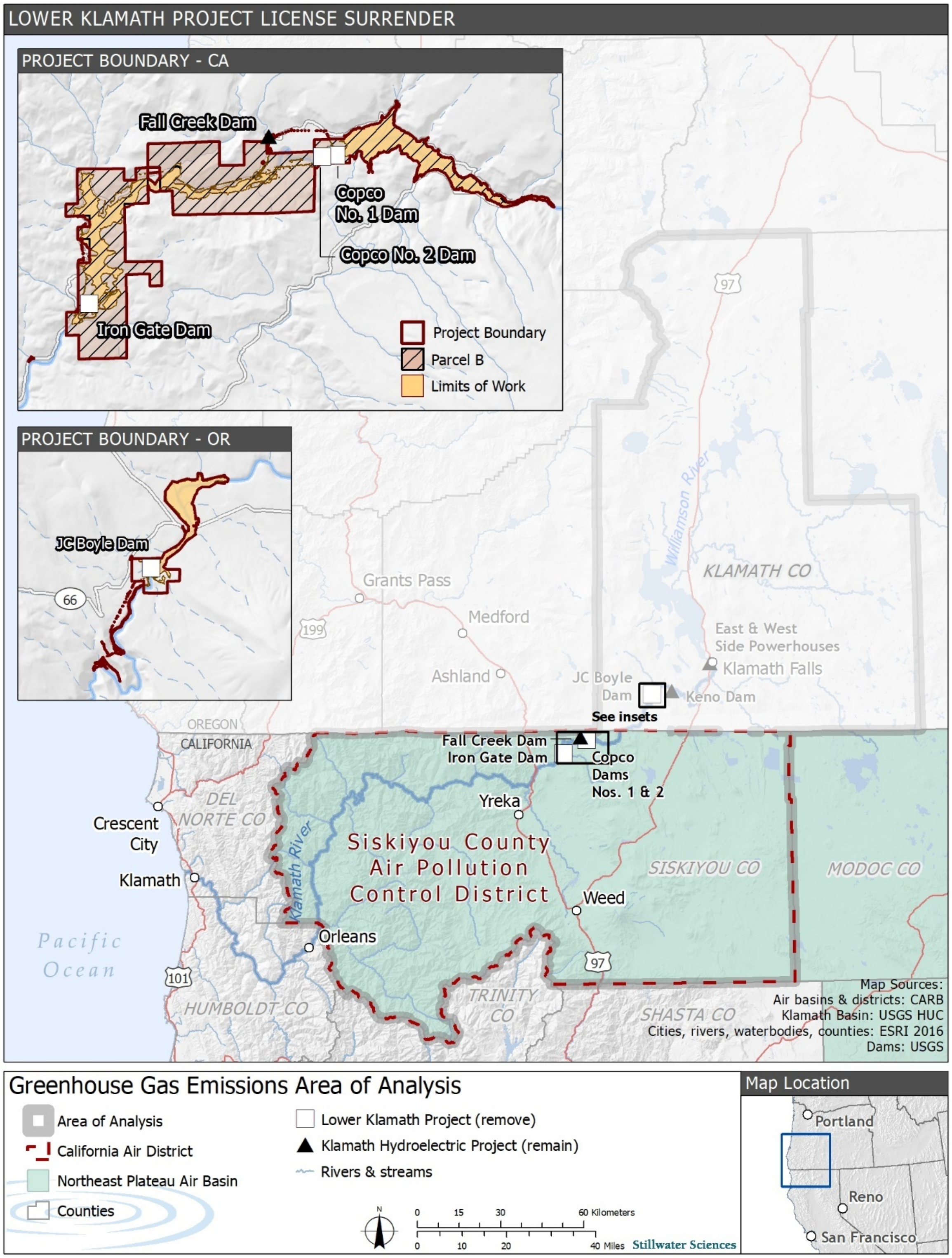

Figure 3.10-1. Area of Analysis for Greenhouse Gas Emissions.

3.10.2 Environmental Setting

3.10.2.1 Greenhouse Gas Emissions

Summary information regarding anticipated global, state, and regional effects of climate change are provided below, as well as a discussion of GHG emissions generated in California and the potential influence of the Lower Klamath Project dam complexes on GHG emissions.

Although Proposed Project-related emissions would be restricted to the Area of Analysis described above, data characterizing existing GHG emissions are only available at the state-level for California (California Air Resources Board [CARB] 2017a). As a result, the GHG environmental setting uses a larger region than that of the Area of Analysis for GHG emissions to establish existing conditions.

Global Climate Change

Radiation from the sun is the Earth's primary source of energy. As solar radiation enters the Earth's atmosphere, a portion is reflected back towards space; a portion is absorbed by the upper atmosphere; and a portion is absorbed by the Earth's surface. The radiation absorbed by the Earth heats the surface, which is then emitted as infrared radiation. As Earth has a much lower temperature than the sun, the Earth emits longer-wavelength radiation[140]. Certain gases in the Earth's atmosphere, classified as GHGs, play a critical role in determining the Earth's surface temperature. GHGs have strong absorption properties at wavelengths that are emitted by the Earth. As a result, radiation that otherwise would have escaped back into space is instead trapped, resulting in a warming of the atmosphere. This phenomenon, known as "the greenhouse effect", is responsible for maintaining a habitable climate on Earth.

Anthropogenic emissions of GHGs, leading to atmospheric levels in excess of natural ambient concentrations, are responsible for intensifying the greenhouse effect, and have led to a trend of unnatural warming of the Earth's atmosphere and oceans, with corresponding effects on global circulation patterns and climate (Stocker 2014). Prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

HFCs, PFCs, and SF_6 are considered high global warming-potential (GWP) GHGs. GWP is a concept developed to compare the ability of each GHG to trap heat in the atmosphere relative to another gas. GWP is based on several factors, including the relative effectiveness of a gas absorbing infrared radiation, and length of time that the gas remains in the atmosphere ("atmospheric lifetime"). The GWP of each gas is measured relative to CO_2, the most abundant GHG. The concept of CO_2-equivalency (CO_2e) is used to account for the different GWP potentials of GHGs to absorb infrared radiation.

Climate change is a global problem because GHGs are global pollutants, unlike criteria air pollutants and toxic air contaminants (TACs), which are pollutants of regional and local concern (see Section 3.9 *Air Quality* for more information on criteria air pollutants and TACs). Whereas pollutants with localized air quality effects have relatively short atmospheric lifetimes (approximately one day), GHGs have long atmospheric lifetimes

[140] The wavelength at which a body emits radiation is proportional to the temperature of the body.

