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Recirculated Portions of the Draft Environmental Impact Report for the Lower Klamath Project License Surrender

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Recirculated Portions of the Draft Environmental Impact Report for the Lower Klamath Project License Surrender

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December 2019

Recirculated Portions of the Draft Environmental Impact Report for the Lower Klamath Project License Surrender

Pursuant to:
California Environmental Quality Act, Public Resources Code, section 21000 et seq.; California Code of Regulations, title 14, section 15000 et seq. (CEQA Guidelines)

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Section 3.9 Air Quality

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3.9 Air Quality

This section focuses on potential air quality impacts from implementing the Proposed Project. Section 3.10 of this EIR discusses greenhouse gas (GHG) emissions and energy consumption associated with implementation of the Proposed Project. The State Water Resources Control Board (State Water Board) did not receive comments related to air quality during the Notice of Preparation (NOP) public scoping process for the Proposed Project (see Volume I, Appendix A), but did receive several comments on the air quality analysis during the public comment period for the Draft EIR. The revised air quality section contained herein addresses public comments on the Draft EIR by providing additional detail regarding elements of the Proposed Project that may affect air quality and by incorporating new modeling information to support the assessment of potential air quality impacts. Please see the Notice of Availability (Notice) for additional information on the recirculated sections of the Draft EIR Volume I and associated Volume II appendices.

3.9.1 Area of Analysis

Criteria air pollutants and toxic air contaminants (TACs) typically have localized air quality effects and relatively short atmospheric lifetimes (approximately one day). For this reason, the Area of Analysis for air quality includes areas within and adjacent to the Proposed Project Limits of Work (Figure RE-3.9-1), where construction activities would occur, which are located in Siskiyou County, California. As pollutants can travel on air currents away from the place of generation, the Air Quality Area of Analysis (Figure RE-3.9-1) includes Siskiyou County as a whole, along with Klamath County, Oregon where construction activity related to the removal of J.C. Boyle Dam would occur. Note that the portion of Proposed Project Limits of Work in Oregon is only being considered to the extent that conditions in this area influence air quality in Siskiyou County, California.

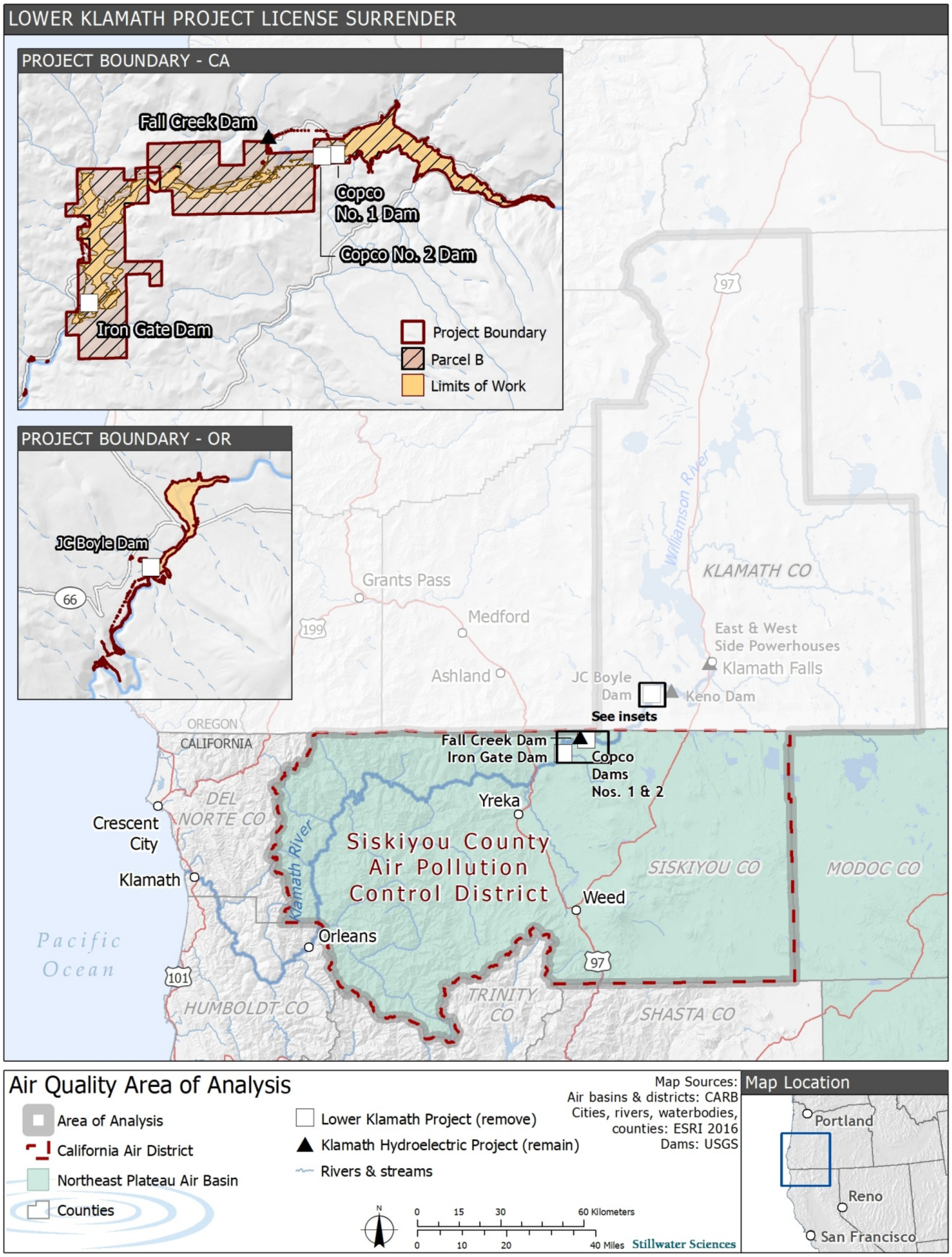

Figure RE-3.9-1. Area of Analysis for Air Quality.

3.9.2 Environmental Setting

This section provides a description of the environmental setting for air quality in the Area of Analysis (Figure RE-3.9-1), including a brief overview of existing air quality conditions in the portion of the Klamath Basin in California to set the stage for subsequent impact analyses. As Proposed Project construction activities in California would occur in Siskiyou County, this section focuses on the environmental setting in this county.

Siskiyou County is located in the Northeast Plateau Air Basin (NPAB) and the Proposed Project is within the Siskiyou County Air Pollution Control District (SCAPCD). The SCAPCD adopts and enforces controls on stationary sources of air pollutants through its permit and inspection programs and regulates agricultural and non-agricultural burning. Other SCAPCD responsibilities include monitoring air quality, preparing air quality plans, and responding to citizen air quality complaints. Per SCAPCD Rule 2.1(A), any project which may cause the issuance of air contaminants, or which may eliminate, reduce or control the issuance of air contaminants, shall first obtain written authorization for such construction from the APCD Control Officer (CARB 2016a).

Ambient concentrations of air pollutant emissions are determined by the amount of emissions released by various sources and the atmosphere's ability to transport and dilute such emissions. In Siskiyou County, the terrain is dominated by volcanic peaks (e.g., Mount Shasta) and forested mountains, with agricultural activities (including rangeland) primarily in areas that are not wooded. Natural factors that affect transport and dilution of air pollutant emissions include terrain, wind, atmospheric stability, and sunlight. Also, air quality is influenced by natural factors, such as topography, meteorology, and climate, in addition to the amount of emissions released by existing air pollutant sources, as discussed separately in this section. The climate of Siskiyou County generally features hot summer days with cool nights and mild winters in the low valleys while the mountainous areas have cool summers and severe winters.

3.9.2.1 Meteorology

The climate in Siskiyou County is characterized by moderately wet winters and dry summers. Approximately 75 percent of the annual total rainfall occurs between November and April. Between June and September, normal rainfall typically is less than one inch per month. Temperatures in Siskiyou County average approximately 60 degrees Fahrenheit (°F) annually, with summer highs in the low 90°F and winter lows in the mid 20°F. Precipitation averages approximately 20 inches per year, although annual precipitation varies markedly from year to year (World Climate 2016). Annual average wind speeds in Siskiyou County are approximately 6.1 miles per hour and predominantly blow from the south. (Western Regional Climate Center 2016).

3.9.2.2 Criteria Air Pollutants

The Clean Air Act (CAA) requires the U.S. Environmental Protection Agency (USEPA) to set National Ambient Air Quality Standards (NAAQS) for six common air pollutants (also known as "criteria air pollutants") (USEPA 2018). Concentrations of criteria air pollutants are used as indicators of ambient air quality conditions. The USEPA has established a maximum concentration (air quality standard) for each criteria air pollutant, above which adverse effects on human health may occur. When an area does not meet the air quality standard for one of the criteria air pollutants, it may be subject to the formal rule-making process, which designates it as nonattainment.

The CAA further classifies ozone, carbon monoxide (CO), and particulate matter (PM_{10} and $PM_{2.5}$) nonattainment areas based on the magnitude of criteria air pollutant exceedances in a given area (42 U.S. Code Section 7401 et seq.). Nonattainment classifications may be used to specify what air pollution reduction measures an area must adopt and when the area must reach attainment. The technical details underlying these classifications are described in the Code of Federal Regulations (CFR) "Protection of Environment" (40 CFR Section 81).

The USEPA has established primary and secondary NAAQS for criteria air pollutants. The primary standards are concentrations developed by the USEPA through review of extensive scientific research and are intended to be protective against human health impacts. The secondary standards were developed to protect elements of human welfare vulnerable to degraded air quality such as visibility of air, agriculture, buildings, infrastructure, and livestock.

Adverse health impacts associated with exposure to air pollution have varying degrees of severity depending on the receptor (i.e., each persons' sensitivity) exposed. For example, infants, children, the elderly, and those with preexisting cardiovascular and respiratory disease (e.g., asthma) experience more severe symptoms in response to acute and chronic exposure. However, the USEPA has concluded that the current NAAQS protect the public health, including the at-risk populations, with an adequate margin of safety.

In 1959, California enacted legislation requiring the state Department of Public Health to establish air quality standards. California law continues to mandate California ambient air quality standards (CAAQS), which are often more stringent than the NAAQS (CARB 2019). The California Air Resources Board (CARB) is responsible for setting standards and adopting regulations to achieve the maximum degree of emissions reduction possible from vehicular and other mobile sources at the state level, as well as for state implementation of the CAA.

Air pollutants come from various sources, both anthropogenic (i.e., vehicle exhaust, power generation, natural gas-fired electricity generation, and the operation of certain equipment in construction and industry) and biogenic (i.e., vegetation, animals, and even the earth itself). Exhaust emissions from vehicles vary according to driving speed, type of engine (e.g., gasoline or diesel), length of use, and horsepower. Emissions from stationary sources (e.g., fossil fuel burning power plants, food processing plants) are estimated by the amount of natural gas and electricity consumption. Construction and industrial equipment generate pollutant emissions that are highly variable by type and technology of specific equipment. Vegetation emits volatile organic compounds (VOCs) which are ozone precursors.

A brief description of each criteria air pollutant (i.e., source types, health effects, and future trends) is provided below, followed by Section 3.9.2.3 *Monitoring-Station Data and Attainment-Area Designations* which describes the air pollutant standards, and subsequent sections that describe whether Siskiyou County complies with the standards.

<u>Ozone</u>

Ozone (O_3) is a photochemical oxidant - a substance whose oxygen combines chemically with another substance in the presence of sunlight. In the lower atmosphere, ozone is the primary component of smog. Ozone is not emitted directly into the air but is formed through complex chemical reactions between certain emissions, known as “precursor emissions,” in the presence of sunlight. The precursor emissions for ozone are reactive organic gases (ROG) and nitrogen oxides (NO_X). ROGs are volatile organic compounds that are photochemically reactive. ROG emissions result primarily from incomplete combustion and the evaporation of chemical solvents and fuels. Common sources of ROG emissions include solvents, pesticides, the burning of fuels, and organic wastes. NO_X is a group of gaseous compounds of nitrogen and oxygen that result from the combustion of fuels. Common sources of NO_X emissions include emissions from burning of fuel in cars, trucks, buses, power plants, and off-road equipment (USEPA 2018).

Ozone located in the upper atmosphere (stratosphere) shields the earth from harmful ultraviolet radiation emitted by the sun. However, ozone located in the lower atmosphere (troposphere) is a major health and environmental concern. As described below, breathing ozone can trigger a variety of health problems, particularly for children, elderly, and people of all ages who have lung disease such as asthma. Ground level ozone can also have harmful effects on sensitive vegetation and ecosystems, including forests, parks, wildlife refuges, and wilderness areas. Ozone can especially cause damage during the growing season (USEPA 2018).

The adverse health effects associated with exposure to ozone pertain primarily to the respiratory system. Scientific evidence indicates that ambient levels of ozone affect not only sensitive receptors, such as people with asthma and children, but healthy adults as well. Exposure to ambient levels of ozone ranging from 0.10 to 0.40 parts per million (ppm) for one or two hours has been found to substantially alter lung function by increasing respiratory rate and pulmonary resistance, decreasing tidal volume, and impairing respiratory mechanics. Ambient levels of ozone above 0.12 ppm are linked to symptomatic responses that include such symptoms as throat dryness, chest tightness, headache, and nausea. In addition to these adverse health effects, ozone exposure can cause an increase in the permeability of respiratory epithelia (i.e., the thin tissue forming the outer layer of the body's respiratory system); such increased permeability leads to an increase in the respiratory system's responsiveness to challenges and the inhibition of the immune system's ability to defend against infection (Godish 2004). These effects may lead to increased school absences, medication use, visits to doctors and emergency rooms, and hospital admissions.

Meteorology and terrain play a major role in ozone formation in the troposphere (i.e., at ground level). Generally, low wind speeds or stagnant air coupled with warm temperatures and clear skies provide the optimum conditions for formation; therefore, summer generally is the peak ozone season. Peak ozone concentrations often occur far downwind from the precursor emissions due to the time it takes for reactions to complete. Therefore, ozone is a regional pollutant that often affects large areas. In general, ozone concentrations over or near urban and rural areas reflect an interplay of emissions of ozone precursors, transport, meteorology, and atmospheric chemistry.

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless, and poisonous gas, produced by incomplete burning of carbon in fuels, primarily from internal-combustion engines used for transportation. In fact, 77 percent of nationwide CO emissions are from transportation. The other 23 percent of emissions are from wood-burning stoves, incinerators, and industrial sources.

CO enters the bloodstream through the lungs by combining with hemoglobin, a component of red blood cells, which normally carries oxygen to the red blood cells. CO combines with hemoglobin much more readily than oxygen does, resulting in a drastic reduction in the amount of oxygen available to the cells. Adverse health effects associated with exposure to CO concentrations include symptoms such as dizziness, headaches, and fatigue. CO exposure is especially harmful to individuals who suffer from cardiovascular and respiratory diseases (USEPA 2018).

The highest CO concentrations generally are associated with the cold, stagnant weather conditions that occur in winter. In contrast to ozone, which tends to be a regional pollutant, CO tends to cause localized problems.

Nitrogen Dioxide

Nitrogen Dioxide (NO_2) is a brownish, highly reactive gas that is present in all urban environments. The major human-made sources of NO_2 are combustion devices, such as boilers, gas turbines, and reciprocating internal-combustion engines (mobile as well as stationary). Combustion devices emit primarily nitric oxide (NO), which reacts with oxygen in the atmosphere to form NO_2 (USEPA 2018). The combined emissions of NO and NO_2 are referred to as NO_X, which is reported as equivalent NO_2. Since NO_2 is formed and depleted by reactions associated with photochemical smog (ozone), the NO_2 concentration in a particular geographical area may not be representative of the local NO_X emission sources.

Inhalation is the most common form of exposure to NO_2, with the principal site of toxicity being the lower respiratory tract. The severity of adverse health effects depends primarily on the concentration of NO_2 inhaled rather than the duration of exposure. An individual may experience a variety of acute symptoms, including coughing, difficulty with breathing, vomiting, headache, and eye irritation, during or shortly after exposure. After approximately 4 to 12 hours of exposure, an individual may experience chemical pneumonitis or pulmonary edema, with breathing abnormalities, cough, cyanosis, chest pain, and rapid heartbeat. Severe, symptomatic NO_2 intoxication after acute exposure has been linked on occasion with prolonged respiratory impairment, including symptoms such as chronic bronchitis and decreased lung function.

Sulfur Dioxide

Sulfur dioxide (SO_2) is produced by stationary sources like coal and oil combustion, steel mills, refineries, and pulp and paper mills. The major adverse health effects associated with SO_2 exposure relate to the upper respiratory tract. SO_2 is a respiratory irritant, with constriction of the bronchioles occurring with inhalation of SO_2 at 5 ppm or more. On contact with the moist mucous membranes, SO_2 produces sulfurous acid, which is a direct irritant. Concentration rather than duration of the exposure is the most important determinant of respiratory effects. Exposure to high SO_2 concentrations may result in edema of the lungs or glottis and respiratory paralysis (USEPA 2018).

Particulate Matter

Particulate matter (PM) is a mixture of solid particles and liquid droplets found in air. PM that is small enough to be inhaled has a diameter of 10 microns or less is referred to as PM_{10}. PM_{10} consists of particulate matter emitted directly into the air, such as fugitive dust, soot, and smoke from mobile and stationary sources, construction operations, fires, natural windblown dust, and can be formed in the atmosphere by condensation or transformation of SO_2 and ROG (USEPA 2018). $PM_{2.5}$ includes a subgroup of finer particles that have a diameter of 2.5 microns or less.

Generally, adverse health effects associated with PM_{10} may result from both short-term and long-term exposure to elevated concentrations, and may include breathing and respiratory symptoms, aggravation of existing respiratory and cardiovascular diseases, alterations to the immune system, carcinogenesis, and premature death (USEPA 2018). The adverse health effects associated with PM_{10} depend on the specific composition of the particulate matter. For example, health effects may be associated with adsorption of metals, polycyclic aromatic hydrocarbons, and other toxic substances onto fine particulate matter (referred to as the "piggybacking effect"), or with fine dust particles of silica or asbestos. $PM_{2.5}$ poses an increased health risk when compared to PM_{10} because the particles can deposit deep in the lungs and are more likely to contain substances that are particularly harmful to human health.

Lead

Lead is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions historically have been mobile and industrial sources. Due to the phase-out of leaded gasoline, as discussed in detail in this section, metal processing currently is the primary source of lead emissions. The highest levels of lead in the atmosphere generally are found near lead smelters. Other stationary sources include waste incinerators, utilities, and lead-acid battery manufacturers.

Twenty years ago, mobile sources (e.g., motor vehicles using leaded fuel) were the main contributor to ambient lead concentrations in the air. In the early 1970s, the USEPA established national regulations to gradually reduce the lead content in gasoline. In 1975, unleaded gasoline was introduced for motor vehicles equipped with catalytic converters. USEPA banned the use of leaded gasoline in highway vehicles in December 1995 (USEPA 2018).

Due to USEPA's regulatory efforts to remove lead from gasoline, emissions of lead from the transportation sector declined by 95 percent between 1980 and 1999, and levels of lead in the air decreased by 94 percent between 1980 and 1999. Transportation sources, primarily airplanes, now contribute to only 13 percent of lead emissions. A recent National Health and Nutrition Examination Survey reported a 78 percent decrease in the levels of lead in people's blood between 1976 and 1991. This dramatic decline can be attributed to the move from leaded to unleaded gasoline (USEPA 2018).

Similarly, lead emissions and ambient lead concentrations have decreased dramatically in California over the past 25 years. The phase-out of lead in gasoline began during the 1970s, and subsequent CARB regulations have eliminated virtually all lead from gasoline now sold in California. All areas of the state currently are designated as attainment for state lead standard (USEPA does not designate areas for the national lead standard). Although the ambient lead standards are no longer violated, lead emissions from stationary sources still pose "hot spot" problems in some areas. Therefore, CARB has identified lead as a TAC.

3.9.2.3 Monitoring-Station Data and Attainment-Area Designations

Concentrations of criteria air pollutants are measured at an ambient air quality monitoring station in Yreka (located at 525 South Foothill Drive), which is the closest monitoring station to the Proposed Project in the NPAB. This monitoring station is centrally located in Siskiyou County and is the main station that measures criteria air pollutants in the county. As such, this monitoring station is considered representative of air quality in Siskiyou County. The most recent three years of available information on air quality data is provided in Table RE-3.9-1. As noted below, carbon monoxide (CO) and nitrogen dioxide (NO_X) are not measured at the Yreka monitoring station. Data for CO and NO_X in Table RE-3.9-1 was obtained from the closest monitoring station to Yreka, which is the Eureka-Jacobs monitoring station in Eureka, CA. The most recent data available for CO from the Eureka-Jacobs monitoring station is 2012–2014.

Table RE-3.9-1. Summary of Annual Ambient Air Quality Data (2014–2016).

	2014	2015	2016
Ozone			
Maximum concentration (1-hour/8-hour average, ppm)	0.082/0.065	0.076/0.066	0.092/0.068
Number of days state standard exceeded (1-hour)	0	0	0
Number of days 8-hour standard exceeded (National/California)	0/0	0/0	0/0
Carbon Monoxide[1]			
Maximum concentration (8-hour, ppm)	0.70	*	*
Number of days state standard exceeded	0	0	0
Number of days national standard exceeded	0	0	0
Nitrogen Dioxide[1]			
Maximum concentration (1-hour, ppb)	26.9	35.9	35.1
Number of days state standard exceeded	0	0	0
Annual average (ppm)	2	3	2
Fine Particulate Matter ($PM_{2.5}$)			
Maximum concentration (ug/m^3) (National/California)	71.9/71.9	51.0/51.0	25.1/25.1
Number of days national standard exceeded (estimated/measured)	*/2	*/2	0.0/0
Annual average (ug/m^3) (National/California)	*/*	*/*	4.9/*

	2014	2015	2016
Respirable Particulate Matter (PM_{10})			
Maximum concentration (ug/m^3) (National/California)	90.6/82.9	65.5/59.6	*/*
Number of days state standard exceeded (estimated/measured)	*/3	6.1/1	*/0
Number of days national standard exceeded (estimated/measured)	0.0/0	0.0/0	*/0
Annual average (ug/m^3) (California)	*	12.9	*

Source: CARB 2017

Notes:

ug/m^3 = micrograms per cubic meter

$PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

PM_{10} = particulate matter less than or equal to 10 microns in diameter

ppm = parts per million

ppb = parts per billion

* Insufficient data available to determine the value.

[1] Carbon monoxide and nitrogen dioxide are not measured at any monitoring station in the NPAB. The data shown in the table were obtained from the Eureka-Jacobs monitoring station in Eureka, California, which is approximately 135 miles southwest of the Proposed Project. The most current data available for carbon monoxide from this monitoring station were for the years 2012–2014.

Both CARB and USEPA use this type of monitoring data to designate areas according to their attainment status for criteria air pollutants. The purpose of these designations is to identify areas with air quality problems, and initiate planning efforts for improvement. The three basic designation categories are "non-attainment," "attainment," and "unclassified." The attainment designation means that an area meets the national or state ambient air quality standards for a given criteria air pollutant. The non-attainment designation means that an area exceeds the national or state ambient air quality standards for a given criteria air pollutant. The unclassified designation is used in an area that cannot be classified on the basis of available information as meeting or not meeting the standards. In addition, the California designations include a subcategory of the non-attainment designation, called "non-attainment-transitional." The non-attainment-transitional designation is given to non-attainment areas that are progressing and nearing attainment.

Table RE-3.9-2 shows the attainment status of Siskiyou County with respect to NAAQS (CARB 2016b) and CAAQS (CARB 2016b). As indicated in Table RE-3.9-2, Siskiyou County is designated as attainment or unclassified for all federal and state ambient air quality standards.

Table RE-3.9-2. Attainment Status Summary, Siskiyou County.

Criteria Pollutant	Federal Designation	State Designation
Ozone (O_3) (1-hour)	(no federal standard)	Attainment
Ozone (O_3) (8-hour)	Unclassified/Attainment*	Attainment
Nitrogen Dioxide (NO_2)	Unclassified/Attainment*	Attainment
Sulfur Dioxide (SO_2)	Unclassified*	Attainment
Carbon Monoxide (CO)	Unclassified/Attainment*	Unclassified*
Particulates (as PM_{10})	Unclassified*	Attainment
Particulates (as $PM_{2.5}$)	Unclassified/Attainment*	Attainment
Lead (Pb)	Unclassified/Attainment*	Attainment
Sulfates (as SO_4)	(no federal standard)	Attainment
Hydrogen Sulfide (H_2S)	(no federal standard)	Unclassified*
Vinyl Chloride (C_2H_3Cl)	(no federal standard)	n/d
Visibility Reducing Particles	(no federal standard)	Unclassified*

Source: CARB 2015a

Notes:

* At the time of designation, if the available data does not support a designation of attainment or non-attainment, the area is designated as unclassified.

n/d—no data/information available

Appendix N *Air Emissions Modeling for the Lower Klamath Project* provides a summary of the existing emission sources and monitoring data, detailed emission calculation methodologies, and detailed emission inventories.

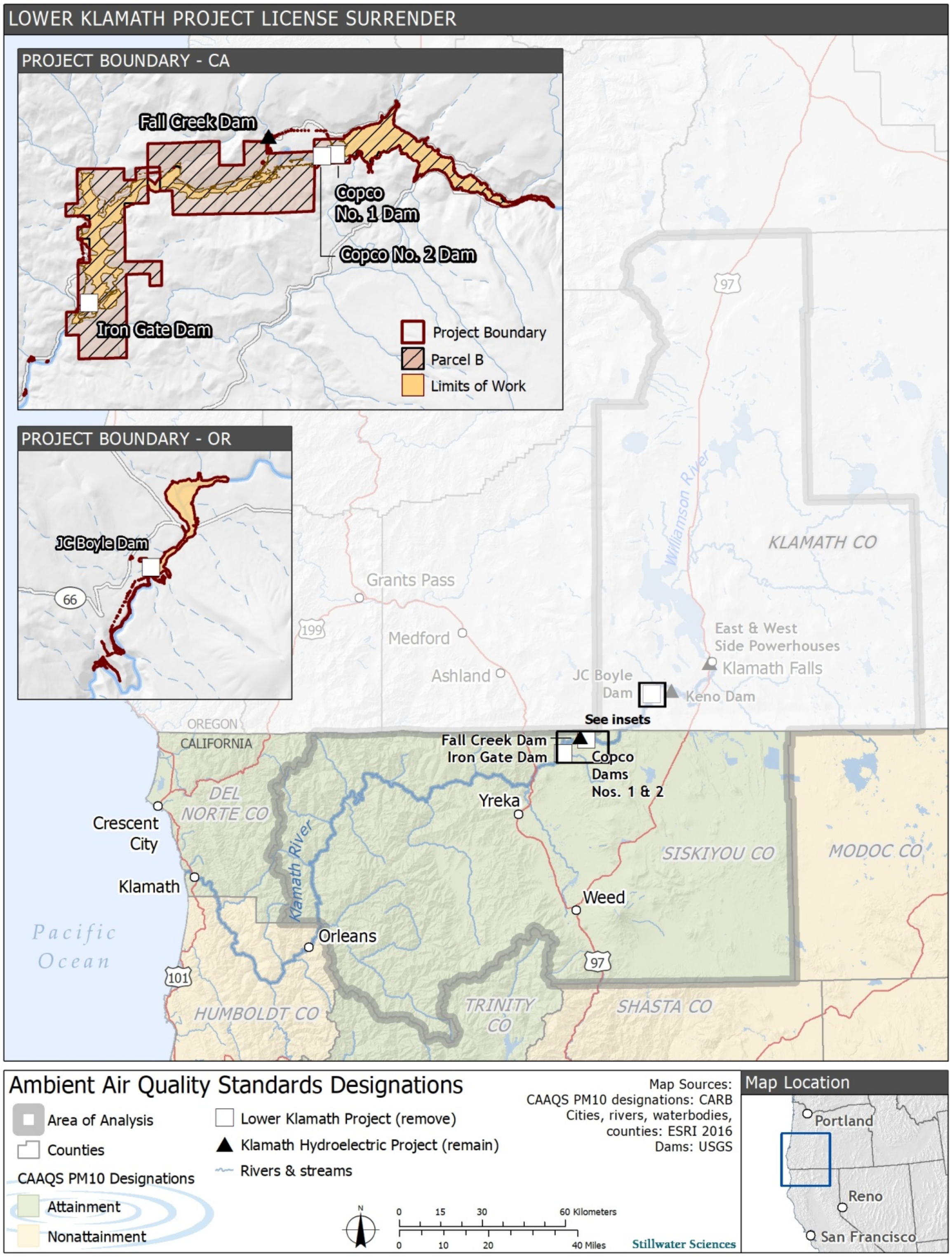

Figure RE-3.9-2. Particulate Matter (PM_{10}) California Ambient Air Quality Standards (CAAQS) Designations.

3.9.2.4 Air Quality Conditions

Sources of criteria air pollutant emissions in Siskiyou County include stationary, area-wide, and mobile sources. These sources are summarized in Table RE-3.9-3. According to Siskiyou County's emissions inventory, stationary sources provide a relatively small contribution to total emissions. Area-wide sources, which include emissions released over a wide area such as consumer products, fireplaces, road dust, and farming operations, account for approximately 94 percent and 78 percent of the county's total PM_{10} and $PM_{2.5}$ emissions respectively, and 66 percent of total ROG emissions. Mobile sources are the largest contributor to the estimated annual average air pollutant levels of NO_X, accounting for approximately 94 percent of the total emissions. Mobile sources also account for approximately 27 percent of the total ROG emissions for the county.

Table RE-3.9-3. Summary of 2015 Estimated Emissions Inventory for Siskiyou County.

Source Type/Category	**Estimated Annual Average Emissions (Tons per Day)**			
	ROG	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Stationary Sources				
Fuel Combustion	0.09	0.33	0.25	0.24
Waste Disposal	0.00	0.00	0.00	0.00
Cleaning and Surface Coating	0.19	-	-	-
Petroleum Production and Marketing	0.40	-	-	-
Industrial Processes	0.14	-	0.35	0.15
Subtotal (Stationary Sources)	**0.82**	**0.33**	**0.61**	**0.39**
Area wide Sources				
Solvent Evaporation	4.63	-	-	-
Miscellaneous Processes	3.89	0.70	17.05	4.80
Subtotal (Area-wide Sources)	**8.52**	**0.70**	**17.05**	**4.80**

Source Type/Category	Estimated Annual Average Emissions (Tons per Day)			
Mobile Sources				
On-Road Motor Vehicles	1.74	4.96	0.24	0.13
Other Mobile Sources	0.90	2.40	0.11	0.10
Subtotal (Mobile Sources)	**2.64**	**7.36**	**0.36**	**0.23**
Grand Total for Siskiyou County	**11.98**	**8.39**	**18.01**	**5.42**

Source: CARB 2015b
Notes: "-" = less than 0.1 ton per day
Totals shown in this table are rounded, and therefore may not appear to add exactly.

3.9.2.5 Local Emission Sources

Land uses surrounding the Limits of Work for the Proposed Project include mainly open space and recreational land. Sources of criteria air pollutants are primarily area-wide and mobile sources. Mobile sources include road motor vehicles, such as trucks and passenger vehicles. Area-wide sources include road dust, farming operations, and fireplaces.

3.9.2.6 Air Quality—Toxic Air Contaminants

TAC, referred to at the federal level as hazardous air pollutants (HAPs), are defined as air pollutants that may cause or contribute to an increase in mortality or serious illness or pose a hazard to human health. TACs usually are present in small quantities in the ambient air. However, in some cases, their high toxicity or health risk may pose a threat to public health even at low concentrations. Of the TACs for which data are available in California, diesel PM, benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, and perchloroethylene pose the greatest risks. TACs can cause long-term health effects such as cancer, birth defects, neurological damage, and genetic damage; or short-term acute effects such as eye watering, respiratory irritation, rhinitis, throat pain, and headaches.

According to CARB, the majority of the estimated health risk from TACs can be attributed to relatively few compounds, the most important being particulate matter from diesel-fueled engines (diesel PM) (CARB 2013). Diesel PM differs from other TACs in that it is not a single substance but rather a complex mixture of hundreds of substances. Although diesel PM is emitted by diesel-fueled, internal combustion engines, the composition of the emissions varies depending on engine type, operating conditions, fuel composition, lubricating oil, and whether an emission control system is present. Other sources of particulate matter emissions are discussed in Section 3.9.2.2 *Criteria Air Pollutants*.

Statewide, diesel PM emissions account for approximately two percent of the annual average for on-road emissions, while other diesel PM emissions from off-road mobile sources (e.g., construction and agricultural equipment) account for an additional three percent (CARB 2013). Statewide diesel PM emissions decreased approximately 37 percent from year 2000 to 2010, primarily from implementation of more stringent federal emission standards and cleaner burning diesel fuel (CARB 2013). CARB anticipates that diesel PM emissions from on-road and other mobile sources (e.g., construction and agricultural equipment) will continue to decrease into 2035. This decrease would also be attributed to more stringent emissions standards and the introduction of cleaner burning diesel fuel.

In addition, asbestos is also considered a TAC. Naturally occurring asbestos, which was identified as a TAC in 1986 by CARB, is located in the existing geology in many parts of California. An investigation was conducted of the potential for naturally occurring asbestos to occur both in the bedrock of the Lower Klamath Project boundary, as well as in the concrete used to construction the dams (KRRC 2019a). A survey of existing geologic information revealed that the mineral content typically associated with naturally occurring asbestos is not known to occur in the Lower Klamath Project Boundary. According to the United State Geological Survey (USGS) and the Department of Conservation, Division of Mines and Geology, the geology of California has been extensively investigated. The Lower Klamath Project Boundary is situated in the Western and High Cascade Range. This range consists of a suite of Tertiary and Quaternary flow rocks. Specifically, the mineral content of these mafic rocks includes andesite and basalt. Naturally occurring asbestos typically occurs in ultramafic rocks with a mineral content of serpentine and amphibole, which are not known to occur in the Project area (USGS 2019). This is confirmed by the California Division of Mines and Geology General Location Guide for Ultramafic Rocks in California – Areas more likely to Contain Naturally Occurring Asbestos (August 2000), as well as several publicly available USGS publications focused on the Cascade Range and Northern California (USGS 2011). While Project construction activities are unlikely to disturb bedrock, these sources suggest that even if bedrock is disturbed, it is unlikely to contain naturally occurring asbestos (KRRC 2019a).

Due to the lack of information pertaining to the specific concrete production of the dam facilities, it is not known for certain whether local aggregate was used in this process. Historical photographs suggest that concrete was locally sourced during the original construction. While available historical records do not specify the precise aggregate borrow sites, there is no evidence that aggregates were hauled long distances to the project sites. Since the aggregate was likely locally-sourced, it is unlikely that the concrete would contain naturally occurring asbestos considering naturally occurring asbestos is not known to occur within the Lower Klamath Project boundary (KRRC 2019a).

Between August and December 2018, HBMS were conducted by the KRRC at the following sites: J.C. Boyle Development, Copco No. 1 Development, Copco No. 2 Development, Iron Gate Development, Iron Gate and Fall Creek hatcheries, and the City of Yreka Intake Structure and Dam. Where accessible, bulk concrete samples were collected as part of these surveys in accordance with the CARB method 435 Method to determine the presence of naturally occurring asbestos. Concrete samples did not contain detectable naturally occurring asbestos above the polarized light microscopy point count threshold of 0.25 percent at each of the sites (KRRC 2019a). Based on the above information, removal of these facilities is unlikely to release naturally occurring asbestos and the Proposed Project is not subject to the requirements of 17 CCR 93105 (Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations) (CARB 2002).

The Proposed Project would result in the demolition of the existing structures and other infrastructure at the Lower Klamath Project facilities. Some of the existing structures on the project sites were constructed prior to 1978. Accordingly, there is the potential for asbestos-containing materials to be present in the structures that would be demolished as part of the Proposed Project. Demolition of structures with asbestos-containing materials can result in potential exposure of people to airborne asbestos. Inhalation of asbestos can cause long-term health effects such as reduced respiratory function, fibrotic lung disease (asbestosis), lung cancer, and mesothelioma. Enlargement of the heart can also occur as an indirect effect from the increase resistance of blood flow through the lungs.

The most recent Asbestos Containing Materials surveys were conducted by the KRRC between August and December 2018 as part of the HBMS. During 2018, sample and analysis was performed at the aforementioned site in accordance with USEPA Natural Emission Standards for Hazardous Air Pollutants requirements. Detectable asbestos above 0.1 percent was identified in several materials (e.g., surfacing materials, thermal system insultation, and miscellaneous materials). The KRRC and its representatives will also be performing a Level II Project Facilities Inspection in the future.

3.9.2.7 Regional Haze

To protect visibility in Class 1 federal lands (e.g., national parks and scenic areas), the USEPA adopted the Regional Haze Rule in 1999. This rule lays out specific requirements to ensure improvements in the anthropogenic components of visibility at 156 of the largest national parks and wilderness areas across the United States, which are referred to as Federal Class I Areas. The goal of the Regional Haze Rule is to ensure that visibility on the 20 percent most impaired days continues to improve at each Federal Class I Area, and that visibility on the 20 percent least impaired days does not get worse. The vast majority of Class I Areas are in the West (118), with 29 in California, including such national treasures as Yosemite and Sequoia National Parks. Good visibility is essential to the enjoyment of national parks and scenic areas. Across the United States, regional haze has decreased the visual range in these pristine areas from 140 miles to 35–90 miles in the west, and from 90 miles to 15–25 miles in the east. This haze is composed of small particles that absorb and scatter light, affecting the clarity and color of what humans see in a vista. The pollutants (also called *haze species*) that create haze are measurable as sulfates, nitrates, organic carbon, elemental carbon, fine soil, sea salt, and coarse mass. Anthropogenic sources of haze include industry, motor vehicles, agricultural and forestry burning, and dust from soils disturbed by human activities. Pollutants from these sources, in concentrations much lower than those which affect public health, can impair visibility anywhere (CARB 2009).