(one year to several thousand years). GHGs persist in the atmosphere for enough time to be dispersed around the globe. The quantity of CO_2e that will ultimately result in measurable climate change is enormous; no single project could measurably contribute to a noticeable incremental change in the global average temperature, or to global, local, or micro-climate change.

Greenhouse Gas Emission and Inventory

As the second largest emitter of GHGs in the United States, and 20th largest in the world, California contributes a significant quantity of GHGs to the atmosphere (CARB 2017a). Emissions of CO_2, CH_4, and N_2O are byproducts of fossil-fuel combustion, and are attributed in large part to human activities associated with transportation, industry/manufacturing, electricity generation and natural gas consumption, and agriculture (CARB 2017a). In California, the transportation sector is the largest emitter of GHGs, followed by industrial activities (CARB 2015) (see Figure 3.10-2).

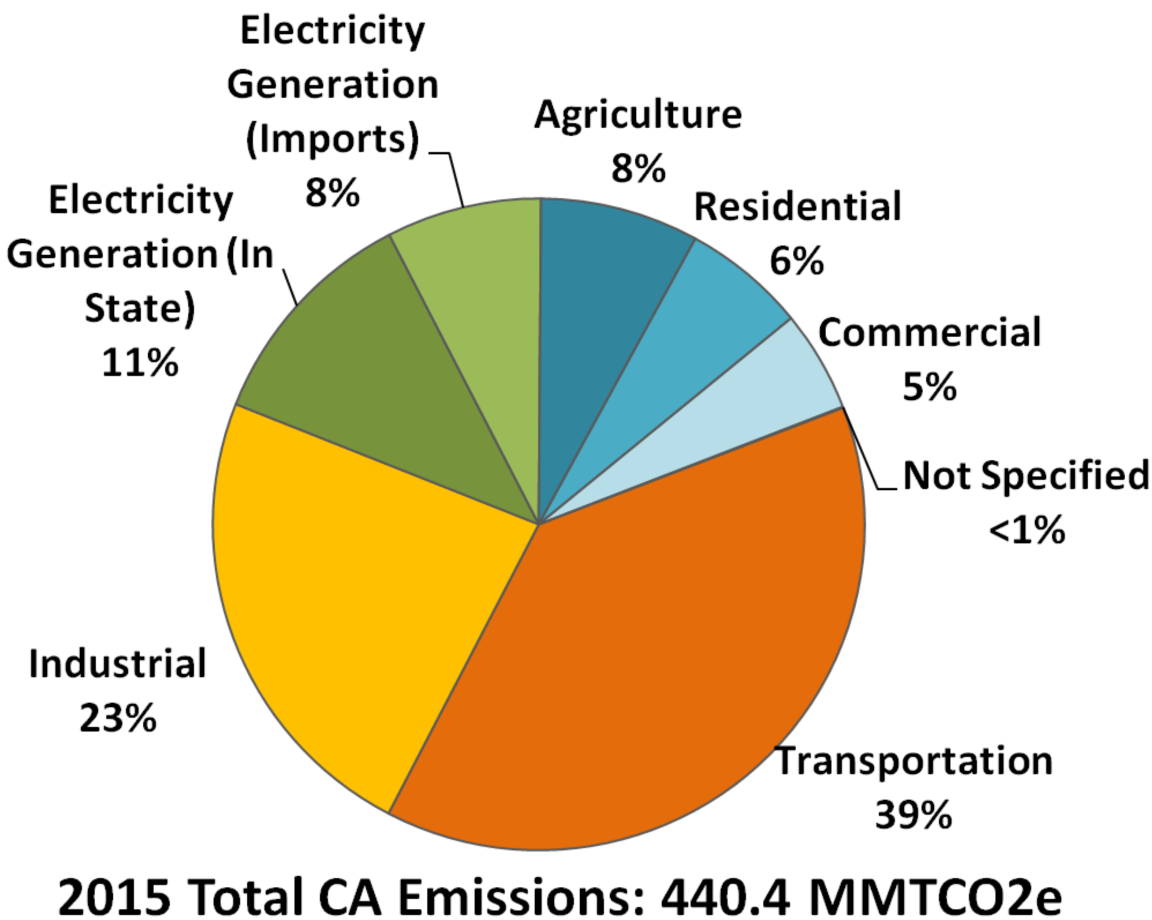

Figure 3.10-2. California GHC Emission Sources, in Million Metric Tons of CO_2e (as of 2015). Source: CARB 2015.

Statewide Effects of Climate Change

Climate change is anticipated to affect environmental conditions in California through a variety of mechanisms. One effect of climate change is sea-level rise. Sea levels along the California coast rose approximately 7 inches during the last century (CEC 2006a), and are predicted to rise an additional 7 to 22 inches by year 2100, depending on the future levels of GHG emissions (Stocker 2014). However, the Governor-appointed Delta Vision Blue Ribbon Task Force has recommended that California plan for a scenario of 16 inches of sea-level rise by year 2050, and 55 inches by year 2100 (CNRA 2008). Effects of sea-level rise could include increased coastal flooding, saltwater intrusion in the low-lying areas, and disruption of wetlands (CEC 2006a).

As the California climate changes over time, the range of various plant and wildlife species could shift or be reduced, depending on the favored temperature and moisture regimes of each species. In the worst cases, some species would become extinct if suitable conditions are no longer available. Additional concerns associated with climate change are a reduction in the snowpack, leading to less overall water storage in the mountains (the largest "reservoir" in the State), and increased risk of wildfire caused by changes in rainfall patterns and plant communities (CEC 2006a).