To comply with the Regional Haze Rule, CARB developed a Regional Haze Plan in 2009 (2009 Plan) which sets out a long-term path towards attaining improved visibility in national parks and other scenic areas, with the goal of achieving visibility which reflects natural conditions by year 2064. Unlike State Implementation Plans which require specific targets and attainment dates, the Regional Haze Rule requires states to provide for a series of interim goals to ensure continued progress. The state Haze Plans must be submitted to the USEPA for review and approval. Progress towards the interim goals are evaluated in a progress report that is required to be prepared every five years. Additionally a Plan revision with new interim goals is required every ten years.

The 2009 Plan sets forth visibility goals and represents California's broader western regional effort to assess the visibility improvements for the first interim goal period of 2018. Currently, no other interim goals have been finalized.

An update of the 2009 Plan is anticipated to be completed in July 2021 and will address the second planning period from 2018 to 2028. The western states have built upon the lessons learned in the first planning period (i.e., 2009-2018) to work toward new tools and methodologies for understanding regional haze in the second planning period. Regional haze planning in the near future will require additional improvements in the analysis of anthropogenic emissions, as well as improvements to quantify natural and international emissions (Uhl et al. 2019).

Northern California Sub-region

The 2009 Plan divides California into four collective geographic areas or sub-regions of the state based on similar natural features, land uses, and population densities. This facilitates comparison of different landscapes, meteorological conditions, and the impacts of local and regional emissions. The Proposed Project is located in the Northern California sub-region, which encompasses most of the Northeast Plateau Air Basin, the northeastern portion of the North

Coast Air Basin, and the northern part of the Sacramento Valley Air Basin. Concentrations of haze-causing pollutants are measured at seventeen IMPROVE (Interagency Monitoring of Protected Visual Environments) monitoring sites throughout California (CARB 2009). The IMPROVE monitoring sites and associated Class I Areas in this subregion are LABE (monitoring Lava Beds and South Warner Wilderness), LAVO (monitoring Lassen Volcanic National Park, Caribou Wilderness, and Thousand Lakes Wilderness), and TRIN (monitoring Marble Mountain Wilderness and Yolla Bolly-Middle Eel Wilderness). Emission sources contributing to haze in the Northern California sub-region are primarily from rural land uses as there are few cities and towns. However, the I-5 corridor has considerable traffic, particularly truck traffic. Major rail freight corridors also pass through the Northern California sub-region (CARB 2009).

There are two Federal Class I Areas within Siskiyou County, including the Lava Beds National Monument (east of the Proposed Project) and the Marble Mountain Wilderness (southwest of the Proposed Project). Visibility impairment at the Lava Beds National Monument is measured at the LABE monitoring site in Siskiyou County. LABE is responsible for measuring and characterizing visibility impairment and haze species for both the Lava Beds National Monument and the South Warner Wilderness (located in Modoc County). Visibility impairment at the Marble Mountain Wilderness is measured at the TRIN monitoring site in Trinity County. TRIN is responsible for measuring and characterizing visibility impairment and haze species for both the Marble Mountain Wilderness and the Yolla Bolly-Middle Eel Wilderness (located in Trinity County) (CARB 2009).

The 2009 Plan compiled visibility impairment data, collected between 2000 and 2004, to establish a “haze plan baseline” for future analysis. As discussed in the 2009 Plan, days with the worst air quality in the Northern California sub-region are dominated by organic aerosols, which peak during the summer months and show a strong correlation with the incidence of wildfires. In addition to wildfires, natural biogenic emissions from plants play an important role in contributing to elevated organic aerosol levels observed during spring and summer months. On the worst air quality days, the emissions of organic aerosols dwarf the contributions from other sources including sulfates and nitrates. Source apportionment shows that natural wildfires and biogenic emissions contribute 70 to 80 percent of the organic aerosols on worst days, with the balance from areas sources and anthropogenic fires (CARB 2009).

The California Regional Haze Plan 2014 Progress Report (2014 Progress Report) compared five-year averages of 2007 to 2011 visibility data with the 2000 to 2004 “haze plan baseline” conditions from the 2009 Plan. The control strategies in the 2009 Plan (i.e., emissions reduction from on-going control programs, construction activity mitigation, source retirement and replacement, smoke management techniques) were determined to be effective in making progress towards the 2018 interim goals. The long-term trends for worst days averages showed visibility improving at every monitoring site, in the absence of very high wildfire years. Current best days were all better than or the same as those of the "haze plan baseline."

3.9.2.8 Sensitive Land Uses

As noted above, high concentrations of criteria air pollutants and toxic air contaminants can result in adverse health effects to humans. Some population groups are considered more sensitive to air pollution and odors than others; in particular, children, elderly, and acutely ill and chronically ill persons, especially those with cardio-respiratory diseases, such as asthma and bronchitis. Sensitive land uses are facilities that generally house more sensitive people (e.g., schools, hospitals, nursing homes, residences, etc.).

The areas surrounding Iron Gate Dam, Copco No. 1 Dam, and Copco No. 2 Dam are sparsely populated with few sensitive land uses. The nearest sensitive land uses are recreational facilities, located along the Copco No. 1 Reservoir and Iron Gate Reservoir, along with hiking trails around the Fall Creek development (see Section 3.20 *Recreation* for more details). These recreation facilities would be closed during dam removal activities. The next closest sensitive land uses include scattered residences that are located along the Klamath River. The closest homes to construction sites are located over 2,000 feet from Copco No. 1 Dam, over 3,500 feet from Copco No. 2 Dam, and over 4,000 feet from Iron Gate Dam. There are also several modular homes located at Copco Village that are currently occupied by PacifiCorp staff. These homes are located within the Limits of Work and range from 850 feet to 2,200 feet west of the Copco No. 2 Powerhouse (Figure 2.7-2). Prior to the beginning of dam deconstruction activities, it is anticipated that these homes would be vacated. The nearest licensed daycare providers and hospitals are located in Yreka, approximately 15 miles southwest of Iron Gate Dam. The nearest schools are more than five miles from Iron Gate Dam (Bogus Elementary is approximately 5.3 miles; Willow Creek Elementary School is approximately 5.5 miles; Hornbrook Elementary School is more than six miles).

3.9.2.9 Characteristics of Odors

Odors generally are regarded as a nuisance rather than a health hazard. However, manifestations of a person's reaction to foul odors can range from psychological (e.g., anger or anxiety) to physiological (e.g., circulatory and respiratory effects, nausea, vomiting, or headache).

The ability to detect odors varies considerably among the population and the odor interpretation is subjective. Some individuals have the ability to smell small quantities of specific substances. Others may not have the same sensitivity but may have sensitivities to odors of other substances. In addition, people may have different reactions to the same odor. An odor that is offensive to one person (e.g., from a fast food restaurant) may be perfectly acceptable to another.

Unfamiliar odors are detected more easily than familiar odors and are more likely to be offensive.

Quality and intensity are two properties present in any odor. The quality of an odor indicates the nature of the smell experience. For instance, if a person describes an odor as flowery or sweet, then the person is describing the quality of the odor. Intensity refers to the strength of the odor. Odor intensity depends on the odorant concentration in the air. When an odorous sample is progressively diluted, the odorant concentration decreases. As this occurs, the intensity of the odor weakens and eventually becomes so low that detection or recognition of the odor is difficult. At some point during dilution, the concentration of the odorant reaches a detection threshold. An odorant concentration below the detection threshold means that the concentration in the air is not detectable by the average person (Siskiyou County 2017).

Odors currently present on a periodic basis in areas within and adjacent to the Proposed Project Limits of Work are generated from livestock, agricultural crop production, wood burning, wildfires, on-site wastewater treatment systems, and algal blooms in Iron Gate Reservoir and Copco No. 1 Reservoir.

3.9.3 Significance Criteria

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

1. Exceed the Siskiyou County Air Pollution Control District (SCAPCD) emissions thresholds for stationary sources in Rule 6.1 (Construction Permit Standards for Criteria Air Pollutants).
2. Substantially conflict with or obstruct implementation of the California Regional Haze Plan.
3. Result in a cumulatively considerable net increase of any criteria pollutant for which the SCAPCD is in non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors).
4. Expose sensitive receptors to substantial toxic air contaminant concentrations.
5. Create objectionable odors adversely affecting a substantial number of people.

For areas that are designated as non-attainment for criteria air pollutants, some of the air districts in California have developed air quality plans that contain measures designed to reduce the sources of these air pollutants. As noted in Table RE-3.9-2 (Attainment Status Summary, Siskiyou County), Siskiyou County is designated as attainment or unclassified for all federal and state ambient air quality standards. As such, the SCAPCD has not developed any air quality plans relevant to the Proposed Project. As noted above, the construction emissions in Oregon are only being considered to the extent that these emissions would influence air quality in Siskiyou County, California. As such, consistency with air quality plans relevant to Klamath County, Oregon are not considered in this section.

An air quality impact would be significant if the concentrations of haze-causing pollutants from the Proposed Project would substantially conflict with or obstruct implementation of the Regional Haze Plan.

As noted above, the project is located in the Northeast Plateau Air Basin and is within the SCAPCD. In determining whether a project has significant air quality impacts on the environment, CEQA practitioners typically apply the local air district's thresholds of significance to projects in the environmental review process. Siskiyou County is in attainment or unclassified for all criteria air pollutants and the SCAPCD has not adopted CEQA significance thresholds.

However, for the purposes of assessing air quality impacts in CEQA documents, SCAPCD Rule 6.1 (Construction Permit Standards for Criteria Pollutants), which contains thresholds for operational emissions from new stationary sources, is commonly used as a significance threshold for construction emissions (e.g., Siskiyou County's Crystal Geyser Bottling Plant Project Final Environmental Impact Report (adopted September 27, 2017); City of Weed's Addendum to the Final Environmental Impact Report for the Love's Travel Stop (April 2019); City of Mount Shasta's Golden Eagle Charter School Proposed Mitigated Negative Declaration and Initial Study (April 2019)).

Although these stationary source emissions thresholds do not directly apply to construction activities, they provide a reference point for levels of emissions that would trigger SCAPCD requirements for best available control technology and/or mitigation off-sets. Per Rule 6.1, criteria air pollutants from the operation of stationary sources are considered significant if they exceed the following thresholds.

- 250 pounds per day for NO_X, volatile organic compounds (VOC), PM_{10}, $PM_{2.5}$, sulfur oxides (SO_X)
- 2,500 pounds per day for CO

In using SCAPCD Rule 6.1 as a threshold in this EIR, the Lead Agency is exercising its discretion to formulate CEQA significance criteria based in part on the SCAPCD rules, as they reflect the best available expert judgment regarding what constitutes significant levels of air pollution within the Northeast Plateau Air Basin and Siskiyou County.

Since the Proposed Project proposes construction activity related to the decommissioning of the Lower Klamath Project facilities that would be completed within two years of execution, it would not include increases in long-term operational emissions. As described in greater detail below, it is assumed that operational emissions under current conditions will be greater than operational emission post-dam removal. 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 SCAPCD stationary source operational emissions significance threshold for construction emissions from the Proposed Project is conservative because these emissions are limited in duration. For purposes of this EIR analysis, an air quality standard would be violated, and a significant air quality impact would result, if the construction emissions from the Proposed Project exceed the stationary source thresholds in SCAPCD Rule 6.1.

An air quality impact would be significant if project construction would expose sensitive receptors to substantial concentrations of TACs. As noted above, population groups including children, elderly, and acutely ill and chronically ill persons, are considered more sensitive to air pollution than others. Sensitive land uses are facilities that generally house more sensitive people (e.g., schools, hospitals, nursing homes, residences, etc.). Sensitive receptors within the immediate vicinity of construction activities would be at the greatest risk for exposure to heavy equipment emission diesel exhaust during construction. Concentrations of mobile source emissions of diesel particulate matter are typically reduced by 60 percent at a distance of approximately 300 feet (Zhu et al. 2002) and 70 percent at a distance of approximately 500 feet (CARB 2005).

There are several sources of odors that could result from the Proposed Project including odors from exposed sediments and odors from construction equipment emissions. These potential sources of odors are discussed below along with a determination of whether substantial numbers of people could be adversely impacted by these sources of odors.

3.9.4 Impact Analysis Approach

Within the Area of Analysis, potential air quality impacts due to construction activities related to the removal of the Lower Klamath Project facilities were quantitatively assessed for Siskiyou County, California and Klamath County, Oregon (to the extent air impacts in Oregon affect California air quality). The quantitative assessment focused on these counties because that is where construction activity would occur. Construction emissions estimates were developed for pre-dam removal activities (i.e., Fall Creek Hatchery modification; road, bridge, and culvert improvements; recreation facility removal; flood improvements; Yreka water supply pipeline relocation; seed collection; invasive exotic vegetation control; and Iron Gate Hatchery modification), decommissioning of the four dams and powerhouse structures, and restoration activities. As noted above, the construction emissions in Oregon are only being considered to the extent that these emissions would influence air quality in Siskiyou County, California.

No increases in operational emissions would occur as part of the Proposed Project; therefore, this analysis considers only construction-related air quality impacts. Operational emissions under current conditions (i.e., operation of the four Lower Klamath Project facilities and Iron Gate Hatchery) are estimated to be significantly greater than operational emissions under the Proposed Project (i.e., reduced operation of Iron Gate Hatchery, re-instated operation of Fall Creek Hatchery, no operation of hydroelectric power generation facilities). This is due to the fact that the existing operational emissions generated by the four Lower Klamath Project facilities (e.g., emissions from employee traffic, emissions from maintenance equipment and minor repairs, fugitive dust from traffic on unpaved roads, etc.) would be eliminated, and production levels at the two hatcheries post-dam removal would decrease relative to current conditions. Overall it is anticipated that there would be a net decrease in operational emissions post-dam removal under the Proposed Project.

The air quality impact modeling described in Appendix N *Air Emissions Modeling for the Lower Klamath Project* is based on the information available in EIR Appendix B *Definite Plan* as well as conservative assumptions regarding construction-related activities (e.g., overlapping of construction phases, equipment horsepower ratings, etc.). The Proposed Project and the data modeled for the EIR are compared to the thresholds noted in Section 3.9.3 *[Air Quality] Significance Criteria* and analyzed in Section 3.9.5 *[Air Quality] Potential Impacts and Mitigation*.

3.9.4.1 Quantification of Criteria Air Pollutants

Quantification of air pollutant emissions were conducted using a combination of methods, including the use of emission factors from the USEPA's published *AP-42: Compilation of Air Emissions Factors*, exhaust emission factors from the Sacramento Metropolitan Air Quality Management District's (SMAQMD) Road Construction Emissions Model (RCEM), conservative assumptions regarding Proposed Project activities (e.g., overlapping of construction phases, equipment horsepower ratings, etc.), and the California Emissions Estimator Model (CalEEMod) version 2016.3.2. Although the RCEM model was created by SMAQMD, this model is recommended for use throughout California for CEQA analyses.

Exhaust emissions from construction equipment were estimated using SMAQMD RCEM, version 9.0. Although the model was developed by SMAQMD, emission rates and engine usage factors for construction equipment are based on the same CARB-approved model (i.e., OFFROAD 2011) used in CalEEMod and statewide for conducting emissions modeling and is therefore appropriate for use in this analysis (SMAQMD 2019). Exhaust emissions from supplemental construction equipment such as lawnmowers, chippers, and chainsaws were estimated using OFFROAD 2007, as these equipment types are not included in the SMAQMD's RCEM. Additional supplemental construction equipment including worker boats and helicopters were estimated using USEPA and the Federal Office of Civil Aviation emissions factors, respectively. Rock blasting activity emissions were also estimated using AP-42 emissions factors for explosive detonation. The CARB EMFAC 2017 model was used to estimate emissions from on-road vehicles from worker commute trips and truck hauling trips. Fugitive dust emissions from construction activity (e.g., grading, earthmoving, stockpiling of material), travel on roads for truck haul trips and for worker commute trips were estimated using AP-42.

The Proposed Project schedule was used to determine when the maximum construction activity would occur, based on anticipated activity phasing, for comparison of emissions to maximum daily thresholds of significance. Overall, the construction phasing was determined based on Appendix B: *Definite Plan – Section 8.6 Construction Schedule*. Generally, the dates associated with construction phases in the Definite Plan were pushed forward one year to acknowledge the KRRC's recent proposed schedule adjustments (KRRC 2019b), and the overall duration of each phase/subphase remained approximately the same.

Equipment activity data (e.g., type, quantity, hours/day) were associated with the appropriate major construction phase (e.g., Pre-Dam Removal, Dam and Powerhouse Removal, Restoration). However, after a review of the anticipated construction phasing presented in the Definite Plan, activity hours were further split into subphases for Copco No. 1 and Iron Gate dams, to isolate activities that would occur prior to the major dam removal activities. For Copco No. 1 Dam demolition, activities were sub-divided into three subphases: Dam Modification, Powerhouse Demolition, and Dam Demolition. For Iron Gate Dam removal, activities were sub-divided into three subphases: Dam Modification, Fish Hatchery at Dam Toe Demolition, and Dam Demolition. For the purpose of this analysis, it was assumed that the recreational facilities removal and the supporting construction or pre-dam removal construction phases would occur prior to major dam removal activity. Because these phases would occur prior to dam removal, they are not included in the calculation of the maximum daily emissions scenario. The maximum daily emissions scenario will occur during dam removal.

In determining the potential maximum daily emissions, the main dam demolition phases for Iron Gate, Copco No. 1, Copco No. 2, and J.C. Boyle, were all assumed to overlap by at least one day. Activities associated with blasting would also potentially occur during each of the main dam demolition phases. Lastly, restoration of all four dams would overlap with the four dam demolitions and blasting activities. Appendix N, Table RE-N-3 provides the overall anticipated construction schedule and general phasing. Maximum daily emissions were estimated by reviewing the overall project schedule in the Definite Plan and determining what phases would overlap to generate the highest emissions.

Since issuance of the Draft EIR in 2018, KRRC has proposed and agreed to implement mitigation measures to reduce emissions of NO_X and particulate matter, including Mitigation Measures Air Quality (AQ)-1 (Off-road construction equipment), AQ-2 (On-road construction equipment), AQ-3 (Trucks used to transport materials), AQ-4 (Blasting-related dust control measures) (KRRC 2019c), and AQ-5 (General construction dust control measures) (KRRC 2019d) (for more detail, see Potential Impact 3.9-1). Mitigation Measure AQ-1 requires the use of off-road construction equipment (50 horsepower or greater) to meet EPA Tier 4 Final emissions standards, or Tier 3 and Tier 4 interim emissions standards if adequately documented that no Tier 4 Final equipment is available or feasible. Mitigation Measures AQ-2 and AQ-3 require on-road construction equipment and heavy-duty trucks to be equipped with engines that meet the 2010 model year or newer emissions standards. Mitigation Measure AQ-4 requires dust control measures to minimize fugitive dust emissions during blasting operations at Copco No. 1 Dam. Mitigation Measure AQ-5 requires dust control measures during general construction activity to minimize fugitive dust emissions from exposed surfaces and track-out onto paved roads. Appendix N provides estimates of emissions without Mitigation Measures AQ-1 through AQ-5, as well as an estimate of the percent reduction in emissions that would occur after implementation of Mitigation Measures AQ-1 through AQ-5. These estimates primarily focus on the reductions in NO_X that would occur from the implementation of Mitigation Measure AQ-1 and the reduction in PM_{10} that would occur from the implementation of Mitigation Measure AQ-5.

3.9.5 Potential Impacts and Mitigation

Potential Impact 3.9-1 Exceedance of the Siskiyou County Air Pollution Control District (SCAPCD) emissions thresholds in Rule 6.1 (Construction Permit Standards for Criteria Air Pollutants).

Table RE-3.9-4 summarizes the unmitigated emissions from major construction activities associated with the Proposed Project including dam and powerhouse deconstruction, blasting, and restoration of the reservoir footprints and disturbed upland areas. Since these Proposed Project activities have the potential to overlap, their daily emissions are combined and compared to emissions thresholds in the SCAPCD's Rule 6.1 (Construction Permit Standards for Criteria Air Pollutants).

The daily emissions estimates in Table RE-3.9-4 also include construction activity related to the removal of J.C. Boyle Dam in Oregon. Due to the potential for the emissions generated from construction activity in Oregon to have air quality impacts in Siskiyou County, California, the emissions from construction activity in Oregon are conservatively added to the emissions from construction activity in California and compared to the SCAPCD's significance thresholds.

Table RE-3.9-4. Unmitigated Emissions Inventories for the Proposed Project.

Phase	**Peak Daily Emissions (pounds per day)[1]**					
	ROG	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$[2]**
Dam and Powerhouse Deconstruction	151	1,202	**1,295**	73	248	76
Blasting	-	13	3	0	-	-
Restoration Activities	45	200	222	19	24	10
Maximum Daily	196	1,415	**1,520**	92	**272**	86
Significance Criterion[1]	250	2,500	250	250	250	250

Source: Appendix N

Notes:

[1] Values shown in **bold** exceed the Siskiyou County Air Pollution Control District's (SCAPCD) thresholds of significance in Rule 6.1 (Construction Permit Standards for Criteria Air Pollutants).

Key:

ROG = reactive organic gases
CO = carbon monoxide
NO_X = nitrogen oxides
SO_2 = sulfur dioxide
PM_{10} = inhalable particulate matter
$PM_{2.5}$ = fine particulate matter

As shown in Table RE-3.9-4, NO_X and PM_{10} emissions exceed the threshold for the combined construction phase of dam removal, blasting, and restoration. As mentioned, these three phases were conservatively assumed to overlap in time, generating the maximum daily emissions. Project exceedances of NO_X and PM_{10} emissions would be a significant and unavoidable impact without mitigation.

As discussed in Section 3.9.4 *[Air Quality] Impact Analysis Approach*, it was assumed that the supporting construction or pre-dam removal construction phases (Fall Creek Hatchery modification; access, road, bridge, and culvert improvements; recreation facility removal; flood improvements; Yreka water supply pipeline relocation; seed collection; invasive exotic vegetation control; and Iron Gate Hatchery modification) would occur prior to major dam removal activity, and therefore, were not included in the estimate of maximum daily emissions for the major construction activities associated with the Proposed Project. As such, the potential impacts of the pre-dam removal activities are addressed separately below.

As discussed in Section 3.9.4.1, *Quantification of Criteria Air Pollutants*, and detailed below, the KRRC has proposed and agreed to implement five air quality mitigation measures to reduce Proposed Project emissions of NO_X and PM_{10}. These air quality mitigation measures include the following and are discussed further below:

- AQ-1 *Off Road Construction Equipment Engine Tier* requires EPA Tier 4 Final emissions standards for off-road compression-ignition (diesel) engines.
- AQ-2 *On-Road Construction Equipment Engine Model Year* requires heavy-duty on road construction equipment to meet model year (MY) 2010 or newer on-road emission standards.
- AQ-3 *Heavy-Duty Trucks Engine Model Year* requires heavy-duty trucks to meet the MY 2010 or later emission standards.
- AQ-4 *Dust Control Measures* requires the implementation of several dust control measures during blasting activity at Copco No. 1 Dam.
- AQ-5 *General Construction Dust Control Measures* requires the implementation of several dust control measures during general construction activity.

The use of USEPA Tier 4 engines, as proposed by Mitigation Measure AQ-1, can reduce diesel exhaust (i.e., PM_{10}) and NO_X emissions by up to 90 percent over Tier 1 engines (SMAQMD 2016a). However, construction fleets in California are comprised of a combination of engines, ranging from Tier 1 to Tier 4, and as older equipment are rebuilt or replaced, the composition of higher tiered engines will increase. At this time, it cannot be determined what ratio of Tier 4 or Tier 3 engines the construction fleet will have. Further, certain equipment types/sizes are not always available in Tier 4 engines, so it cannot be guaranteed that the entire fleet can be composed of Tier 4 engines (Appendix N). As shown above in Table RE-3.9-4, maximum daily emissions of NO_X were estimated to be as high as 1,518 lb/day, and therefore, an 84 percent reduction in emissions would be needed to achieve the 250 lb/day threshold. Considering that statewide average construction fleet emissions continue to improve, and the unlikeliness that Tier 4 engines would be available for all equipment types, the needed 84 percent reduction in NO_X emissions would not be achieved and emissions would remain above the 250 lb/day threshold for NO_X (Appendix N).

The use of on-road construction equipment and heavy duty trucks that meet MY 2010 or newer emissions standards, as described by Mitigation Measures AQ-2 and AQ-3, can also reduce diesel exhaust (i.e., PM_{10}) and NO_X emissions. However, due to the uncertainty of the specific model year emissions standards that will be met by the construction fleet for the Proposed Project, providing an accurate quantification of these reductions was not feasible. Therefore, it is estimated that the needed 84 percent reduction in NO_X emissions would not be achieved and emissions would remain above the 250 lb/day threshold for NOx (Appendix N).

Implementation of the dust control measures in Mitigation Measures AQ-4 and AQ-5 can reduce fugitive dust by up to 50 percent. As noted above, the implementation of Mitigation Measure AQ-1 could also significantly reduce exhaust emissions (i.e., PM_{10}). As shown above in Table RE-3.9-4, maximum daily emissions of PM_{10} were estimated to be as high as 272 lb/day, and approximately 77 percent of these emissions would be from fugitive dust and 23 percent would be from exhaust. Therefore, a 50 percent or greater reduction in fugitive dust and exhaust emissions would reduce PM_{10} emissions well below the 250 lb/day threshold.

With the implementation of Mitigation Measures AQ-1 through AQ-5, construction emissions from the Proposed Project would still result in significant and unavoidable impacts from NO_X.

In addition to Mitigation Measures AQ-1 through AQ-5, Appendix N describes different or additional fugitive dust reduction measures and exhaust reduction measures that could reduce emissions of NO_x and PM_{10} from the Proposed Project. However, overseeing development and implementation of such measures does not fall within the scope of the State Water Board's water quality certification authority and the State Water Board cannot ensure their implementation. Without an enforcement mechanism, such measures cannot be deemed feasible for the purposes of CEQA.

The discussion below provides more detailed information about the emissions from the various project activities (i.e., dam and powerhouse deconstruction, blasting, restoration activities, and pre-dam removal activities).

Dam and Powerhouse Deconstruction
Vehicle exhaust and fugitive dust emissions from dam removal activities would generate emissions of ROG, NO_X, CO, SO_2, PM_{10}, and $PM_{2.5}$ during the dam deconstruction period. The emission sources would include exhaust emissions from off-road construction equipment, on-road trucks, construction worker employee commuting vehicles, fugitive dust emissions from unpaved roads, blasting activities, and general earth-moving activities. Activities that could generate fugitive dust include on-site operation of construction equipment and removal and placement of excavated materials (cut/fill activities).

Predicted unmitigated peak daily emission rates for ROG, NO_X, CO, SO_2, PM_{10}, and $PM_{2.5}$ for dam and powerhouse deconstruction are summarized in Table RE-3.9-5. This analysis uses the conservative assumption that the peak day of construction could occur at the same time for each dam; therefore, the peak daily emissions are additive.

Table RE-3.9-5. Unmitigated Emissions Inventories for Dam and Powerhouse Deconstruction.

Location	**Peak Daily Emissions (pounds per day)**[1]					
	ROG	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Iron Gate	44	255	**391**	11	73	21
Copco No. 1	25	146	205	24	10	14
Copco No. 2	19	448	159	23	73	13
J.C. Boyle	62	354	**542**	14	92	28
Maximum Daily	151	1,203	**1,295**	72	248	76
California Total[2]	89	849	**753**	58	156	48
Oregon Total	62	354	**542**	14	92	28
Significance Criterion[1]	250	2,500	250	250	250	250

Source: Appendix N

Notes:

[1] Values shown in **bold** exceed the Siskiyou County Air Pollution Control District's (SCAPCD) thresholds of significance in Rule 6.1 (Construction Permit Standards for Criteria Air Pollutants).

[2] Appendix N - California total includes emissions for activities at Iron Gate Dam, Copco No. 1 Dam, and Copco No. 2 Dam.

As Table RE-3.9-5 shows, emissions from deconstruction of the dams would exceed the significance criteria for NO_X. The greatest source of NO_X emissions from each of the dams would be off-road construction equipment, followed by on-road trucks, and then employee commuting vehicles. As indicated in Table RE-3.9-4, deconstruction of the dams would produce the majority of construction emissions that would occur from the Proposed Project.

Cofferdams would be constructed during deconstruction activities from concrete rubble, rock, and earthen materials that would come from the dam removal activities, as possible. As the cofferdams would be constructed from materials salvaged from the dam demolition activities, emissions associated with cofferdam construction would already be included in the emissions inventory. Demolition of the cofferdams would be included in the emissions inventory for general dam demolition activities.

Following drawdown of the reservoirs and prior to the establishment of ground vegetation from reseeding, there is the potential for windblown dust to be generated from the exposed sediment deposits remaining in the reservoirs. Once reseeding occurs, it typically takes a minimum of four weeks for vegetation to be established to reduce the potential for windblown dust. Considering that reservoir drawdown would occur in the winter months (January to March), it is anticipated that the seasonally wet conditions would substantially reduce the potential for windblown dust until the establishment of vegetation. However, there is the potential for short-term impacts from windblown dust not accounted for in the particulate matter emission estimates in Table RE-3.9-5. Due to the mitigating factors noted above, it is not anticipated that the additional emissions from windblown dust would result in a change to the significance determinations.

Blasting Activities
Blasting activities would occur during each of the main dam demolition phases and has the potential to result in short-term increases in criteria air pollutants including CO and NO_X. Table RE-3.9-6 summarizes the emissions from the blasting activities.

Table RE-3.9-6. Unmitigated Emissions from Blasting Activities.

Phase	Peak Daily Emissions (pounds per day)					
	ROG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Blasting (including maximum daily emissions)	-	13	3	0.4	-	-

Source: Appendix N

Note that particulate matter associated with blasting is considered to be indistinguishable from particulate matter resulting from the shattered rock and thus the air pollutant modeling (Table RE-3.9-6) does not include emission factors for blasting-related particulate matter (PM_{10}, $PM_{2.5}$) (USEPA 1995). However, and as a conservative approach, the KRRC proposed and the State Water Board included, Mitigation Measure AQ-4 would reduce dust emissions from blasting associated with removal of Copco No. 1 Dam in addition to other measures that would ensure onsite dust is controlled.

Restoration Activities
Restoration actions included in the Reservoir Area Management Plan (Appendix B: *Definite Plan – Appendix H*) could result in short-term increases in criteria pollutant emissions from vehicles exhaust and fugitive dust from the use of helicopters or other small aircraft, 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 riverbank sediment and surrounding areas. Additional fall seeding may be necessary to supplement areas where spring hydroseeding was unsuccessful (Appendix B: *Definite Plan*).

The majority of peak daily emissions that would be generated by the restoration activities would occur from the use of barges or aircraft for reseeding during and following reservoir drawdown. As noted above, the restoration of all four dams was assumed to overlap with the four dam demolition and blasting activities. Table RE-3.9-7 summarizes emissions from restoration activities.

Table RE-3.9-7. Unmitigated Emissions from Restoration Activities.

Phase	Peak Daily Emissions (pounds per day)					
	ROG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Iron Gate	18.36	69.02	71.87	9.40	8.03	3.27
Copco No. 1	5.72	39.43	50.31	0.10	5.42	2.29
Copco No. 2	2.45	16.90	21.56	0.04	2.32	0.98
J.C. Boyle	18.86	74.41	77.90	9.42	8.23	3.45
Maximum Daily	45	200	222	19	24	10

Source: Appendix N

Pre-Dam Removal Activities

The pre-dam removal activities include the Fall Creek hatchery modification, access, road, bridge, and culvert improvements, recreation facility removal, flood improvements, Yreka water supply pipeline relocation, seed collection, invasive exotic vegetation control, and Iron Gate hatchery modification. As noted above, these activities would occur prior to major dam removal activity, and therefore, were not included in the estimate of maximum daily emissions for the major construction activities associated with the Proposed Project. Table RE-3.9-8 summarizes emissions from the pre-dam removal activities.

Table RE-3.9-8. Unmitigated Emissions from Pre-Dam Removal Activities.

Location	**Peak Daily Emissions (pounds per day)**					
	ROG	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$[2]**
Fall Creek hatchery modification	0.67	2.76	2.36	0.00	0.31	0.13
Access, road, bridge, and culvert replacements	3.70	19.87	26.47	0.20	2.33	1.14
Recreational facility removal	8.00	31.03	24.24	0.03	3.18	1.43
Flood improvements[1]	–	–	–	–	–	–
Yreka water supply pipeline relocation	1.33	5.46	7.97	0.01	1.09	0.49
Seed collection[1]	–	–	–	–	–	–
Invasive Exotic Vegetation control 1	0.28	3.80	2.68	0.01	0.14	0.13
Invasive Exotic Vegetation control 2	0.28	3.80	2.68	0.01	0.14	0.13
Iron Gate hatchery modification	3.02	21.44	22.76	0.04	1.12	1.04
Maximum Daily	17.29	88.16	89.14	0.29	8.31	4.49
Significance Criterion	250	2,500	250	250	250	250

Source: Emissions calculations are provided in Attachment A to Appendix N.
Notes:
[1] Emissions for these items are captured in on-road emissions calculations because there is no heavy equipment associated with these activities.

As Table RE-3.9-8 shows, emissions from the pre-dam removal activities would not exceed the SCAPCD significance criteria.

Health Impacts

As noted above, construction of the Proposed Project would result in emissions that would exceed SCAPCD's daily emissions thresholds for NO_X, even with the implementation of mitigation. The exceedance of the daily emissions threshold for NO_X would occur during a maximum daily emissions scenario for major construction activities including dam and powerhouse deconstruction, blasting, and restoration of the reservoir footprints and disturbed upland areas.

As described in Section 3.9.2.2 *Criteria Air Pollutants*, exposure to criteria pollutant emissions can cause human health effects. Potential health effects vary depending primarily on the pollutant type, the concentration of pollutants during exposure, and the duration of exposure. Air pollution does not affect every individual in the population in the same way, and some groups are more sensitive than others to adverse health effects.

As discussed in Section 3.9.2.8 *Sensitive Land Uses*, some population groups are considered more sensitive to air pollution and odors than others; in particular, children, elderly, and acutely ill and chronically ill persons, especially those with cardiorespiratory diseases, such as asthma and bronchitis. Sensitive land uses are facilities that generally house more sensitive people (e.g., schools, hospitals, nursing homes, residences, etc.) and that have a greater exposure time than that of other land uses.

As noted under Potential Impact 3.9-4, the nearest sensitive land uses are recreational facilities, located along the Copco No. 1 Reservoir and Iron Gate Reservoir, along with hiking trails around the Fall Creek development (see Section 3.20 *Recreation* for more details). These recreation facilities would be closed during dam removal activities. The next closest sensitive land uses include scattered residences that are located along the Klamath River. The closest homes to construction sites are located over 2,000 feet from Copco No. 1 Dam, over 3,500 feet from Copco No. 2 Dam, and over 4,000 feet from Iron Gate Dam. There are also several modular homes located at Copco Village that are currently occupied by PacifiCorp staff. These homes are located within the Limits of Work and range from 850 feet to 2,200 feet west of the Copco No. 2 Powerhouse (Figure 2.7-2). Prior to the beginning of dam deconstruction activities, it is anticipated that these homes would be vacated. However, for the purposes of this analysis, it is conservatively assumed that the homes at Copco Village would be occupied.

The exact location and magnitude of health impacts that could occur as a result of major construction activity associated with the Proposed Project is infeasible to model with a high degree of accuracy. Localized impacts of directly emitted criteria air pollutants do not always equate to local concentrations due to the transport of emissions. Furthermore, given the uncertainty surrounding the age, existing health, genetic sensitivity, and number of receptors in the project area, it is not possible to quantitatively assess potential human health impacts. As such, human health impacts are discussed qualitatively.

As described in Section 3.9.2.2 *Criteria Air Pollutants*," ROGs and NO_X are precursors to ozone. Increased concentrations of ozone can cause health effects generally associated with reduced lung function. The contribution of ROGs and NO_X to a region's ambient ozone concentrations is the result of complex photochemistry. Due to the reaction time involved, peak ozone concentrations often occur far downwind of the precursor emissions. Therefore, ozone is a regional pollutant that often affects large areas. In general, ozone concentrations over or near urban and rural areas reflect an interplay of emissions of ozone precursors, transport, meteorology, and atmospheric chemistry. It takes a large amount of additional precursor emissions to result in a quantifiable increase in ambient ozone levels over a region. A project emitting only 10 tons per year of ROGs or NO_X is small enough that its regional impact on ambient ozone levels may not be detected in the regional air quality models used to determine ozone levels (SCAQMD 2014).

Although the NO_X emissions associated with the major project construction activities would be high during a potential maximum daily emissions scenario, potential emissions at this level would be intermittent and short-term. The peak daily emissions are not expected to occur every day during construction activity. These simply represent the maximum emissions that could be expected during a day of construction. It is anticipated that only a fraction of the total number of days with construction activity would have peak daily emissions. Over the duration of major project construction activities (16 months), a total of approximately 392 tons of NO_X could be emitted. The primary source of these NO_X emissions is exhaust from construction equipment and vehicles that would operate throughout the project area and would not be concentrated in any single location. Therefore, project construction would not expose a sensitive receptor to the totality of related air pollutant emissions. As construction-related emissions would be of short duration and relatively low on a regional scale, it is expected that their contribution to regional ozone concentrations and the associated health impacts would be minimal. As the Project's emissions contribution would be minimal during construction, the project would not exceed state or national thresholds, and it is not reasonably foreseeable to conclude that the project would result in significant health impacts.