Regional Effects of Climate Change

Projected changes in climate conditions are expected to result in a wide variety of effects in the Pacific Northwest[141] and the Klamath Basin. The most relevant consequences related to the Area of Analysis for GHGs include changes to stream flow, temperature, precipitation, groundwater, and vegetation changes. In general, climate model projections include:

- Increased average ambient air and water temperature
- Increased number of extreme heat days
- Changes to annual and seasonal precipitation, including increased frequency and length of drought, less winter snow and more winter rain, and changes in water quality
- Increased heavy precipitation
- Reduced snow pack and snow melt, resulting in less runoff during the late spring through early autumn
- Vegetation changes
- Groundwater hydrology changes
- Changes to annual stream flow

Lower Klamath Project Facility Influence on GHG Emissions

The hydroelectric power that is generated by the Lower Klamath Project dam complexes is considered a renewable source of energy that produces significantly reduced GHG emissions relative to other non-renewable energy sources in the region that burn fossil fuels. GHG emissions generated by hydroelectric facilities are primarily from power plant operations and maintenance. In addition, there is also the potential for plant matter to decay in the reservoirs which can cause the buildup and release of methane. As discussed in Appendix N, the Karuk Tribe (2006) estimated the total amount of methane released from Keno, J.C. Boyle, Copco, and Iron Gate reservoirs in its comments on the

[141] The Pacific Northwest is defined by the U.S. Global Change Research Program (USGCRP) as Washington, Oregon, Idaho, and western Montana. Although the USGCRP "Pacific Northwest" region does not include California, it has the climate most representative of the Klamath Basin. The USGCRP region that contains California is the "Southwest" climate region, which includes California, Nevada, Arizona, Utah, and parts of New Mexico, Colorado, and Texas. The Southwest data represent primarily desert climates, which are less similar to the Klamath Basin.

Draft Environmental Impact Statement for relicensing and/or decommissioning of the Klamath Hydroelectric Project. The emissions estimation method presented by the Karuk Tribe was adapted for the analysis in Appendix N to estimate emissions from the water impounded in the reservoirs associated with the Lower Klamath Project dam complexes. According to Table O-2 in Appendix N, it is estimated that the methane produced by the Lower Klamath Project dam complexes ranges from 4,000 to 14,000 metric tons of CO2e annually.

As Section 3.2 *Water Quality* and Section 3.4 *Phytoplankton and Periphyton* describe in detail, the Klamath River produces significant concentrations of algae, particularly in the Copco No. 1 and Iron Gate reservoirs. The primary types of algae found in these reservoirs have been diatoms (prevalent throughout the Klamath River system) and two types of cyanobacteria: *Aphanizomenon flos-aquae* and *Microcystis aeruginosa*. As with other forms of biomass, algae sequester GHGs during photosynthesis that would otherwise be in the atmosphere.

Algal production in the Lower Klamath Project reservoirs can result in temporary sequestration of CO_2 as carbon present in algal cells. When algae die at the end of their life and sink to the bottom of the Lower Klamath Project reservoirs, the temporarily sequestered carbon can be released back to the atmosphere during microbial decomposition. However, in the anoxic (lacking oxygen) environment of the Lower Klamath Project reservoir sediments, algal biomass can resist decomposition and continue to sequester carbon until disturbed and exposed to an oxygenated environment. For example, when sediments comprised of dead algae are released to downstream reaches of the Klamath River, they are subjected to oxygenated conditions and aerobic bacterial decomposition of the sediments would release sequestered carbon.

3.10.2.2 Energy

The Lower Klamath Project includes four hydroelectric developments along the mainstem of the Klamath River between river mile (RM) 193.1 and 229.8. As shown in Table 3.10-1, the installed generating capacity of the existing Lower Klamath Project is approximately 163 megawatts (MW) and, on average, the Lower Klamath Project generates 686,000 megawatt-hours (MWh) of electricity annually (PacifiCorp 2016).

Table 3.10-1. Lower Klamath Project Dam Complexes.

Dam Complex Name	Generating Facility	Total Authorized Generating Capacity (MW)	Average Annual Generation (MWh)	Location	River Mile
Copco No. 1 Dam and Reservoir	Copco No. 1 Powerhouse	20.0	106,000	California	201.8 to 208.3
Copco No. 2 Dam and Reservoir	Copco No. 2 Powerhouse	27.0	135,000	California	201.5 (Dam) and 200 (Powerhouse)
Iron Gate Dam and Reservoir	Iron Gate Powerhouse	18.0	116,000	California	193.1 to 200.0
J.C. Boyle Dam and Reservoir	J.C. Boyle Powerhouse	97.98	329,000	Oregon	229.8 (Dam) and 225.2 (Powerhouse)
Total	**--**	**162.98**	**686,000**	**--**	**--**

Source: FERC 2007, river miles updated based on Appendix B: *Definite Plan*.

The Lower Klamath Project in California includes Copco No. 1, Copco No. 2, and Iron Gate facilities. As shown in Table 3.10-1, these developments have a generation capacity of approximately 65 MW of electricity and produce an average of 357,000 MWh of electricity annually. This accounts for approximately 52 percent of the Lower Klamath Project total generation.

Although the J.C. Boyle dam complex is located in Oregon, it is being considered in this section since removal of this dam is related to the Proposed Project and the emissions of greenhouse gases are inherently a cumulative impact.

3.10.3 Significance Criteria

Criteria for determining significant impacts of GHGs and energy are based upon Appendices F and G of the CEQA Guidelines (California Code of Regulations title 14, section 15000 et seq.) and best professional judgment. Effects of GHGs and changes in energy production are considered significant if the Proposed Project would result in one or more of the following conditions or situations:

1. Generation of GHG emissions, either directly or indirectly, that would exceed 10,000 MT CO_2e.
2. Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

Significance Thresholds

The nature of the GHG emissions from the Proposed Project differs from most projects considered highest priority for curbing emissions either on a statewide or regional basis. Typical emission sources considered for quantitative thresholds of significance involve construction and ongoing operational emissions from stationary industrial projects with high rates of combustion emissions (e.g., refineries, power plants, other processing that uses industrial boilers) or the construction and increased power and transportation needs from newly constructed residential or commercial projects.

The Siskiyou County Air Pollution Control District (SCAPCD) has not adopted quantitative thresholds for determining the significance of greenhouse gas emissions. In the absence of quantitative significance thresholds for GHG emissions in the SCAPCD, the calculated GHG emissions from the Proposed Project are compared to quantitative thresholds of significance adopted by other air districts in California. The South Coast Air Quality Management District (SCAQMD) and the Bay Area Air Quality Management District have adopted numerical CEQA thresholds of significance for GHG emissions from the operation of industrial projects. Both districts use a threshold of 10,000 metric tons (MT) CO_2e per year for industrial projects that would capture 90 percent of all operational GHG emissions from stationary sources in each air basin (BAAQMD 2017, SCAQMD 2008).

Since the project proposes construction activity related to the decommissioning of the Lower Klamath Project dam complexes that would be completed at the end of 2021, it does not include long-term operational emissions. Unlike operational emissions, construction emissions do not occur continuously over the lifetime of a project. Rather, construction emissions are temporary emissions that are spread out over the construction period. Therefore, the application of the 10,000 $MTCO_2$e operational GHG emissions significance threshold for construction emissions from the Proposed Project is conservative because these emissions are limited in duration. As such, a GHG impact would be significant if the construction emissions from the Proposed Project exceed the 10,000 $MTCO_2$e threshold.

A GHG impact would be significant if GHG emissions from the Proposed Project would substantially obstruct compliance with the GHG emission reduction goals in Assembly Bill (AB 32), Senate Bill 32 (SB 32), and Executive Order S-3-05 (EO S-3-05). In addition, an impact would be significant if the removal of the Lower Klamath Project hydroelectric facilities would conflict with the California Renewable Portfolio Standard (RPS) (S-14-08, SB X1-2, and SB 350). AB 32 established the goal for the reduction of California's GHG emissions to 1990 levels by 2020. SB 32 established the goal of reducing emissions 40 percent under 1990 levels by 2030. Executive Order S-3-05 established the goal of reducing emissions 80 percent under 1990 levels by 2050. The California RPS established the goals of requiring retail sellers of electricity to provide a power mix that includes 33 percent renewable sources by 2020 and 50 percent renewable sources by 2030.

Following the passage of AB 32, some of the regional air districts in the state, such as the SCAQMD and BAAQMD, based their planning and regulations on the requirements of AB 32. These air districts set forth GHG significance thresholds specifically to meet AB 32 requirements, and so plans and projects that meet those thresholds can be assumed to meet the requirements of AB 32 (BAAQMD 2017). This includes the 10,000 $MTCO_2$e threshold for industrial projects that is compared to the construction emissions from the Proposed Project. If the Proposed Project will generate construction emissions that are less than this threshold, then it would not conflict with the AB 32 goal of reducing GHG emissions to 1990 levels by 2020.

Prior to the adoption of AB 32, EO S-3-05 established the goal of reducing California's emissions 80 percent under 1990 levels by 2050. In 2016, SB 32 was signed into law, establishing the state's mid-term target for 2030 emissions to be 40 percent below the 1990 emissions. The plan outlined in Senate Bill 32, involves increasing renewable energy use, putting more electric cars on the road, improving energy efficiency, and curbing emissions from key industries. Adopted regulations that correspond to elements of the Scoping Plan include the Renewable Portfolio Standard, the Cap-and-Trade Program, and the Low Carbon Fuel Standard (CARB 2017b). Since the Proposed Project involves construction activity related to the decommissioning of the Lower Klamath Project dam complexes that will be completed at the end of 2021, and the Proposed Project will not have long-term operational emissions, the potential for the project to conflict with the goals in EO S-3-05 and SB 32 is limited. Despite this, a discussion of the Proposed Project's compliance with existing regulatory requirements (e.g., low carbon fuel standards) and the California RPS is included under Potential Impact 3.10-2 to assess whether the Proposed Project will conflict with the GHG reduction goals in EO S-3-05 and SB 32.

In 2002, California established an RPS that requires a retail seller of electricity to include in its resource portfolio a certain amount of electricity from renewable energy sources, such as wind, geothermal, and solar energy. The retailer can satisfy this obligation by using renewable energy from its own facilities, purchasing renewable energy from another supplier's facilities, using Renewable Energy Credits (RECs) that certify renewable energy has been created, or a combination of all of these. California's RPS requirements have been accelerated and expanded a number of times since its inception. Most recently, Governor Jerry Brown signed into law Senate Bill (SB) 350 in October 2015, which requires utilities to procure 50 percent of their electricity from renewables by 2030. SB 350 also requires California utilities to develop integrated resource plans that incorporate a greenhouse gas emission reduction planning component. Compliance with the California RPS requires PacifiCorp to develop and implement an integrated resource plan that demonstrates they are on schedule to comply with the goals of providing 33 percent renewable sources by 2020 and 50 percent renewable sources by 2050.

3.10.4 Impact Analysis Approach

The quantification of direct GHG emissions was performed similarly to that of the Lower Klamath Project air quality analysis (Section 3.9 *Air Quality*) with a few exceptions (see discussion below). Project-related construction emissions were compared to applicable thresholds of significance to evaluate environmental impacts from GHGs. Direct short-term GHG emissions include those associated with on- and off-site construction equipment, construction worker commuting, and haul truck emissions. For this analysis, direct GHG emissions associated with the reduced operation of Iron Gate Fish Hatchery combined with the re-instated operation of Fall Creek Hatchery were set at the same as existing operation conditions at Iron Gate Hatchery for eight years following dam removal. This is due to the fact that the existing functions at the Iron Gate Hatchery that will be eliminated as part of dam removal activities, will be replaced by the reopening and operation of the Fall Creek Hatchery and by making improvements to the Iron Gate Hatchery (Section 2.7.6 *Hatchery Operations*).

Indirect GHG emissions were qualitatively analyzed, which includes potential GHG emissions associated with non-renewable power sources that could potentially be used to replace the hydropower associated with the Lower Klamath Project dam complexes on an interim basis.

The construction GHG emissions estimates used for this Lower Klamath Project EIR (Appendices N and O) were developed in 2011 as part of 2012 EIS/EIR analysis.

Although there have since been modifications to the Proposed Project schedule (Table 2.7-1), the 2011 GHG emissions modeling is still relevant as the construction-related activities and their associated emissions for the Proposed Project are materially similar to those modeled in 2011. Minor changes in proposed construction activities between the 2012 EIS/EIR analysis and the Proposed Project are primarily due to the timing associated with removing Iron Gate Dam, Copco No. 1 Dam, and Copco No. 2 Dam. The Proposed Project and the data modeled as part of the 2012 EIS/EIR are compared to the thresholds noted in Section 3.10.3 *Significance Criteria* and analyzed in Section 3.10.5 *[Greenhouse Gas Emissions] Potential Impacts and Mitigation*.