Regarding NO_2, for analysis purposes, NO_X emissions were assumed to be NO_2 emissions. NO_2 and NO_X health impacts are associated with respiratory irritation. NO_X emissions would exceed daily thresholds, but these emissions would be intermittent and short term; therefore are not anticipated to result in significant health effects.

The ROG and NO_X emissions from the Proposed Project would make a minimal contribution to regional ozone concentrations and associated health effects. As indicated in Table RE-3.9-4, ROG emissions from the Proposed Project would be below the SCAPCD threshold. In addition to ozone, NO_X emissions would not contribute to potential exceedances of the NAAQS and CAAQS for NO_2. As indicated in Table RE-3.9-2, Siskiyou County is designated as attainment or unclassified for all federal and state ambient air quality standards. As shown in Table RE-3.9-1, NO_2 concentrations in the baseline year (2016) were well below the NAAQS and CAAQS (1-hour maximum concentration of 35.1 ppb vs. 100 ppb [NAAQS] and 0.18 ppm [CAAQS]). Thus, it is not expected that the Proposed Project's construction-related NO_X emissions (total of approximately 392 tons over the 16-month construction period) would result in exceedances of the NO_2 standards or contribute to the associated health effects.

Construction of the Proposed Project, with mitigation, would not exceed thresholds for PM_{10} or $PM_{2.5}$ and would not contribute to exceedances of the NAAQS and CAAQS for particulate matter. Implementing measures to reduce fugitive dust emissions would minimize particulate matter emissions associated with fugitive dust. In addition, using Tier 4 final equipment would minimize exhaust emissions (i.e., PM_{10}) during construction. The emissions shown would be generated by activities occurring throughout the project area. Thus, although some emissions would be generated in the vicinity of sensitive receptors, overall particulate matter emissions would be dispersed throughout the project area, and not concentrated at a single location in the immediate vicinity of a sensitive receptor. Due to the Project-related particulate matter experienced at any single location during construction would be minimal, project construction would not result in a significant impact on human health related to particulate emissions.

Mitigation Measure AQ-1 – Off-Road Construction Equipment Engine Tier
For the construction activities occurring within California, any off-road construction equipment (e.g., loaders, excavators, etc.) that are 50 horsepower or greater must be equipped with engines that meet the EPA Tier 4 Final emissions standards for off-road compression-ignition (diesel) engines, unless such an engine is not available for a particular item of equipment. To the extent allowed by CARB Off-Road Diesel Fueled Fleets regulations, Tier 3 and Tier 4 interim engines will be allowed when the contractor has documented, with appropriate evidence, that no Tier 4 Final equipment or emissions equivalent retrofit equipment is available or feasible (CARB 2016c). Documentation may consist of signed statements from at least two construction equipment rental firms.

Mitigation Measure AQ-2 – On-Road Construction Equipment Engine Model Year
Any heavy-duty on-road construction equipment must be equipped with engines that meet the MY 2010 or newer on-road emission standards.

Mitigation Measure AQ-3 – Heavy-Duty Trucks Engine Model Year
Any heavy-duty trucks used to transport materials to or from the construction sites must be equipped with engines that meet the MY 2010 or later emission standards for on-road heavy-duty engines and vehicles. Older model engines may also be used if they are retrofitted with control devices to reduce emissions to the applicable emission standards.

Mitigation Measure AQ-4 – Blasting-related Dust Control Measures
Dust control measures will be incorporated to the maximum extent feasible during blasting operations at Copco No. 1 Dam. The following control measures will be used during blasting activities as applicable: Conduct blasting on calm days to the extent feasible. Wind direction with respect to nearby residences must be considered. Design blast stemming to minimize dust and to control fly rock.

Mitigation Measure AQ-5 – General Construction Dust Control Measures
To reduce fugitive dust emissions, KRRC shall implement the following measures:

- Water all exposed surfaces as appropriate to control fugitive dust through sufficient soil moisture. Under normal dry-season conditions this is generally a minimum of two times daily. Watering of exposed surfaces is not necessary when soils are already sufficiently wetted (e.g., during rain). Exposed surfaces include, but are not limited to soil piles, graded areas, unpaved parking areas, staging areas, and access roads.
- Install stabilized construction entrances where appropriate, to include geotextile fabric and/or coarse rock to manage the amount of soil tracked onto paved roadways by motor vehicle equipment, and suspended in runoff, from the active construction sites.

KRRC will include these specifications, or modifications thereto that provide comparable benefits, in its project description for approval by the Federal Energy Regulatory Commission in its license surrender order.

Significance
Significant and unavoidable impact with mitigation for NO_X emissions

No significant impact with mitigation for PM_{10} emissions

No significant impact for ROG, CO, SO_2, and $PM_{2.5}$ emissions

Potential Impact 3.9-2 Substantially conflict with or obstruct implementation of the California Regional Haze Plan.
As noted in Table RE-3.9-2 (Attainment Status Summary, Siskiyou County), Siskiyou County is designated as attainment or unclassified for all federal and state ambient air quality standards. As such, the SCAPCD has not developed any air quality plans relevant to the Proposed Project. As noted above, the construction emissions in Oregon are only being considered to the extent that these emissions would influence air quality in Siskiyou County, California. As such, consistency with air quality plans relevant to Klamath County, Oregon are not considered in this section.

In 1999, the USEPA adopted the Regional Haze Rule, which requires states to establish a series of interim goals to ensure continued progress towards improving visibility in Class 1 federal lands (e.g., national parks and other scenic areas). To comply with the Regional Haze Rule, CARB developed a Regional Haze Plan (2009 Plan), which sets out a long-term path towards attaining improved visibility in Class 1 federal lands, with the goal of achieving visibility which reflects natural conditions by year 2064. The 2009 Plan identifies the pollutant emissions that contribute to impairing visibility, which include SO_X, NO_X, PM_{10}, $PM_{2.5}$, ROG, and ammonia (NH_3). Unlike State Implementation Plans, which require specific targets and attainment dates, the Regional Haze Rule requires states to provide for a series of interim goals to ensure continued progress. Each state is required to submit a five year progress report, as well as a revised Plan every ten years. These mid-course reviews allow states to evaluate interim progress towards their goals. The 2009 Plan set forth visibility goals and represents California's broader western regional effort to assess the visibility improvements for the first planning period of 2009 to 2018. The update of the 2009 Plan is anticipated to be completed in July 2021 and will address the second planning period from 2018 to 2028 (Uhl et al. 2019). Although the first planning period ended in 2018, this analysis discusses the goals for this period as it is the best available information relative to regional haze impacts of the Proposed Project.

The Proposed Project is located in the Northern California sub-region identified in the 2009 Plan, which encompasses most of the Northeast Plateau Air Basin, the northeastern portion of the North Coast Air Basin, and the northern part of the Sacramento Valley Air Basin. The closest Class 1 areas near the Proposed Project include the Marble Mountain Wilderness and Lava Beds National Monument. The IMPROVE monitoring sites that monitor these Class I Areas are the TRIN (Marble Mountain Wilderness) and LABE (Lava Beds National Monument) monitoring sites. Sources of haze in this area of northern California include, but are not limited to, rural land uses, traffic on Interstate 5, railroad freight traffic, wildfires, and natural biogenic emissions from plants (CARB 2009).

Table RE-3.9-9 shows the interim progress goals in the 2009 Plan for the first planning period (2009–2018) to achieve future natural conditions by 2064 at the closest Class I Areas to the Proposed Project.

Table RE-3.9-9. Summary of Progress Goals in the 2009 Regional Haze Plan.

Improve Monitoring Site	Class I Areas	2018 Worst Days RPG[1, 2]	2018 Worst Days URP[1, 3]	2064 Natural Conditions Worst Day[1]
TRIN	Marble Mountain Wilderness	16.4	15.2	7.9
LABE	Lava Beds National Monument	14.4	13.4	7.9

Notes:

[1] Visibility is calculated in deciviews. One deciview (dv) unit corresponds with the minimum visibility change detectable to the human eye. As deciview levels decrease, visibility improves.

[2] Reasonable Progress Goals (RPGs) are expressed in deciviews and indicate the planned improvement in visibility for the 20 percent most-impaired days (worst days) of the baseline years.

[3] Uniform Rate of Progress (URP) is a linear path towards natural conditions for each Class I Area. It represents a uniform rate of deciview reduction if haze levels on the worst days decreased the same number of deciviews per year over 60 years beginning in 2004 and ending at natural conditions in 2064.

In 2014, CARB adopted the 2014 Progress Report, which stated that the control strategies in the 2009 Plan were determined to be working to reduce emissions to reach the short-term goals for 2018. The 2014 Progress Report concludes that based on the reductions in anthropogenic source emissions in California and the concurrent improvement in visibility, that the Regional Haze Plan strategies were sufficient for California and its neighboring states to meet their 2018 progress goals (CARB 2014).

The Proposed Project involves construction activity related to the decommissioning of the Lower Klamath Project facilities that would be completed within two years of execution. As indicated under Potential Impact 3.9-1, the Proposed Project's construction activity will generate emissions of several of these haze-causing pollutants including ROG, NO_X, SO_X, PM_{10}, and $PM_{2.5}$. The concentrations of haze-causing pollutants that would be emitted from the Proposed Project's construction activity have the potential to contribute to visibility impairment in the Northern California sub-region in the short-term. Due to the temporary nature of the Proposed Project's construction activity, it is not anticipated that that the Proposed Project would produce significant concentrations of haze-causing pollutants. However, the contribution of the Proposed Project is conservatively assumed to conflict with the goals of the 2009 Plan without mitigation.

As discussed in the 2009 Plan, the Regional Haze Rule requires that the state consider measures to mitigate the impacts of construction activities in their strategy for achieving their interim progress goals. In the discussion of construction activity mitigation in the 2009 Plan, it emphasizes the anticipated emissions reductions from CARB regulations for off-road vehicles and local air district regulations for controlling fugitive dust. The 2009 Plan does not recommend project-specific mitigation measures that would reduce the emission of haze-causing pollutants and provide consistency with the 2009 Plan and the interim progress goals. As discussed under Potential Impact 3.9-1, air quality mitigation measures would be implemented for the Proposed Project to reduce the emissions of NO_X and PM_{10}. Although not specifically recommended in the 2009 Plan, these air quality mitigation measures, along with existing regulatory requirements, will ensure consistency with the 2009 Plan. Therefore, with the implementation of mitigation, the Proposed Project would not conflict with the 2009 Plan's short-term goals.

As discussed above, the Proposed Project would not result in an increase in operational emissions as it is assumed that operational emissions under current conditions will be greater than operational emission post-dam removal. Therefore, the Proposed Project would not conflict with the 2009 Plan's longer-term goals, aimed at achieving natural visibility conditions by 2064.

Therefore, with the implementation of mitigation, the proposed project would not conflict with or obstruct implementation of the 2009 Plan.

Significance

No significant impact with mitigation in the short-term

No significant impact in the long-term

Potential Impact 3.9-3 Short-term cumulative increase in criteria pollutants for which the Siskiyou County Air Pollution Control District (SCAPCD) is non-attainment.

Siskiyou County, California, is designated as attainment or unclassified for all federal and state ambient air quality standards (Table RE-3.9-2). As such, the Proposed Project would not result in a cumulatively considerable net increase of any criteria air pollutant for which Siskiyou County is non-attainment (including releasing emissions which exceed quantitative thresholds for ozone precursors).

Significance

No significant impact

Potential Impact 3.9-4 Short-term exposure of sensitive receptors to substantial toxic air contaminant concentrations.

The areas surrounding Iron Gate Dam, Copco No. 1 Dam, and Copco No. 2 Dam is sparsely populated with few sensitive land uses. The nearest sensitive land uses to the major construction activities are recreational facilities located at Copco No. 1 and Iron Gate reservoirs, along with hiking trails around the Fall Creek development (Section 3.20 *Recreation*). The next closest sensitive land uses include scattered residences that are located along the Klamath River. The closest homes to construction sites are located over 2,000 feet from Copco No. 1 Dam, over 3,500 feet from Copco No. 2 Dam, and over 4,000 feet from Iron Gate Dam. As noted above, there are also several modular homes located at Copco Village that are currently occupied by PacifiCorp staff. These homes are located within the Limits of Work and range from 850 feet to 2,200 feet west of the Copco No. 2 Powerhouse (Figure 2.7-2). Prior to the beginning of dam deconstruction activities, it is anticipated that these homes would be vacated. However, for the purposes of this analysis, it is conservatively assumed that the homes at Copco Village would be occupied.

This section evaluates the Proposed Project's potential to create a significant hazard to sensitive receptors (e.g., residents and recreationists) near the construction sites through exposure to substantial TAC concentrations during construction activities. TAC are defined as air pollutants that may cause or contribute to an increase in mortality or serious illness or pose a hazard to human health. TAC can cause long-term health effects such as cancer, birth defects, neurological damage, and genetic damage; or short-term acute effects such as eye watering, respiratory irritation, rhinitis, throat pain, and headaches. TAC expected to be associated with Proposed Project implementation include diesel particulate matter (diesel PM) and asbestos.

According to CARB, the majority of the estimated health risk from TAC can be attributed to relatively few compounds, the most important being particulate matter from diesel-fueled engines (diesel PM) (CARB 2013). Diesel PM differs from other TAC in that it is not a single substance but rather a complex mixture of hundreds of substances. Although diesel PM is emitted by diesel-fueled, internal combustion engines, the composition of the emissions varies depending on engine type, operating conditions, fuel composition, lubricating oil, and whether an emission control system is present.

With regards to exposure of diesel PM, the dose to which receptors are exposed is the primary factor used to determine health risk. Dose is a function of the concentration of a substance or substances in the environment and the duration of exposure to the substance. Dose is positively correlated with time, meaning that a longer exposure period would result in a higher level of health risk for many exposed receptors. Thus, the risks estimated for an exposed individual are higher if a fixed exposure occurs over a longer period.

Construction-related activities would result in temporary, intermittent emissions of diesel PM from the exhaust of off-road, heavy-duty diesel equipment. On-road diesel-powered haul trucks traveling to and from the construction areas are less of a concern because they would not stay on site for long period of time. Sensitive receptors in the vicinity of the construction sites would potentially be exposed to diesel PM from heavy equipment and vehicle emission diesel exhaust during construction. However, even during the most intensive construction phases, there would not be substantial TAC concentrations, except in the immediate vicinity of the active construction sites, because concentrations of mobile-source diesel PM disperse rapidly with distance. Concentrations of mobile source emissions of diesel PM are typically reduced by 60 percent at a distance of approximately 300 feet (Zhu et al. 2002) and 70 percent at a distance of approximately 500 feet (CARB 2005). Construction activities for the Proposed Project and associated emissions would vary by construction phase and the emissions to which nearby receptors would be exposed would also vary throughout the construction period. As construction activities would take place at several construction sites, the concentration of diesel PM in any one location would be limited.

Since the recreation facilities near the construction sites would be closed during dam removal activities, it is not anticipated that recreationists would be exposed to substantial TAC concentrations during construction activity. As noted above, the closest residences are located approximately 850 feet away from the construction sites where the major construction activity associated with the Proposed Project would occur. Due to the short-term nature of the proposed construction activity and the fact that the nearest residences are located approximately 850 feet from where the major construction activity will occur, it is not anticipated that sensitive receptors residing at the closest residences would be exposed to substantial TAC concentrations during construction activities. Therefore, impacts from the major construction activity associated with the Proposed Project would be less than significant.

Some of the pre-dam removal activities may be located closer in proximity to sensitive land uses than the major construction activities associated with the Proposed Project. However, due to the limited scale and duration of these activities it is not anticipated that they would expose sensitive receptors to substantial TAC concentrations. Based on the emissions modeling conducted, maximum daily emissions of diesel PM (modeled by PM_{10} which is conservatively considered a surrogate for diesel PM), would not exceed 5 lb/day for all pre-dam removal activities, combined. This maximum daily emission level represents all pre-dam removal activities; however, individual subphases (Fall Creek hatchery modification, access, road, bridge, and culvert improvements, recreation facility removal, flood improvements, Yreka water supply pipeline relocation, seed collection, invasive exotic vegetation control, and Iron Gate Hatchery modification) would result individually in less emissions. Thus, due to the dispersive properties of diesel PM, concentrations from individual construction sites would be lower, resulting in less exposure to any one receptor. In addition, the use of off-road heavy-duty diesel equipment associated with pre-dam removal activities would be limited to the construction duration of less than two years but with each individual subphase being shorter (i.e., one month to six months). As construction progresses, activity intensity and duration would vary throughout the various geographic locations. As such, no single receptor would be exposed to substantial construction-related emissions of diesel PM for extended periods of time. Thus, given the temporary and intermittent nature of construction activities associated with the pre-dam removal activities, the dose of diesel PM to any one receptor would be limited. Therefore, impacts from the pre-dam removal activities would be less than significant.

As discussed in Section 3.9.2.6 *Air Quality-Toxic Air Contaminants*, an investigation was conducted of the potential for naturally occurring asbestos to occur both in the bedrock of the Lower Klamath Project boundary, as well as in the concrete used to construction the dams. An investigation was also conducted of the potential for asbestos-containing materials to occur in the structures proposed for demolition (KRRC 2019a).

Naturally occurring asbestos has also been identified as a TAC. As discussed in Section 3.9.2.6 *Air Quality-Toxic Air Contaminants*, the naturally occurring asbestos investigation concluded that it is unlikely that the bedrock in the Lower Klamath Project boundary and the concrete used to construct the dams contain naturally occurring asbestos. Therefore, impacts related to the handling of naturally occurring asbestos would be less than significant. Although unlikely, if naturally occurring asbestos is encountered either during bedrock-disturbing activities, or in concrete during demolition activities, KRRC or its representatives will handle the naturally occurring asbestos in accordance with, as relevant, the federal EPA’s fact sheet, *Naturally Occurring Asbestos: Approaches for Reducing Exposure* (March 2008) and the *Guide to Normal Demolition Practices Under the Asbestos NESHAP* (September 1992) (KRRC 2019a).

As discussed in Section 3.9.2.6 *Air Quality-Toxic Air Contaminants*, detectable asbestos above 0.1 percent was identified in several materials in the structures proposed for demolition (e.g., surfacing materials, thermal system insulation, and miscellaneous materials) that could become airborne during Project activities. Asbestos-related work (i.e., abatement and disposal of asbestos containing materials) will be performed by KRRC and its representatives in compliance with, as relevant, local, state, and federal regulations including California Division of Occupational Safety and those implemented by the SCAPCD (KRRC 2019a). Compliance with applicable regulations related to the handling of hazardous materials is included as Mitigation Measure HZ-1 Hazardous *Materials Management* in Section 3.21 *Hazards and Hazardous Materials*. Implementation of this mitigation measure will reduce potential impacts to workers and the closest sensitive receptors from airborne asbestos to less than significant levels.

Therefore, the exposure of sensitive receptors to TAC concentrations during construction activity is less than significant with mitigation

Significance

No significant impact with mitigation

Potential Impact 3.9-5 Short-term exposure to objectionable odors near construction sites.