Greenhouse Gas Emissions Quantification

The Lower Klamath Project GHG analysis evaluated the following three pollutants: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Emissions of CO_2, CH_4, and N_2O were estimated for on- and off-site combustion sources, including mobile and stationary sources. The other two pollutants commonly evaluated in various mandatory and voluntary reporting protocols, hydrofluorocarbons and perfluorocarbons, are not expected to be emitted in large quantities and are not discussed further in this section. It is likely that sulfur hexafluoride (SF_6) would be released during deconstruction because the circuit breakers from the power facilities would be emptied. Although SF_6 has a relatively high GWP, sufficient data was not available at the time of this writing to quantify emissions.

Each GHG contributes to climate change differently, as expressed by its GWP. GHG emissions are discussed in terms of carbon dioxide equivalent (CO_2e) emissions, which express, for a given mixture of GHG, the amount of CO_2 that would have the same GWP over a specific timescale. CO_2e is determined by multiplying the mass of each GHG by its GWP[142]. This analysis uses the GWP from the Intergovernmental Panel on Climate Change's (IPCC) Second Assessment Report (IPCC 1996) for a 100-year period to estimate CO_2e. Although subsequent assessment reports have been published by the IPCC, the international standard, as reflected in various federal, state, and voluntary reporting programs, is to use GWPs from the Second Assessment Report.

Direct GHG emissions were calculated for construction activities related to dam demolition including heavy equipment use, hauling of demolition debris to landfills, and worker transportation. Detailed calculations for the Proposed Project are provided in Appendices N (Air Quality Supplemental Methodology Information and Detailed Impact Analyses) and O (Greenhouse Gas Emissions Impacts).

If a United States Environmental Protection Agency (USEPA)-approved emissions factor model (e.g., EMFAC2007, MOBILE6.2, OFFROAD, or NONROAD) does not estimate emissions of a particular pollutant, then emission factors were obtained, if possible, from the Federal Mandatory Reporting of Greenhouse Gases Rule (40 CFR Part 98).

A combination of techniques was used to estimate emissions from reservoir restoration activities. Emissions from landing and takeoff operations associated with aerial seed application were estimated using the Federal Aviation Administration's Emissions and

[142] As an example, CH_4 has a GWP of 21, as specified in the Intergovernmental Panel on Climate Change's (IPCC) Second Assessment Report (1996). One metric ton of CH_4 is equal to 21 metric tons of CO_2e (1 metric ton x 21).

Dispersion Modeling System. Emissions from hydroseeding barges were estimated using the following sources listed below.

- Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data (USEPA 2000)
- AP-42, Chapter 3.3: Gasoline and Diesel Industrial Emissions (USEPA 1995)
- Title 17 California Code of Regulations, Section 93115.7: Air Toxic Control Measure for Stationary Compression Ignition Engines – Stationary Prime Diesel-Fueled Compression Ignition Engine (>50 bhp) Emission Standards
- Title 13 California Code of Regulations, Section 2423: Exhaust Emission Standards and Test Procedures—Off-Road Compression-Ignition Engine

Emissions from ground support equipment were estimated using the emission factors for off-road engines identified above and EMFAC for on-road motor vehicle emissions.

The California Emissions Estimator Model, Version 2011.1.1, was used to estimate exhaust emissions that would occur from grading activities associated with restoring parking lots associated with recreational facilities proposed for removal and restoration. The California Emissions Estimator Model makes general assumptions about the quantity and types of construction equipment needed to grade a site based on its size (acreage).

The Sacramento Metropolitan Air Quality Management District's Road Construction Emissions Model, Version 6.3.2 (2009), was used to estimate exhaust emission factors associated with relocation of the Yreka water supply pipeline. The Siskiyou County Air Pollution Control District does not have a comparable model to estimate emissions from linear projects like the proposed pipeline relocation action.

Energy Conservation

Appendix F of the *State CEQA Guidelines* requires that an EIR shall include a "discussion of the potential energy impacts of proposed projects, with particular emphasis on avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy."

There are no unusual project characteristics that would necessitate the use of construction equipment or practices that would be less energy efficient than at comparable construction sites in the region or State. Therefore, it is expected that construction energy consumption associated with the Proposed Project would not be any more inefficient, wasteful, or unnecessary than other similar construction projects of this nature. Therefore, this issue is not further addressed in this section.

This project proposes the removal of the Lower Klamath Project dam complexes and would not result in long-term energy use. For this analysis, energy use associated with the reduced operation of Iron Gate Fish Hatchery combined with the re-instated operation of Fall Creek Hatchery was set to be the same as existing conditions operations at Iron Gate Hatchery for the eight years following dam removal. This is due to the fact that the existing functions at the Iron Gate Hatchery that will be eliminated as part of dam removal activities, will be replaced by the reopening and operation of the Fall Creek Hatchery and by making improvements to the Iron Gate Hatchery (Section 2.7.6 *Hatchery Operations*). As such, the issue of energy conservation during long-term operation is not further addressed in this section.

CEQA Guidelines Appendix F indicates that "increasing reliance on renewable energy sources" is one of the means of achieving the goal of energy conservation (see Appendix F [I][3] and [II][D][4]). The Proposed Project will result in the decommissioning of the Lower Klamath Project hydroelectric facilities in California, which have a generation capacity of approximately 65 MW of electricity and produce an average of 357,000 MWh of electricity annually. As described in the PacifiCorp Integrated Resource Plan (IRP), PacifiCorp plans to transition to additional renewable energy sources, or purchase RECs, to provide a power mix that complies with the California Renewable Portfolio Standard (RPS). Although, the Proposed Project would result in the loss of a renewable energy source, overall PacifiCorp will be increasing the percentage of renewable energy sources in its power mix to comply with the California RPS.

3.10.5 Potential Impacts and Mitigation

Potential Impact 3.10-1 Generation of greenhouse gas emissions, either directly or indirectly, that would exceed 10,000 MT CO_2e.

The nature of the GHG emissions from the Proposed Project differs from most projects considered highest priority for curbing emissions either on a statewide or regional basis. Typical emission sources considered for quantitative thresholds of significance involve construction and ongoing operational emissions from stationary industrial projects with high rates of combustion emissions (e.g., refineries, power plants, other processing that uses industrial boilers) or the construction and increased power and transportation needs from newly constructed residential or commercial projects. In these cases ongoing emissions from combustion and transportation are likely to be cumulatively considerable.