The SCAPCD addresses odor impacts through Rule 4.2 (Nuisance Section 24243), which states "No person shall discharge from any source whatsoever, such quantities of air contaminants or other material which cause injury, detriment, nuisance or annoyance to any considerable number of persons or to the public or which endanger the comfort, repose, health or safety of any such persons or the public or which cause or have a natural tendency to cause injury or damage to business or property." Rule 4.2 does not apply to odors emanating from agricultural operations in the growing of crops or raising of fowl or animals (CARB 2016a).

The following odors could result from the Proposed Project:

- Odors from exposed sediments (including algae) in the reservoir footprints; and
- Odors from construction equipment/vehicle exhaust.

Both of these odor sources would be likely to generate minor odor impacts relative to land use types capable of generating significant odor impacts (e.g., wastewater treatment plant, sanitary landfill, petroleum refinery, rendering plant, food packaging plant) (SMAQMD 2016b).

The Proposed Project would ultimately drain Iron Gate, Copco No. 1, and Copco No. 2 reservoirs and expose the underlying sediments. As the reservoir sediment deposits contain unoxidized organic matter from algal detritus (organic content of the sediments is on average 2.7 to 5.1 percent by mass [GEC 2006]), earthy or sulfide odors (e.g., tidal marsh sediment odors at low tide), may be evident during or immediately following reservoir drawdown while the exposed sediments dry out and new vegetation is established. There is the potential that these odors could temporarily impact nearby land uses such as the closest recreational facilities and residential uses. These odor impacts have the potential to cause nearby recreationists and residents to reduce outdoor activity or take other actions to avoid detection of the odors (e.g., keep windows closed). The level of impact would be dependent on proximity to the reservoirs and wind patterns during and immediately following reservoir drawdown (i.e., primarily during winter and early spring months). Within a relatively short amount of time (i.e., days to a few weeks), the sediment surfaces would oxidize as they are exposed to air and the organic compounds causing the odors would be broken down. Due to the low density of development in the vicinity of the reservoirs, the relatively low number of recreationists in the vicinity of the Lower Klamath Project reservoirs during winter and spring months, and the short-term nature of the anticipated odor impacts (days to a few weeks during dam removal year 2), it is not anticipated that the Proposed Project would create objectionable odors affecting a substantial number of people and thus would not result in a significant impact.

As discussed in Section 3.20 *Recreation*, two-thirds of recreational users of the Klamath River reservoirs that were surveyed responded that the algae blooms in the reservoirs produced bad odors. Reservoir drawdown under the Proposed Project primarily would occur during winter months (January–March) (Table 2.7-1) when intense algae blooms do not typically occur in lakes and reservoirs in general, or in the Lower Klamath Project reservoirs in particular (Section 3.2 *Water Quality* and Section 3.4 *Phytoplankton and Periphyton*). Despite a very low likelihood of occurrence, algae blooms could be present as reservoir drawdown occurs and as the water level lowers in the reservoirs, algae would settle on the exposed sediments. If this does occur, it is anticipated that the algae and underlying sediments would dry out quickly (i.e., within days to weeks), which would substantially reduce any odors generated by decaying algae. Similar to odors from the reservoir sediments, it is not anticipated that a substantial number of people would be impacted due to the low density of development in the area and the short-term nature of the odor impacts. Ultimately, the Proposed Project is anticipated to substantially reduce the annual occurrence of odors from algae blooms since this section of the Klamath River would be restored to a free-flowing condition.

During construction, there is the potential for the generation of objectionable odors in the form of construction equipment/vehicle exhaust in the immediate vicinity of the construction sites at the three dams (Copco No. 1, Copco No. 2, and Iron Gate). However, these emissions would rapidly dissipate and be diluted by the atmosphere downwind of the site. As noted above, concentrations of mobile source emissions of diesel PM are typically reduced by 60 percent at a distance of approximately 300 feet (Zhu et al. 2002) and 70 percent at a distance of approximately 500 feet (CARB 2005). At this distance from the construction sites, there would also be a substantial reduction in odors generated by exhaust emissions. The nearest residences to the dam construction sites are approximately 850 feet away, which would provide adequate distance for the dissipation of odors from construction activity. Due to the low density of development in the areas within and adjacent to the Limits of Work, intervening topography and vegetation, and the rapid dissipation of odors from construction activity, it is not anticipated that these odors would impact a substantial number of people.

As noted above, some of the pre-dam removal activities may be located closer in proximity to nearby residential uses than the major construction activities associated with the Proposed Project. However, due to the limited scale and duration of these activities, it is not anticipated that the construction equipment/vehicle exhaust generated from the pre-dam removal activities would create objectionable odors affecting a substantial number of people.

Significance

No significant impact

3.9.6 References

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Section 3.10 Greenhouse Gas Emissions and Energy

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3.10 Greenhouse Gas Emissions and Energy

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. The State Water Resources Control Board (State Water Board) received several comments related to GHG emissions and energy during the Notice of Preparation (NOP) public scoping process for the Lower Klamath Project (see Volume I, Appendix A). The State Water Board also received several comments on the GHG emissions and energy analysis during the public comment period for the Draft EIR. The revised GHG emissions and energy section contained herein includes information that addresses public comments on the Draft EIR by providing additional detail regarding elements of the Proposed Project that may affect GHG emissions and energy and by incorporating new modeling information to support the assessment of potential impacts. The recirculated GHG emissions and energy sections contain an expanded discussion of energy impacts, an updated significance threshold for GHG emissions, new estimates for ecosystem and construction related GHG emissions, a new mitigation measure, and updated methodology for cumulative impact assessment. Please see the Notice of Availability (Notice) for additional information on the recirculated sections of the Draft EIR Volume I and associated Volume II appendices.

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 GHG emissions from global industrialization over the last 200 years. A typical project, even a very large one, does not generate enough GHG emissions on its own to influence global climate change significantly; hence, the issue of global climate change is, by definition, a cumulative environmental impact.

In light of this, Section 3.10 provides information on the anticipated results of climate change at a global, state, and regional scale, rather than defining a discrete zone of anticipated impact as the area of analysis in the manner adopted for other resources in the EIR.

The areas of potential emissions attributable to the Proposed Project, however, are more discrete. Section 3.10 identifies two meaningful ranges of comparison for emissions of GHGs: one for direct emissions and another for indirect emissions. Therefore, this section defines the area of analysis for GHGs based on the area of potential emissions increases, rather than as the area of potential impacts from those emissions.

This section analyzes the direct GHG emissions and energy use of implementing the Proposed Project in the area shown in Figure RE-3.10-1.

The Primary Area of Analysis for potential generation of GHGs includes portions of California and Oregon where emissions from Proposed Project activities would be generated, due to the persistence and mobility of GHG gases and the cumulative nature of the impact. In addition, the EIR considers a Secondary Area of Analysis where indirect GHG emissions would occur. The Secondary Area of Analysis is the grid area for PacifiCorp's Power Control Area (PCA) where indirect emissions could result from changes to the power mix used to provide electricity to PacifiCorp customers after implementation of the Proposed Project (Figure RE-3.10-2).PacifiCorp's PCA includes all generation facilities in parts of six western states. Because PacifiCorp's PCA includes only hydro and a small amount of biogas in California, any indirect GHG emissions would be anticipated to occur mostly outside of California. However, a discussion of energy supply resources and related GHG emissions related to providing electricity to PacifiCorp customers—including those in California—is provided.

In summary, while the analysis focuses on emissions generated in the Primary and Secondary Areas of Analysis as direct and indirect results of the Proposed Project, the analysis also considers potential regional, state, and global climate change effects.

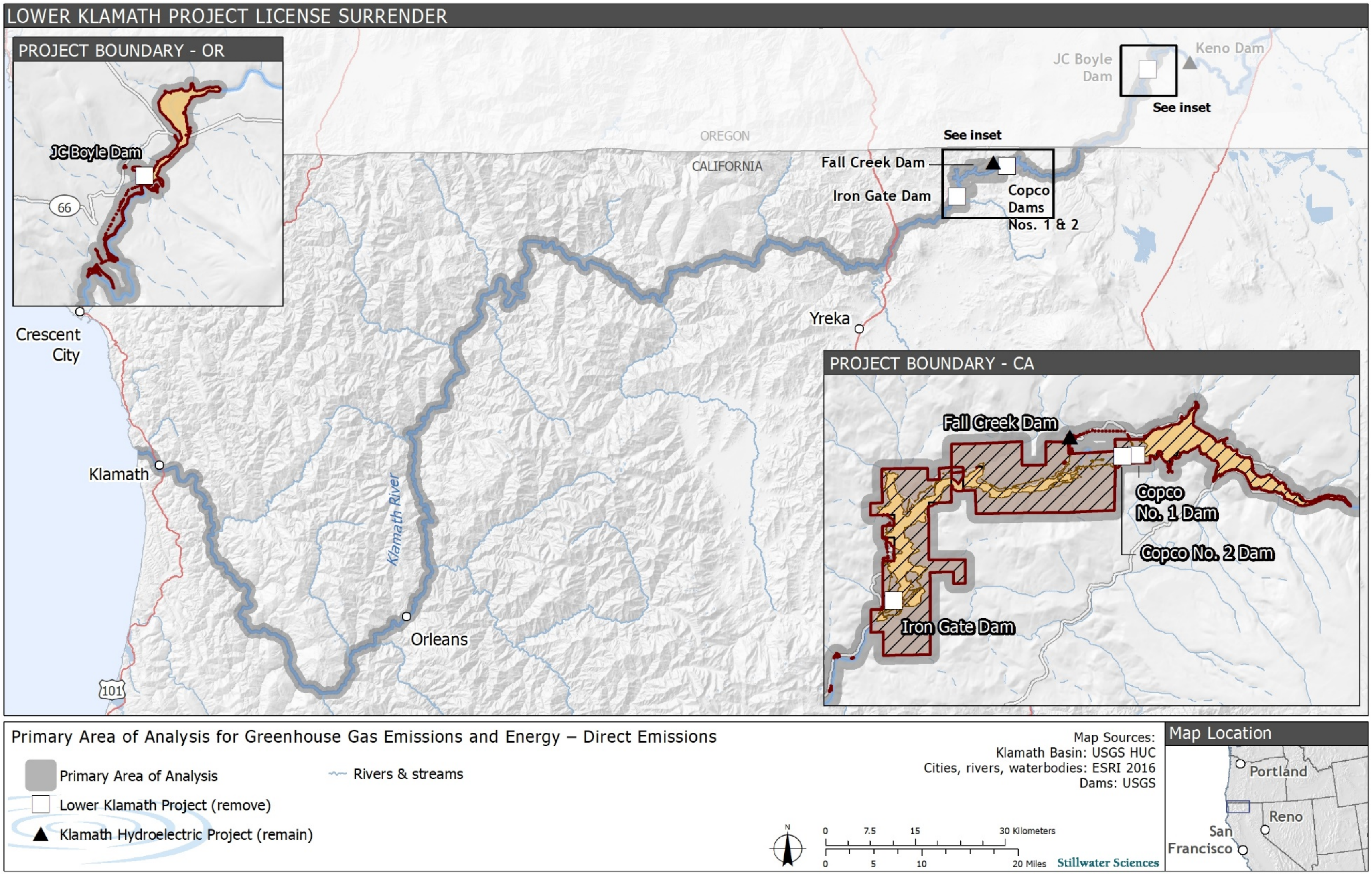

Figure RE-3.10-1. Primary Area of Analysis for Greenhouse Gas Emissions and Energy – Direct Emissions.

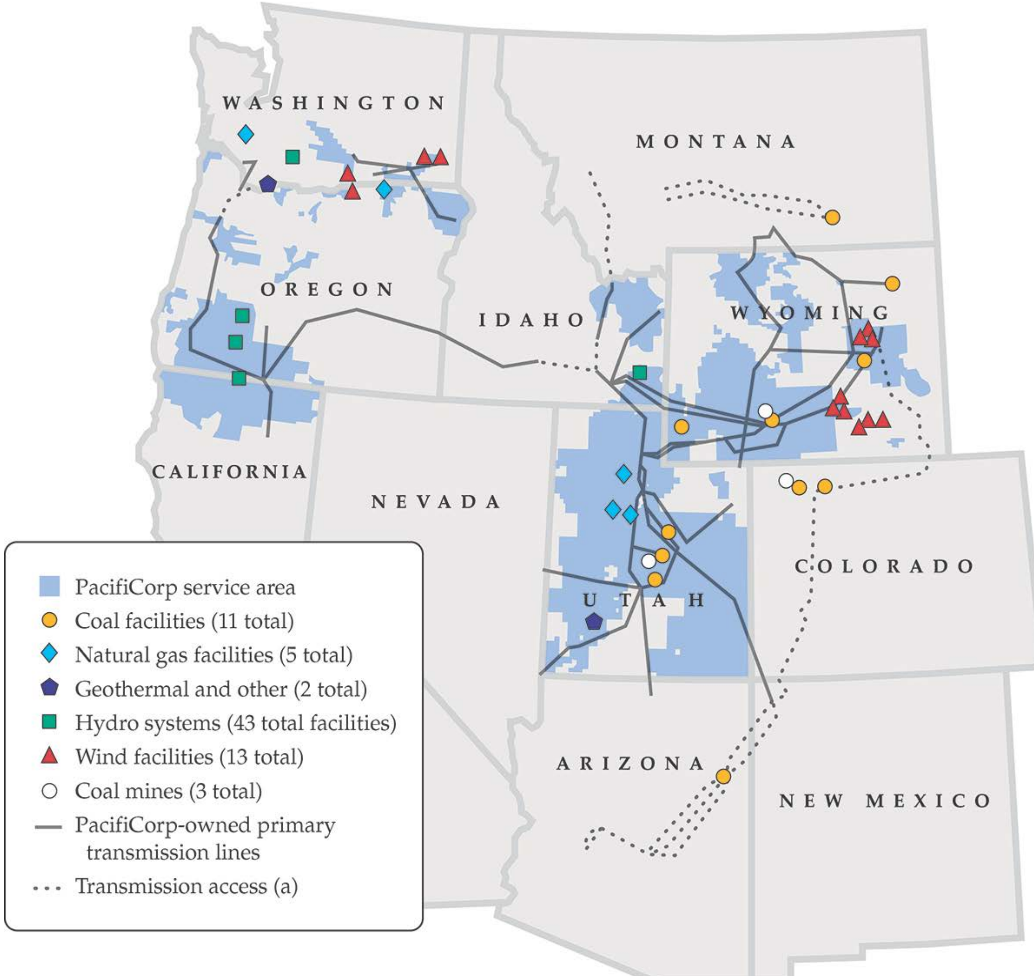

Figure RE-3.10-2. Secondary Area of Analysis for Greenhouse Gas Emissions and Energy – Indirect Emissions. Source: PacifiCorp (2012).

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.

Due to the unconfined nature of GHGs, the breadth of the sources and impacts, and the cumulative nature of the impacts, a description of the environmental setting confined to the Area of Analysis would not provide useful information. The GHG environmental setting uses a larger region than the Primary and Secondary Areas of Analysis in describing existing conditions for GHG emissions. Additionally, direct and indirect emissions in the Primary and Secondary Areas of Analysis are described quantitatively to the extent possible using available information, as well as qualitatively.

Greenhouse Gas Emissions and Global Climate Change

Radiation from the sun is the Earth's primary source of energy. As solar radiation reaches 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 the Earth has a much lower temperature than the sun, the Earth emits longer-wavelength radiation[1]. 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.

Land-based (terrestrial) ecosystems (e.g., forests, grasslands/shrublands, agricultural lands, wetlands) and water-based (aquatic) ecosystems (e.g., rivers, streams, lakes, reservoirs, estuaries, coastal waters, oceans) both remove GHGs from and emit GHGs to the atmosphere as part of the natural movement of carbon through life forms on Earth (i.e., the biosphere). Because carbon movement through the biosphere happens relatively quickly, corresponding to the lifespan of biota which primarily include plants and phytoplankton (algae), natural terrestrial and aquatic ecosystem GHG emissions are considered to be part of the 'fast carbon cycle' (Ciais et al. 2013). A second, 'slow' part of Earth's carbon cycle involves carbon movement between rocks and sediments and the biosphere through volcanic emissions of carbon dioxide (CO_2), chemical weathering, erosion, and sediment formation on the sea floor (Ciais et al. 2013).

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

Turnover times of the mainly geological reservoirs of the 'slow carbon cycle' are 10,000 years or longer (Ciais et al. 2013). Anthropogenic (i.e., resulting from human activity) emissions of GHGs rapidly accelerate the movement of carbon from the 'slow' part of the carbon cycle to the 'fast' part of the carbon cycle, leading to atmospheric GHG levels in excess of natural ambient concentrations, and thus intensify the greenhouse effect. Anthropogenic emissions of GHGs due to burning of fossil fuels have led to a trend of accelerated warming of the Earth's atmosphere and oceans, with corresponding effects on global circulation patterns and climate (Stocker 2014). Prominent GHGs contributing to the accelerated 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 GHGs considered to have high global warming-potential (GWP). GWP is a concept developed to compare the ability of a GHG to trap heat in the atmosphere relative to (or as compared with) 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 GHG 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 (USEPA 2019a).

For a more detailed discussion of climate change that is beyond the scope of this EIR, please refer to the *Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report* (**https://www.ipcc.ch/assessment-report/ar4/**) and the *Third National Climate Assessment* (**http://s3.amazonaws.com/nca2014/low/NCA3_Climate_Change_Impacts_in_the_United%20States_LowRes.pdf?download=1**). Climate change is a global problem because GHGs are global pollutants with a cumulative global effect, 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 (one year to several thousand years). GHGs persist in the atmosphere for enough time to be dispersed around the globe. The quantity of GHGs 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.

Global anthropogenic GHG emissions are primarily driven by population size, land use patterns, economic activity, lifestyle, energy use, technology, and climate policy (IPCC 2014). In 2010, CO_2 remained the major anthropogenic GHG, accounting for 76 percent of total anthropogenic GHG emissions. Of the total GHG emissions in 2010, 16 percent came from CH_4, 6.2 percent from N_2O, and 2 percent from fluorinated gases (e.g., HFCs, PFCs). Total global annual anthropogenic GHG emissions increased by about 10 gigatonnes (1,000,000,000 metric tons) CO_2 equivalents per year ($GtCO_2$-eq) between 2000 and 2010. This increase directly came from the energy (47 percent), industry (30 percent), transport (11 percent) and building (3 percent) sectors (IPCC 2014).

Past, present, and future global GHG emissions will determine the severity of climate change and associated impacts. Presently, estimated anthropogenic global warming is estimated to be increasing at 0.2°C (likely between 0.1°C and 0.3°C) per decade due to past and ongoing GHG emissions (IPCC 2018).

Generally, global impacts from climate change include increases in mean temperature in most terrestrial and marine regions, hot extremes in most developed regions, heavy precipitation in several regions, and the probability of drought and precipitation deficits in some regions. Furthermore, temperature increases amplify the exposure of small islands, low-lying coastal areas and deltas to the risks associated with sea-level rise for many human and ecological systems, including increased saltwater intrusion, flooding, and damage to infrastructure (IPCC 2018).

Evidence of observed climate change impacts are the strongest and most comprehensive for natural systems. Many terrestrial, freshwater, and marine species have shifted their geographic ranges, seasonal activities, migration patterns, abundances, and species interactions in response to ongoing climate change. Many land and ocean ecosystems and some of the services they provide (e.g., habitat, cycling of water and nutrients) have already changed due to climate change. Some impacts may be long-lasting or irreversible, such as the loss of some ecosystems (IPCC 2018).

To date, a few recent species extinctions have been attributed to anthropogenic climate change. However, evidence suggests that natural global climate change, at rates slower than anthropogenic climate change, has caused significant ecosystem shifts and species extinctions during the past millions of years (IPCC 2014).

Greenhouse Gas Emissions and California Climate Change

As the second largest emitter of anthropogenic GHGs in the United States, and 20th largest in the world, California contributes a significant quantity of GHGs to the atmosphere (CARB 2017a). Anthropogenic 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 anthropogenic GHGs, followed by industrial activities (CARB 2017) (see Figure RE-3.10-3). Electricity generation (combining in-state and out of state generation) forms the next-largest set of emissions. As indicated in Figure RE-

3.10-3, approximately 424.1 million metric tons of CO_2e ($MMTCO_2e$) of anthropogenic GHG emissions were generated in California in 2017.

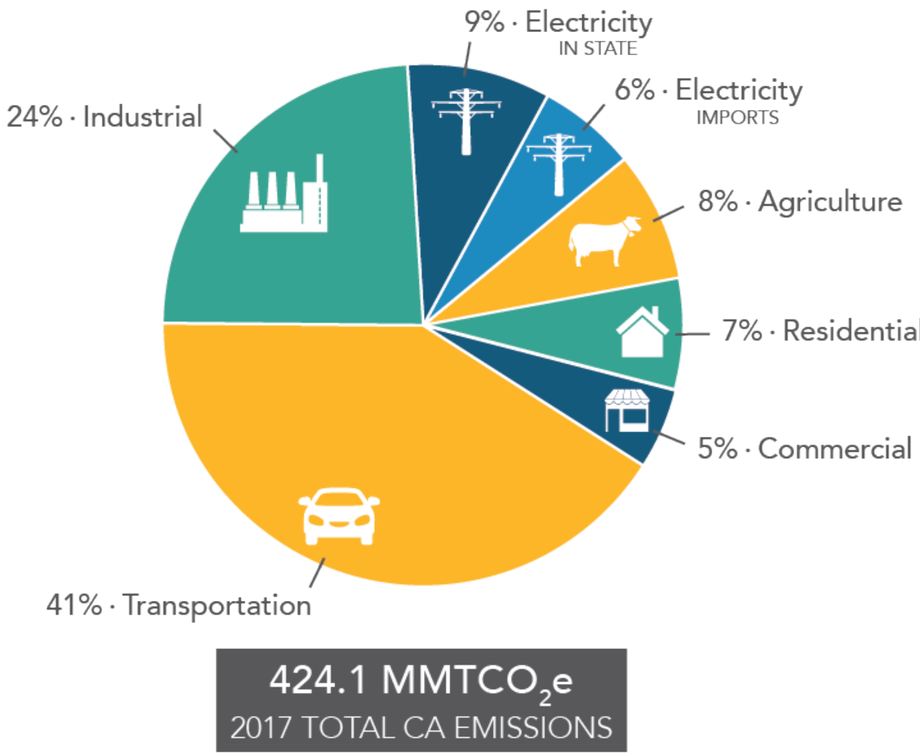

Figure RE-3.10-3. California Anthropogenic GHG Emission Sources, in Million Metric Tons of CO_2e (as of 2017). Source: CARB 2017.

The natural cycling of carbon sequestration and release during the growth, death, and decay of plants and animals in natural ecosystems in the state is not assessed or quantified in the California Air Resources Control Board (CARB) Climate Change Scoping Plan (CARB 2017a). The Global Warming Solutions Act of 2006 (AB 32) directed 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), and to maintain such reductions thereafter. CARB approved the Scoping Plan in 2008 and first updated it in May 2014. The second update in November 2017 also address the actions necessary to achieve the further GHG emissions reduction goal of reducing GHG emissions to 40 percent below 1990 levels by 2030, as described in Senate Bill 32 (SB 32). The CARB Scoping Plan identifies development of a wholistic plan to support restoration and encourage ecosystem sequestration of carbon, and the plan sets a goal to identify of initial natural and working lands projects to maintain sequestration of 15-20 $MMTCO_2e$. In 2018, CARB developed an initial inventory of ecosystem carbon in California's natural and working lands. The initial inventory determined there are approximately 5,340 $MMTCO_2e$ of ecosystem carbon in the carbon pools (biomass and soil organic matter) that CARB quantified. Forest and shrubland contain the vast majority of

California's carbon stock because they cover the majority of California's landscape and have the highest carbon density of any land cover type. All other land categories combined represent 35 percent of the California's total acreage, but only 15 percent of carbon stocks. The inventory also identifies that some natural lands (e.g., wetlands) are sources of GHG emissions. For example, in the inventory it was calculated that wetlands in California emitted just under 1 $MMTCO_2e$ during 2016 (CARB 2018a). The science, methods, and techniques for accounting of ecosystem carbon are relatively new and still rapidly advancing. Although significant progress has been made in the inventory development for California, more work is underway. The parts of the inventory that have been in development for several years generally have a reasonably constrained uncertainty (between 15 percent and 40 percent), but other parts of the inventory that CARB has started to develop recently contain significant uncertainties (CARB 2018a). While providing additional information, the 2018 CARB initial inventory of natural and working lands represents a partial inventory that would be updated and refined as more continuous data become available (e.g., soil carbon modeling, vegetation classification and mapping, changes in carbon stock, etc.) and inventory methods improve.

Although natural ecosystems have the potential to produce some GHG emissions, the rehabilitation and maintenance of natural and working lands is identified as part of the state's climate solution. As stated in the Scoping Plan (CARB 2017a):

> "These lands support clean air, wildlife and pollinator habitat, rural economies, and are critical components of the California's water infrastructure. Keeping these lands and water intact and at high levels of ecological function (including resilient carbon sequestration) is necessary for the well-being and security of Californians in 2030, 2050, and beyond. Forests, rangelands, farms, wetlands, riparian areas, deserts, coastal areas, and the ocean store substantial carbon in biomass and soils."

California is already experiencing the effects of a changing climate, and these impacts are projected to worsen, even with only moderate increases in global GHG emissions. These effects include, but are not limited to, increasing temperatures, greater variability in precipitation levels, reductions in the amount of precipitation falling as snow, more frequent and severe forest wildfires, and rising sea levels that cause increased coastal flooding and erosion, as discussed further below. For additional information please refer to *California Fourth Climate Change Assessment – Statewide Summary Report* (CEC 2018a).

Increasing temperatures: In California, present-day (1986-2016) temperatures throughout the state have warmed above temperatures recorded during the first six decades of the 20th century (1901-1960). Annual temperature increases over most of the state have exceeded 1°F, with some areas exceeding 2°F (CEC 2018a).

Increasing variability in precipitation: California's variable precipitation has multi-year wet or dry periods, which impact social, economic, and natural systems throughout the state related to their duration and severity. Recent events such as the unusually wet years of 2005, 2011, and 2017, as well as the droughts of 2001-2004, 2007-2010, and 2012-2016, exemplify the highly variable climate in California. Climate change is projected to increase the intensity of these wet and dry periods (CEC 2018a).

Decreasing snowpack: Snowpack in the mountains of California and Nevada provides a natural reservoir and a key source of surface and groundwater. Climate change has already started to reduce the amount of precipitation falling as snow and the amount of spring snow water accumulation in the western U.S. (CEC 2018a).

Increasing frequency and severity of wildfires: Wildfire characteristics are determined by both natural and anthropogenic factors. Climate change, combined with anthropogenic factors, has already contributed to more frequent and severe forest wildfires in the western U.S. Wildfires have also been occurring at higher elevations in California, which is a trend that is projected to continue as climate change worsens. Changing vegetation patterns in the state due to climate change will also affect the location and characteristics of fires (CEC 2018a).

Sea-level rise: Sea-level rise along the central and southern California coast has risen more than 15 cm (5.9 inches) over the 20th century. Recently, even moderate tides and storms have produced extremely high sea-levels. Over the 21st century, it is virtually certain that sea-levels will rise substantially; however, uncertainty persists in the rate of rise. Flooding from sea-level rise and coastal wave events leads to bluff, cliff, and beach erosion, which could affect large geographic areas (hundreds of kilometers) (CEC 2018a).

Greenhouse Gas Emissions and Climate Change in the Klamath Basin

Regional climate-related risks vary depending on the magnitude and rate of warming, geographic location, levels of development and vulnerability, and choices and implementation of adaptation and mitigation options. While quantification of existing fast-cycle GHG emissions are not available for the Klamath Basin, emissions estimates are available for the Western Cordillera ecoregion of the Western United States, which includes the Klamath Mountains and the Southern Cascades subregions that make up the Klamath Basin (Zhu and Reed 2012). As shown in Table RE-3.10-1, overall the Western Cordillera ecoregion is a sink for CO_2, due in large part to extensive forested areas that sequester carbon in tree biomass. The Western Cordillera ecoregion is also a small source of CH_4 and N_2O, due to seasonal releases of these GHGs by trees.

Riverine CO_2 emissions reported by Zhu and Reed (2012) for the Western Cordillera ecoregion (0.00503 teragrams [one trillion grams] CO_2e per square kilometer per year [Tg $CO_2e/km^2/yr$]) are within the range of reported CO_2 emissions from rivers throughout the United States (0.00323 to 0.01470 Tg $CO_2e/km^2/yr$) (Butman and Raymond 2011) and the world (0.01023 to 0.02086 $Tg/km^2/yr$) (Deemer et al. (2016). These values can be used to estimate a range of annual CO_2 emissions from the Klamath River, not including the Lower Klamath Project reservoirs (Table RE-3.10-2). Further consideration of the emissions reported in Zhu and Reed (2012), Butman and Raymond (2011), and Deemer et al. (2016), as applied to the Klamath River, is presented in Section 3.10.4 *[Greenhouse Gas Emissions and Energy] – Impact Analysis Approach* and Section 3.10.5 *[Greenhouse Gas Emissions and Energy] – Potential Impacts and Mitigation,* specifically Potential Impacts 3.10-2 and 3.10-3. Emissions for the Lower Klamath Project reservoirs are further discussed below.

Table RE-3.10-1. Minimum and Maximum Estimated Averages of Annual Fast-carbon Cycle Carbon Dioxide, Methane, and Nitrous Oxide Emissions and Sequestration (Expressed as CO_2e) from 2001 to 2005 in the Western Cordillera Ecoregion of the Western United States. Source: Zhu and Reed (2012).

Ecosystem	**Carbon Dioxide (CO_2) ($TgCO_2e/yr$)**		**Methane (CH_4) ($TgCO_2e/yr$)**		**Nitrous oxide (N_2O) ($TgCO_2e/yr$)**		**Area (km^2)**	**Existing Emissions ($MTCO_2e/yr$)**	
	Min	**Max**	**Min**	**Max**	**Min**	**Max**		**Min**	**Max**
Forests	-257.9	-72	-0.9	-0.9	0.3	0.3	546,533	-1.4E+14	-4.0E+13
Grasslands/shrublands	-53.6	0.8	-0.8	-0.8	0.2	0.2	277,874	-1.5E+13	5.6E+10
Agricultural lands	-1.4	0.1	0	0	0	0	16,722	-2.3E+10	1.7E+09
Wetlands	-2.7	-0.4	0.4	0.4	0	0	3,656	-8.4E+09	0.0E+00
Other lands	-0.6	1.6	0	0	0	0	27,469	-1.6E+10	4.4E+10
Total	**-316.2**	**-69.9**	**-1.3**	**-1.3**	**0.6**	**0.6**	**872,254**	**-1.6E+14**	**-4.0E+13**

Table RE-3.10-2. Estimated Annual GHG Emissions from the Klamath River.

Estimated Emissions as $CO_{2\text{-eq}}$ ($TgCO_2e/km^2$-yr)	**Source**	**Estimated Surface Area (km^2)[1]**	**Estimated Existing Emissions ($MTCO_2e/yr$)**
0.00323 to 0.01470 [2]	Butman and Raymond (2011)	14.9	48,000 to 219,000 [5]
0.01023 to 0.02086 [3]	Deemer et al. (2016)	14.9	152,000 to 311,000 [5]
0.00503 (0.00313, 0.00899) [4]	Zhu and Reed 2012	14.9	75,000 (47,000,134,000) [5]

[1] Klamath River surface area estimated as an average wetted width of 125 feet multiplied by distance in river miles from Link River Dam (RM 259.7) to the Klamath River Estuary (RM 0), not including the reach lengths of each of the Lower Klamath Project reservoirs, and converted to kilometers. Lower Klamath Project Reservoir surface area and emissions estimates are calculated separately in Table RE-3.10-5.

[2] Includes CO_2 estimates.

[3] Includes CH_4 and CO_2 estimates.

[4] Includes CO_2 estimates.

[5] Rounded to the nearest 1,000 $MTCO_{2\text{-eq}}$/yr

Projected changes in climate conditions are expected to result in a wide variety of effects in the Klamath Basin, based on projections developed for the broader Pacific Northwest[2]. The most relevant consequences of climate change related to the Klamath Basin 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 snowpack and snow melt, resulting in less runoff during the late spring through early autumn
- Vegetation changes
- Groundwater hydrology changes
- Changes to annual stream flow

Projected climate changes in long-term (30 year) annual averages of maximum temperature, minimum temperature, and precipitation rates in Siskiyou County are shown in Table RE-3.10-3 and Table RE-3.10-4. Data is shown for Historical Baseline (1961–1990) and two future periods: Mid–Century (2035–2064) and End of Century (2070–2099). Data is available for two different scenarios including a medium emissions scenario (where emissions peak around 2030 and then decline) and a high emissions scenario (where emissions continue to rise strongly through 2050 and plateau around 2100). These data do not present forecasts, but rather present potential scenarios to describe how climate change may evolve in areas of California based on scenarios presented by the Intergovernmental Panel on Climate Change (IPCC). How climate change actually evolves in California depends in large point on the trajectory of global GHG emissions, which is a function of policy, technology, behavior, and other variables that have yet to be determined. This information is drawn from the California Energy Commission (CEC) Cal-Adapt website, which can be accessed for additional information (CEC 2019).

[2] 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.

Table RE-3.10-3. Project Climate Change for Siskiyou County (Medium Emissions Scenario).

Avg. Minimum Temp (°F)			**Avg. Maximum Temp. (°F)**			**Avg. Precipitation (inches/day)**		
Historical Baseline (1961–1990)	Mid-Century (2035–2064)	End-of Century (2070–2099)	Historical Baseline (1961–1990)	Mid-Century (2035–2064)	End-of Century (2070–2099)	Historical Baseline (1961–1990)	Mid-Century (2035–2064)	End-of Century (2070–2099)
30.5	34.3	35.6	59.7	64.2	65.6	0.122	0.125	0.126

Source: CEC 2019

Table RE-3.10-4. Project Climate Change for Siskiyou County (High Emissions Scenario).

Avg. Minimum Temp (°F)			**Avg. Maximum Temp. (°F)**			**Avg. Precipitation (inches/day)**		
Historical Baseline (1961–1990)	Mid-Century (2035–2064)	End-of Century (2070–2099)	Historical Baseline (1961–1990)	Mid-Century (2035–2064)	End-of Century (2070–2099)	Historical Baseline (1961–1990)	Mid-Century (2035–2064)	End-of Century (2070–2099)
30.5	35.3	39.0	59.7	65.2	69.1	0.122	0.126	0.127

Source: CEC 2019

Lower Klamath Project Facilities 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 conventional energy sources that burn fossil fuels. However, although power generation by hydroelectric facilities does not require combustion processes beyond motor vehicle emissions by operations and maintenance personnel, the Lower Klamath Project hydroelectric reservoirs are sources of GHGs to the atmosphere (Barros et al. 2011, Hertwich 2013, Deemer et al. 2016, Harrison et al. 2017) due to the inter-conversion of various forms of carbon in reservoirs as part of the natural 'fast carbon cycle' (see also Section 3.10.2.1 *Greenhouse Gas Emissions – Greenhouse Gas Emissions and Global Climate Change*). For example, photosynthesis and respiration of CO_2 by plants and algae occurs in the reservoirs on a daily basis, whereas oxidation of decaying plants and other sources of organic matter under aerobic conditions releases CO_2 as well as small amounts of a more potent GHG, N_2O. Under anaerobic/anoxic (i.e., low or no oxygen) conditions, such as in the bottoms of J.C. Boyle, Copco No. 1, and Iron Gate reservoirs in the late summer/early fall, or in wetland soils, decomposition of detrital algae and plants, as well as soil-associated organic matter, generates CH_4 as well as small amounts of N_2O. Estimated annual GHG emissions from the Lower Klamath Project reservoirs are presented in Table RE-3.10-5.

Table RE-3.10-5. Estimated Annual GHG Emissions from the Lower Klamath Project Reservoirs.

Estimated Emissions as $CO_{2\text{-eq}}$ ($TgCO_{2\text{-eq}}/km^2$-yr)	Source	Estimated Surface Area (km^2)	Estimated Existing Emissions ($MTCO_{2\text{-eq}}$/yr) [2,3]
0.00010 to 0.00029 [1]	Deemer et al. (2016)	9.2	940 to 2,620

[1] Includes CH_4 and CO_2 estimates.

[2] Does not include drawdown-specific rates reported in Harrison et al. (2017), since the Harrison et al. (2017) rates are not presented as annual amounts.

[3] Totals may not sum due to rounding.

As Section 3.2 *Water Quality* and Section 3.4 *Phytoplankton and Periphyton* describe in detail, the Klamath River Hydroelectric Reach 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 temporarily sequester atmospheric CO_2 during photosynthesis that would otherwise be in the atmosphere. Due to the limited oxygen supply in the bottom waters and sediments of the Lower Klamath Project reservoirs, when algae die at the end of their life and sink to the bottom, unoxidized portions of this material along with other sources of detrital organic matter may resist decomposition over time. Should these sediments containing dead algae be released to downstream reaches of the Klamath River during high flow events, they would be subjected to oxygenated conditions where aerobic bacterial decomposition would release the temporarily sequestered carbon, primarily as CO_2.

The Lower Klamath Project facilities currently generate operational GHG emissions from several other sources including, but not limited to, employee traffic, maintenance equipment, and releases of minor amounts of SF_6 from gas insulated switchgear equipment. These emissions are not quantified, but, as noted above, total emissions from hydropower operations are generally significantly lower than GHG emissions generated by electrical power generation from fossil fuel combustion.