For the Proposed Project, there are few direct operational GHG emissions. As noted above, direct GHG emissions associated with operation of the Iron Gate Hatchery and Fall Creek Hatchery are assumed to be the same as existing baseline GHG emissions associated with current hatchery operations. Appreciable direct GHG emissions would occur only for a limited time as a result of construction related to dam deconstruction, restoration, relocation and demolition of recreational facilities, and Yreka supply pipeline relocation.

However, the Proposed Project has the potential to indirectly produce GHG emissions through conversion from the hydroelectric energy produced by the Lower Klamath Project to regional power from a mixture of sources likely including GHG-emitting fossil fuels.

Summary

Table 3.10-2 summarizes the total uncontrolled emissions associated with the Proposed Project activities including dam and powerhouse deconstruction, restoration activities, relocation and demolition of recreational facilities, and the Yreka supply pipeline relocation. The GHG emissions estimates in Table 3.10-2 include construction activity related to the removal of J.C. Boyle Dam in Oregon. Due to the cumulative nature of GHG emissions, the emissions from construction activity in Oregon are conservatively added to the emissions from construction activity in California and compared to the SCAQMD's 10,000 $MTCO_2$e significance threshold.

Table 3.10-2. Uncontrolled Direct GHG Emissions Inventories for the Proposed Project.

Project Activity	Emissions ($MTCO_2e$)
Dam and Powerhouse Deconstruction	8,558
Restoration Activities	704
Recreation Facilities	160
Yreka Supply Pipeline Relocation	33
Total Emissions	**9,455**

Source: Appendix N

As shown in Table 3.10-2, total GHG emissions from the Proposed Project are estimated to be approximately 9,455 $MTCO_2e$, which is below the SCAQMD's 10,000 $MTCO_2e$ significance threshold. As such, the construction GHG emissions from the Proposed Project would be less than significant. The discussion below provides more detailed information about the emissions from the various project activities.

Dam and Powerhouse Deconstruction

Vehicle and equipment exhaust from dam removal activities would produce GHG emissions during the dam deconstruction period. The emission sources would include off-road construction equipment, on-road trucks, and construction worker commuting vehicles (Section 2.7.1 *Dam and Powerhouse Deconstruction*). Table 3.10-3 summarizes uncontrolled emissions associated with dam and powerhouse deconstruction.

Table 3.10-3. Uncontrolled Direct GHG Emissions Inventories for Dam and Powerhouse Deconstruction.

Location	Project Emissions ($MTCO_2E$)			
	CO_2	CH_4	N_2O	Total
Iron Gate	4,106	4	0	4,110
Copco No. 1	1,459	1	0	1,461
Copco No. 2	970	1	0	971
J.C. Boyle	2,016	<1	0	2,016
Total Emissions	**8,551**	**6**	**0**	**8,558**
California Total	6,535	6	0	6,542
Oregon Total	2,016	n/a	0	2,016

Source: Appendix N

As Table 3.10-3 shows, deconstruction of the dams would contribute approximately 8,558 $MTCO_2e$ of GHG emissions during the deconstruction period. As indicated in Table 3.10-2, deconstruction of the dams would produce the majority of construction emissions that would occur from the Proposed Project.

Cofferdams would be constructed at the Lower Klamath Project during deconstruction activities from concrete rubble, rock, and earthen materials that would come from the dam removal activities, as possible. Construction of the cofferdams from materials salvaged from the dam demolition activities would reduce the need for importing new construction materials. As the cofferdams would be constructed from materials salvaged from the dam demolition activities, GHG emissions associated with cofferdam construction would already be included in the emissions inventory. Additional emissions could occur when the cofferdams are later demolished. Due to the limited size of these structures and the fact that much of the material used to construct the coffer dams would be disposed of in close proximity to the dam sites, it is not anticipated that the additional emissions from this activity would result in a change to the significance determination.

Restoration Activities
Restoration actions included in the Reservoir Area Management Plan (Appendix B: *Definite Plan – Appendix H*) would produce GHG emissions from the use of helicopters, trucks, and barges. Following drawdown of the reservoirs, revegetation efforts would be initiated to support establishment of native wetland, riparian, and upland species on newly exposed sediment. Additional fall seeding may be necessary to supplement areas where spring hydroseeding was unsuccessful. Table 3.10-4 summarizes GHG emissions from restoration activities.

Table 3.10-4. Uncontrolled Direct GHG Emissions Inventories for Restoration (Seeding).

Location	Project Emissions ($MTCO_2E$)			
	Ground Equipment	Barges	Aerial	Total
Iron Gate	29	88	149	266
Copco No. 1 and Copco No. 2	32	88	298	419
J.C. Boyle	19	n/a	n/a	19
Total Emissions	**80**	**177**	**447**	**704**

Source: Appendix N

As shown in Table 3.10-4, total GHG emissions from restoration activities are estimated to be approximately 704 $MTCO_2e$. As indicated in Table 3.10-2, next to deconstruction of the dams, restoration activities would be the second largest contributor of the construction emissions that would occur from the Proposed Project.

Recreation Facilities
Relocation and demolition of various recreation facilities (Section 2.7.8.3 *Recreation Facilities Management*) would produce GHG emissions from vehicle exhaust. The demolition of the Lower Klamath Project recreation facilities would change recreation opportunities from reservoir-based recreation to river-based recreation. This change would require several recreation facilities to be relocated or demolished. On- and off-road construction equipment would be used to complete these activities. GHG emissions from recreation facilities removal and construction were estimated using the California Emissions Estimator Model (CalEEMod). Approximately 160 $MTCO_2e$ would be emitted during relocation and demolition of the recreation facilities (Appendix N).

City of Yreka Water Supply Pipeline Relocation

Construction of a new Yreka water supply pipeline (Section 2.7.7 *City of Yreka Water Supply Pipeline Relocation*) would produce GHG emissions from vehicle exhaust. On- and off-road construction equipment would be used to complete the relocation and construction of the water supply pipeline. Construction of the pipeline is to occur prior to initiating drawdown of the Iron Gate Reservoir. It is estimated the replacement of the water supply pipeline would last approximately one month. The Sacramento Metropolitan Air Quality Management District's Road Construction Emissions Model (2009) was used to estimate emissions associated with grubbing/land clearing, grading/excavation, and other phases of construction. The Road Construction Emissions Model estimated that approximately 33 $MTCO_2e$ would be emitted.

Replacement of Hydroelectric Energy

Removing a renewable source of energy by removing the dams has the potential to result in increased GHG emissions from possible non-renewable alternate sources of power. GHG emissions could occur in the event that the renewable source of power represented by the Lower Klamath Project was replaced by other regional power sources, which in part, could be generated from fossil fuels.

As described above, the average annual electricity generation from the Lower Klamath Project is 686,000 MWh (Table 3.10-1). This includes generation from the following developments: Copco No. 1 Dam, Copco No. 2 Dam, Iron Gate Dam, and J.C. Boyle Dam. The Lower Klamath Project dam complexes in California (Copco No. 1, Copco No. 2, and Iron Gate) have a generation capacity of approximately 65 MW of electricity and produce an average of 357,000 MWh of electricity annually. This accounts for approximately 52 percent of the Lower Klamath Project total electrical production.

The 2015 electricity generation resource mix for PacifiCorp's Power Control Area (PCA), which is a region of the power grid in which all power plants are centrally dispatched, is dominated by coal (62 percent), natural gas (15.4 percent), wind (7.1 percent), and hydroelectricity (5.2 percent) (PacifiCorp 2017a). Electricity produced from the Lower Klamath Project, if removed, would likely be replaced with another source within the PacifiCorp PCA because the amount of electricity provided by the Lower Klamath Project is only approximately two percent of PacifiCorp's total generation capacity (CEC 2006b).

In 2017, PacifiCorp issued an Integrated Resource Plan (IRP) identifying the preferred power generation portfolio over the next 20 years. The IRP indicates that PacifiCorp plans to meet new energy resource needs primarily through new renewable resources and demand management (e.g., energy efficiency measures) over the 20-year (2017–2036) planning horizon. The IRP includes the anticipated loss of Lower Klamath Project hydroelectric generation beginning in 2020. The preferred portfolio also identified a reduction in coal capacity of 3,650 MW through the end of 2036. PacifiCorp projects that between 2017 and 2036 its average annual CO_2 emissions would be reduced by 24.5 percent falling from 43.8 million tons in 2017 to 33.1 million tons in 2036 representing an annual average reduction in CO_2 emissions of 10.7 million tons (PacifiCorp 2017b).

Removal of the reservoirs associated with the Lower Klamath Project dam complexes would also result in a reduction in methane (CH_4) production. As previously described, CH_4 emissions from the reservoirs range from 4,000 to 14,000 $MTCO_2e$ per year. Under the Proposed Project, these CH_4 emissions would cease to be a factor and would further reduce GHG emissions beyond the projections in the PacifiCorp 2017 IRP.

Since it is planned in the 2017 IRP for PacifiCorp to add new sources of renewable power or purchase RECs to comply with the California RPS, and removal of the reservoirs would result in a reduction in methane production, it is not anticipated that the replacement of the hydroelectric energy from the Lower Klamath Project dam complexes would result in an increase in GHG emissions from non-renewable power sources. As such, GHG impacts from replacement of the hydroelectric energy from the Lower Klamath Project dam complexes is determined to be less than significant.

Significance
No significant impact

Potential Impact 3.10-2 Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions.
Climate change is a cumulative phenomenon, and it is not possible to link a single project to specific climatological changes. The Proposed Project would result in temporary direct GHG emissions from construction and restoration related activities, but would not include direct operational GHG emissions. However, the Proposed Project could result in additional indirect emissions from non-renewable replacement power that could potentially be provided until PacifiCorp adds new sources of renewable power that would replace the removed dams.

For the purposes of this analysis, the Proposed Project is analyzed for compliance with the following applicable plans, policies, and regulations:

- Assembly Bill 32 (AB 32)
- Executive Order S-3-05 (EO S-3-05) and Senate Bill 32 (SB 32)
- Renewable Portfolio Standard (RPS) (S-14-08, SB X1-2, and SB 350)

Assembly Bill 32 (AB 32)
The Global Warming Solutions Act of 2006 (AB 32) directed the CARB to develop the Climate Change Scoping Plan (Scoping Plan), which outlines a set of actions to achieve the AB 32 goal of reducing GHG emissions to 1990 levels by 2020 (CARB 2008). CARB approved the Scoping Plan in 2008 and updated it in May 2014 and November 2017.

As discussed under Potential Impact 3.10-1, the construction emissions from the Proposed Project would fall below the 10,000 $MTCO_2e$ significance threshold developed by the SCAQMD and BAAQMD to provide consistency with AB 32. Since the project's GHG emissions would be below a GHG threshold developed to provide consistency with AB 32, the Proposed Project would not conflict with AB 32.

In addition, It is noted that CARB announced in July 2018, that the State has already met the AB 32 goal of reducing emissions to 1990 levels by 2020 approximately four years early. As stated in the Executive Summary of the 2018 Edition of the California Greenhouse Gas Emissions Inventory: 2000–2016 (CARB 2018):

> "The inventory for 2016 shows that California's GHG emissions continue to decrease, a trend observed since 2007. In 2016, emissions from routine GHG

> emitting activities statewide were 429 million metric tons of CO2 equivalent (MMTCO2e), 12 MMTCO2e lower than 2015 levels. This puts total emissions just below the 2020 target of 431 million metric tons. Emissions vary from year-to-year depending on the weather and other factors, but California will continue to implement its greenhouse gas reductions program to ensure the state remains on track to meet its climate targets in 2020 and beyond."

Executive Order S-3-05 (EO S-3-05) and Senate Bill 32 (SB 32)

Since the Proposed Project involves construction activity related to the decommissioning of the Lower Klamath Project dam complexes that would be completed at the end of 2021, and the Proposed Project would not have long-term operational emissions, the potential for the project to conflict with the goals in EO S-3-05 and SB 32 is limited. However, a discussion of the Proposed Project's compliance with existing regulatory requirements (e.g., low carbon fuel standards) and the California RPS is included below to assess whether the project would conflict with the GHG reduction goals in EO S-3-05 and SB 32.

In 2016, the CARB released the updated Mobile Source Strategy, which addresses the current and proposed programs for reducing mobile source emissions, including GHG emissions. The Mobile Source Strategy identifies programs that the state and federal government have or would adopt, which further the goals of the Scoping Plan. Some programs provide incentives to facilitate increased purchase of new, lower emission light-, medium-, and heavy- duty vehicles to aid the state in achieving emission reduction goals. Other programs require certain engine years to upgrade the engine to newer, cleaner engines by specific dates or strict performance standards for specific model years. These programs for more stringent emission are required by state and federal law and are monitored by CARB or USEPA (CARB 2016). As such, the vehicles used during construction of the Proposed Project are required to comply with the applicable GHG reduction programs. KRRC or the construction contractor are required to provide verification of compliance to CARB or USEPA under state and federal law.

As described below, PacifiCorp plans to add new sources of renewable power or purchase RECs to comply with the California RPS. As such, the power mix provided by PacifiCorp after removal of the Lower Klamath Project dam complexes would comply with regulations that support the goals identified in S-3-05 and SB 32.

Therefore, the Proposed Project and the power mix that would be provided by PacifiCorp after removal of the Lower Klamath Project dam complexes, would conform with relevant actions and programs detailed in the Scoping Plan and Mobile Source Strategy. As such, the Proposed Project would not conflict with EO S-3-05 and SB 32.

Renewable Portfolio Standard (RPS) (S-14-08, SB X1-2, and SB 350)

In 2017, PacifiCorp issued an Integrated Resource Plan (IRP) identifying the preferred power generation portfolio over the next 20 years that "reflects a cost-conscious transition to a cleaner energy future". The IRP indicates that PacifiCorp plans to meet new energy resource needs primarily through new renewable resources and demand management (e.g., energy efficiency measures) over the 20-year (2017–2036) planning horizon by adding approximately 4,000 MW of wind and solar resources and 2,100 MW through energy efficiency and load control. The IRP includes the anticipated loss of Lower Klamath Project hydroelectric generation beginning in 2020. The preferred portfolio also identified a reduction in coal capacity of 3,650 MW through the end of

2036. As it relates to compliance with the California RPS, the PacifiCorp IRP concludes that the California RPS compliance position is improved by the addition of repowered wind, new renewable resources and transmission in the 2017 IRP preferred portfolio and would require the purchase of under 150,000 RECs per year to achieve compliance through the planning horizon.

Although the Proposed Project would result in the loss of a renewable energy source, overall PacifiCorp would be increasing the percentage of renewable energy sources in its power mix to comply with the California RPS. Since it is planned in the 2017 IRP for PacifiCorp to add new sources of renewable power or purchase RECs to comply with the California RPS, the Proposed Project would not conflict with the State's RPS.

As such, the Proposed Project would not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

Significance

No significant impact

3.10.6 References

BAAQMD (Bay Area Air Quality Management District). 2017. California Environmental Quality Act Air Quality Guidelines. May. Available at: http://www.baaqmd.gov/Divisions/Planning-and-Research/CEQA-GUIDELINES.aspx.

CARB (California Air Resources Board). 2008. Climate Change Scoping Plan: A Framework for Change. December. Available at: https://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm. Accessed on: March 22, 2011.

CARB. 2015. California GHG inventory for 2015 by economic sector. Available at: https://www.arb.ca.gov/cc/inventory/data/graph/pie/pie_2015_by_sector.png.

CARB. 2016. Mobile Source Strategy. Available at: https://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.pdf.

CARB. 2017a. California greenhouse gas emission inventory – 2017 edition: 2000 to 2015. Available at: https://www.arb.ca.gov/cc/inventory/data/data.htm.

CARB. 2017b. *Update to the Climate Change Scoping Plan: The Strategy for achieving California's 2030 greenhouse reduction target*. Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf.

CARB. 2018. *California Greenhouse Gas Emissions for 2000 to 2016. Trends of Emissions and Other Indicators*. Available at: https://www.arb.ca.gov/cc/inventory/pubs/reports/2000_2016/ghg_inventory_trends_00-16.pdf.

CEC (California Energy Commission). 2006a. Inventory of California greenhouse gas emissions and sinks 1990 to 2004. (CEC-600-2006-013-SF.) Available at: https://www.energy.ca.gov/2006publications/CEC-600-2006-013/CEC-600-2006-013-SF.PDF.

CEC. 2006b. Economic modeling of relicensing and decommissioning options for the Klamath Basin Hydroelectric Project. (CEC-700-2006-010). Available at: https://www.energy.ca.gov/2006publications/CEC-700-2006-010/CEC-700-2006-010.PDF.

CNRA (California Natural Resources Agency). 2008. Delta Vision Blue Ribbon Task Force letter to Governor Schwarzenegger on sea level rise. Available: http://deltavision.ca.gov/BlueRibbonTaskForce/April2008/Item2_Attachment1.pdf.

FERC (Federal Energy Regulatory Commission). 2007. Final Environmental Impact Statement for Hydropower License. Volume I. Klamath Hydroelectric FERC Project No. 2082-0278.

IPCC (Intergovernmental Panel on Climate Change). 1996. IPCC second assessment climate change 1995. A report of the Intergovernmental Panel on Climate Change.

Karuk Tribe of California. 2006. Comments of Draft EIR in Klamath Hydroelectric Project Docket for Filing: P-2082-027 (Klamath). Submitted to FERC by the Karuk Tribe of California, Orleans, CA. 60 p. Available at: http://www.klamathwaterquality.com/documents/karuk_comments_20061201-5040(16445270).pdf.

PacifiCorp. 2016. Klamath River: Project OVERVIEW. Available at: http://www.pacificorp.com/es/hydro/hl/kr.html.

PacifiCorp. 2017a. Integrated Resource Plan. Available at: https://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Integrated_Resource_Plan/2017_IRP/2017_IRP_VolumeI_IRP_Final.pdf.

PacifiCorp. 2017b. Fact Sheet – Energy Resource Mix.

SCAQMD (South Coast Air Quality Management District). 2008. Draft Guidance Document – Interim CEQA Greenhouse Gas (GHG) Significance Threshold. October. Available at: http://www.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-(ghg)-ceqa-significance-thresholds/ghgattachmente.pdf.

SMAQMD (Sacramento Metropolitan Air Quality Management District). 2009. Roadway Construction Emissions Model, Version 6.3.2.

Stocker, T. 2014. Climate change 2013: the physical science basis. Climate Change Lecture Series.

USEPA (U.S. Environmental Protection Agency). 1995. Compilation of air pollutant emission factors, Volume 1: Stationary Point and Area Sources. AP-42, Fifth Edition. Available at: https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors.

USEPA. 2000. Analysis of commercial marine vessels emissions and fuel consumption data. EPA420-R-00-002. Available at: https://www.epa.gov/transportation-air-pollution-and-climate-change.

This page left blank intentionally