GHG Emissions from the PacifiCorp PCA

As noted above, the power generating facilities and transmission infrastructure in the PacifiCorp PCA currently generates GHG emissions from the combustion of fossil fuels to generate power and fugitive emissions from gas insulated switchgear equipment and natural gas distribution. According to the PacifiCorp Sustainability Report (2019), the total GHG emissions from power generation (owned and purchased) in 2017 was 43,314 $MTCO_2e$. In addition, 89,520 $MTCO_2e$ of fugitive SF_6 emissions were emitted in 2017 from gas insulated switchgear equipment within the PacifiCorp PCA. The Sustainability Report also indicates that GHG emissions from power generation decreased by 12.3 percent between 2005 and 2017 (PacifiCorp 2019a).

PacifiCorp is required to file Integrated Resource Plans (IRPs) every two years with the state utility commissions of Utah, Oregon, Washington, Wyoming, Idaho, and California. A key component of the IRPs is to develop a long-range plan for meeting renewable energy goals and GHG emissions reductions targets for the entire PacifiCorp PCA. In California, the renewable energy goals currently require PacifiCorp to demonstrate that they are on schedule to provide 33 percent of its total energy generation from renewable sources by 2020 and 60 percent by 2030. The current PacifiCorp IRP was filed in October 2019 (2019 IRP) and outlines a plan for transitioning to a future where energy is generated without GHG emissions. The 2019 IRP states that between 2018-2020, PacifiCorp will have increased the percentage of zero-carbon energy resources in its portfolio by 70 percent. The IRP also states that over the last 13 years, PacifiCorp has become the largest regulated utility owner of wind power in the West. In addition, the 2019 IRP identifies the company’s efforts to collaborate with other utility providers to create a more open and connected Western grid. For example, in 2014 PacifiCorp facilitated the development of the Western Energy Imbalance Market (EIM) in partnership with the California Independent System Operator. This market allows utilities across the West to access available lowest-cost energy in near real time, making it easier for zero fuel-cost renewable energy to be delivered where it is needed. As stated in the 2019 IRP, "If excess solar energy in California, excess wind from Wyoming or hydropower from Washington and Oregon is available, PacifiCorp will harness it and transport it instantly across the company's 16,500-mile grid" (PacifiCorp 2019b).

3.10.2.2 Energy

The U.S. energy supply is composed of a wide variety of energy resources, however, not all energy resources have the same environmental benefits and costs. The U.S. Environmental Protection Agency (USEPA) generally groups energy sources into three classifications, which includes conventional, renewable, and green (USEPA 2019b).

Conventional power includes the combustion of fossil fuels (coal, natural gas, and oil) and the nuclear fission of uranium. The Earth contains a finite supply of these fuels. Fossil fuels, which formed hundreds of millions of years ago, have environmental costs from mining, drilling, extraction, refining, transportation, and emit GHGs and air pollution during power generation. Although nuclear power generation emits no GHGs during power generation, it does require mining, extraction, and long-term radioactive waste storage (USEPA 2019b).

Renewable energy includes resources that rely on fuel sources that restore themselves over short periods of time and do not diminish. Such fuel sources include the sun, wind, moving water, organic plant and waste material (eligible biomass), and the Earth's heat (geothermal). The four Lower Klamath Project facilities are classified as renewable energy since they rely on moving water as a natural fuel source to generate electricity. The three Lower Klamath Project facilities in California are also defined as small hydroelectric plants that qualify as renewable energy under the State's Renewable Portfolio Standard (RPS), since they individually have a generating capacity of less than 30 megawatts (MW) (CEC 2018b). Although the impacts tend to be smaller than conventional power sources, some renewable energy technologies can have negative impacts on the environment. For example, hydroelectric resources can have environmental trade-offs on such issues as fisheries and land use (USEPA 2019b). Renewable energy sources also have the potential to generate some GHG emissions, though to a far lesser degree than conventional energy sources.

Green energy is a subset of renewable energy and represents those renewable energy resources and technologies that have the least adverse environmental impacts. Green energy is defined as electricity produced from solar, wind, geothermal, biogas, eligible biomass, and low-impact small hydroelectric sources. Customers often buy green energy for its low/zero emissions profile and carbon footprint reduction benefits (USEPA 2019b).

PacifiCorp PCA

PacifiCorp is a utility company that provides electricity to 1.9 million customers across 141,000 square miles in six western states. The PacifiCorp PCA, which is a region of the power grid in which all power plants are centrally dispatched, includes portions of the grid in the states of Utah, Oregon, Wyoming, Washington, Idaho, and California. Each power generating facility in the control area contributes to an interconnected electrical grid that delivers energy to consumers throughout the PacifiCorp PCA (PacifiCorp 2018).

In 2015, the electricity generation resource mix for PacifiCorp's PCA was dominated by coal (62 percent), natural gas (15.4 percent), wind (7.1 percent), and hydroelectricity (5.2 percent) (PacifiCorp 2017). In 2017, the owned electrical generation resources mix for PacifiCorp's PCA included 54.4 percent coal, 25.4 percent natural gas, and 20.2 percent renewable energy resources (PacifiCorp 2019a). According to the 2019 IRP, the company owns 1,135 MW of hydroelectric generation capacity and purchases 89 MW from other hydroelectric resources (PacifiCorp 2019b).

Energy Generated by the Lower Klamath Project Facilities

The Lower Klamath Project includes four hydroelectric developments along the mainstem of the Klamath River between river mile (RM) 193.1 and 233.3. As shown in Table RE-3.10-6, the installed generating capacity of the existing Lower Klamath Project is approximately 163 megawatts (MW) and, on average, the Lower Klamath Project generates 501,088 megawatt-hours (MWh) of electricity annually (PacifiCorp 2016).

Table RE-3.10-6. Lower Klamath Project Complexes.

Complex Name	Generating Facility	Total Authorized Generating Capacity (MW)[1]	Average Annual Generation (MWh)[2]	Location	River Mile
Copco No. 1 Dam and Reservoir	Copco No. 1 Powerhouse	20.0	95,158	California	201.8 to 208.3
Copco No. 2 Dam and Reservoir	Copco No. 2 Powerhouse	27.0	80,785	California	201.5 (Dam) and 200 (Powerhouse)
Iron Gate Dam and Reservoir	Iron Gate Powerhouse	18.0	103,225	California	193.1 to 200.0
J.C. Boyle Dam and Reservoir	J.C. Boyle Powerhouse	97.98	221,920	Oregon	229.8 (Dam) and 225.2 (Powerhouse)
Total	**--**	**162.98**	**501,088**	**--**	**--**

Source: FERC 2007, USEIA 2019.
Notes:

1. Nameplate capacity for Lower Klamath Project Complexes from FERC 2007.
2. Average annual generation (MWh) from USEIA 2019 is based on net energy generation from 2015-2018.
3. 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 RE-3.10-6, these three developments have a nameplate generation capacity of approximately 65 MW of electricity and produce an average of 279,168 MWh (32 MW) of electricity annually. In the EIR baseline year of 2016, the actual power generation from these three facilities was 286,508 MWh (32.7 MW). The Lower Klamath Project facilities in California account for approximately 56 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, the emissions may reach California, California energy and GHG reduction plans include consideration of imported energy, and the emissions of GHGs 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 that would exceed a no net increase threshold.
2. Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.
3. Wasteful, inefficient, or unnecessary consumption of energy resources that would cause potentially significant environmental impacts.
4. A substantial impact on local and regional energy supplies and/or on requirements for additional capacity.
5. Conflict with or obstruct a state or local plan for renewable energy or energy efficiency.

Significance Thresholds

Outside of the direct construction and operational emissions, the nature of the GHG emissions from the Proposed Project differs from most projects that CARB has identified as the 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 (CARB 2017b).

As noted in the CARB Scoping Plan, quantitative thresholds for the exchange of CO_2 between the atmosphere and California's natural and working lands (e.g., natural ecosystems and agricultural lands) have not been developed (CARB 2017b). The CARB Scoping Plan focuses on the rehabilitation and maintenance of natural and working lands to increase and/or maintain carbon sequestration as part of the state's climate solution. The Scoping Plan notes that natural and working lands have potential for carbon sequestration. The Scoping Plan also notes that some natural and working lands may be sources of GHG emissions; however, reductions in these emissions are not part of the state's strategy for achieving the longer-term GHG reductions targets for 2030 and 2050 (CARB 2017b).

The SCAPCD has not adopted quantitative thresholds for determining the significance of GHG emissions. In the absence of quantitative significance thresholds for GHG emissions in the SCAPCD, and of guidance in statewide plans regarding whether fast-cycle carbon emissions and fossil fuel emissions should be considered similarly for purposes of CEQA analysis, the EIR takes the conservative approach of assessing direct and indirect GHG emissions from the Proposed Project as compared to a no net increase threshold. The intent of this analysis is not to present the use of a no net increase threshold as a generally applied threshold of significance for GHG impacts. Its use in this EIR is related directly to the facts surrounding the Proposed Project and the lack of availability of other threshold options.

Direct sources of emissions from the Proposed Project include two years of construction emissions, temporary emissions from the reservoir sediment, and long-term annual emissions from the conversion of the reservoir areas to riverine, wetland, and terrestrial habitat types. Additionally, there could be long-term indirect emissions from the Proposed Project from PacifiCorp's energy mix (which includes coal, natural gas, etc.) that that would be used to replace the hydropower associated with the Lower Klamath Project facilities. Each of these potential sources of emissions is assessed against the "no net increase" threshold, applying the best relevant information regarding that particular type of emission.

A GHG impact additionally would be significant if GHG emissions from the Proposed Project would conflict with an applicable plan for GHG reduction. To the extent that the Project does not result in a net increase of GHGs, it does not result in a conflict with GHG reduction plans. For potential emissions paths that result in emissions, the EIR evaluates whether the emissions 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). 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. 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, SB 350, and SB 100). 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 60 percent renewable sources by 2030. As noted above, the three Lower Klamath Project hydroelectric facilities in California are defined as small hydroelectric plants that qualify as renewable energy under the State's RPS, since they individually have a generating capacity of less than 30 MW (CEC 2018b). Thus, the analysis addresses potential for the identified emission sources to conflict with these goals.

As described above, 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 California Air Resources Board's *Climate Change Scoping Plan* include the Renewable Portfolio Standard, the Cap-and-Trade Program, and the Low Carbon Fuel Standard (CARB 2017b).

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, small hydro, 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 the program's inception. Most recently, then-Governor Jerry Brown signed into law Senate Bill (SB) 100 in September 2018, which requires utilities to procure 60 percent of their electricity from renewables by 2030, and sets as a state policy that state agencies and end-use retail customers receive 100 percent of energy from renewable and zero-carbon resources by 2045. In addition, SB 350 requires California utilities to develop IRPs that incorporate a GHG emission reduction planning component. Compliance with the California RPS requires PacifiCorp to develop and implement an IRP that demonstrates they are on schedule to comply with the goals of providing 33 percent renewable sources by 2020 and 60 percent renewable sources by 2030. To ensure retail sellers meet their RPS requirement, the California Public Utilities Commission (CPUC) is responsible for establishing enforcement procedures and imposing penalties for non-compliance with the program (CPUC 2018).

Additionally, other states within PacifiCorp's PCA have GHG reduction goals that similarly require reductions in the generation of GHG emissions (PacifiCorp 2019b). For example, the State of Oregon has adopted a number of GHG reduction goals, including passing the nation's first coal-to-clean law, which eliminates out-of-state coal-fired electricity by 2030. Oregon will also close the last remaining coal plant in the state 20 years early in 2020. In addition, Oregon has increased their RPS target by requiring utilities to obtain 50 percent of their energy from renewable sources by 2040 (State of Oregon Governor's Office 2019).

3.10.4 Impact Analysis Approach

The quantification of direct construction 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). Direct short-term construction GHG emissions include those associated with on- and off-site construction equipment, construction worker commuting, and haul truck emissions.

For this analysis, operational emissions under current conditions (i.e., of the four Lower Klamath Project facilities and Iron Gate Hatchery) are anticipated to be significantly greater than the reduced operation of Iron Gate Hatchery combined with the re-instated operation of Fall Creek Hatchery. This is because existing emissions generated by operation of the four Lower Klamath Project facilities (e.g., employee traffic, maintenance equipment, releases of minor amounts of SF_6 from gas insulated switchgear equipment, emissions from the reservoirs as part of the natural carbon cycle, etc.) would be eliminated, and production levels at the two hatcheries post-dam removal would decrease relative to current conditions. Thus, although two hatcheries will operate post-dam removal, overall it is anticipated that there would be a net decrease in operational emissions post-dam removal (Section 2.7.6 *Hatchery Operations*).

As noted above in Section 3.10.2 *[Greenhouse Gas Emissions and Energy] – Environmental Setting*, there is the potential for the release of sequestered carbon from the exposure of sediments containing algal biomass when these sediments are released to downstream reaches of the Klamath River. As part of the natural fast-carbon cycle, the sediments containing dead algae, released to downstream reaches of the Klamath River during high flow events, would be subjected to oxygenated conditions where aerobic bacterial decomposition would release the temporarily sequestered carbon, primarily as CO_2. Aerobic bacterial decomposition of organic sediment is a natural process that would have occurred on a yearly basis if the reservoirs would have been in place and accumulated detritus. The potential emissions from reservoir sediments associated with drawdown has been estimated for the Proposed Project, based on laboratory-measured rates of biochemical oxygen demand (BOD) from Lower Klamath Project reservoir sediments, as applied to the release and/or oxidation of the total mass of reservoir sediment deposits. These potential emissions are compared to a no net increase threshold of significance.

As discussed in Section 2.7.4 *Restoration Within the Reservoir Footprint* (pages 2-69 to 2-76) and Section 2.75 *Restoration of Upland Areas Outside of the Reservoir Footprint* (page 2-77), the proposed restoration activities will include planting of a variety of vegetation species. This increase in vegetative cover has the potential to sequester carbon. However, the conversion of the reservoir areas to riverine, wetland, and terrestrial habitat types also has the potential to generate GHG emissions. A range of potential emissions from these changes in land use have been estimated for the Proposed Project. These potential emissions are compared to a no net increase threshold of significance.

Indirect GHG emissions from the Proposed Project include potential emissions associated with energy generation sources (e.g., coal, natural gas) that could be used in the electrical generation mix to replace the hydropower associated with the Lower Klamath Project dam complexes on an interim basis. For this analysis, potential indirect GHG emissions from continued power production for the PacifiCorp PCA are compared to a no net increase threshold.

Where the quantitative or qualitative estimates for emissions exceed the no net increase threshold, the emissions are further evaluated for compliance with GHG reduction plans.

The GHGs impact modeling described in Appendix N *Air Emissions Modeling for the Lower Klamath Project and* Appendix O *Greenhouse Gas and Energy*

Modeling for the Lower Klamath Project is focused on construction emissions and is based on information available in Appendix B *Definite Plan* and refined information on construction equipment and activities provided by KRRC. The emissions estimates related to the reservoir sediments during drawdown and the conversion of the reservoir areas to riverine, wetland, and terrestrial habitat types is based on a review of pertinent literature, as further discussed below. The qualitative analysis of potential indirect emissions from continued power production for the PacifiCorp PCA is based on a review of relevant energy planning documents including the PacifiCorp IRPs prepared between 2015 and 2019. The Proposed Project and the potential sources of GHG emissions are compared to the thresholds noted in Section 3.10.3 *Significance Criteria* and analyzed in Section 3.10.5 *[Greenhouse Gas Emissions and Energy] Potential Impacts and Mitigation*.

Greenhouse Gas Emissions Quantification

The Lower Klamath Project construction and operations GHG analysis focuses primarily on 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.

Other pollutants commonly evaluated in various mandatory and voluntary GHG reporting protocols include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF_3). Unlike many other GHGs, fluorinated gases have no natural sources and only come from human-related activities. HFCs are commonly used as refrigerants, aerosol propellants, foam blowing agents, solvents, and fire retardants. PFCs are produced as a byproduct of aluminum production and are used in the manufacturing of semiconductors (USEPA 2019c). NF3 is released in the manufacture of semiconductors and liquid crystal display panels, and certain types of solar panels and chemical lasers. Since the Proposed Project is not expected to emit more than trace amounts of these pollutants, if any at all, they are not discussed further in this section.

Because sulfur hexafluoride (SF_6) is used as an insulating medium in gas insulated switchgear equipment such as interrupters, transformers, capacitors, circuit breakers, and circuit switchers, there is also the potential for the release of SF_6 during decommissioning of the Lower Klamath Project facilities. During the decommissioning activities, SF_6 gas could be emptied from the gas insulated switchgear equipment in some Lower Klamath Project facilities. Due to its high global warming potential and long atmospheric lifetime, regulations such as 17 CCR 95350-95359 (Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear) strictly limit the release of SF_6 to assist in implementation of the State's GHG reduction goals. As indicated in a letter (dated October 31, 2019) submitted by KRRC to the State Water Board, KRRC has expressed its commitment to comply with all applicable regulations for the handling of electrical power equipment insulated with SF_6 gas during activities related to the Proposed Project (KRRC 2019a). As such, it is anticipated that the

SF_6 in the gas-insulated switchgear equipment at the Lower Klamath Project facilities would be completely or almost completely contained during decommissioning and recycled to minimize the potential for the release of SF_6 emissions. It is anticipated that there would be no net increase of SF_6 emissions during decommissioning of the Lower Klamath Project facilities. Although there is the potential for the accidental release of SF_6 during decommissioning activities beyond the amounts allowed per regulatory requirements, any attempt to quantify such unauthorized releases would be speculative.

Direct emissions of CO_2, CH_4, and N_2O were calculated for construction activities including pre-dam removal activities, dam and powerhouse deconstruction, and restoration activities. Detailed calculations for the Proposed Project are provided in Appendix N *Air Emissions Modeling for the Lower Klamath Project* and Appendix O *Greenhouse Gas and Energy Modeling for the Lower Klamath Project*.

Quantification of GHG emissions was conducted using a combination of methods, including the use of emission factors from the USEPA's published *AP-42: Compilation of Air Emissions Factors*, exhaust emission factors from the Sacramento Metropolitan Air Quality Management District's (SMAQMD) Road Construction Emissions Model (RCEM), and the California Emissions Estimator Model (CalEEMod) version 2016.3.2. Although the RCEM model was created by SMAQMD, this model uses CARB's OFFROAD model to derive exhaust emission factors, and therefore, is appropriate for use throughout California for CEQA analyses.

Exhaust emissions from construction equipment were estimated using SMAQMD RCEM, version 9.0. Although the model was developed by SMAQMD, emission rates and engine usage factors for construction equipment are based on the same CARB-approved model (i.e., OFFROAD) used in CalEEMod and statewide for conducting emissions modeling and is therefore appropriate for use in this analysis. Exhaust emissions from supplemental construction equipment such as lawnmowers, chippers, and chainsaws were estimated using OFFROAD 2007, since these equipment types are not included in the SMAQMD's RCEM. Additional supplemental construction equipment including boats and helicopters were estimated using EPA and the Federal Office of Civil Aviation emissions factors, respectively. The CARB EMFAC 2017 model was used to estimate emissions from on-road vehicles from worker commute trips and truck hauling trips.

In addition to emissions from construction equipment, drawdown of the Lower Klamath Project reservoirs would result in temporary GHG emissions from exposure and mobilization of the accumulated reservoir sediments. During initial drawdown, reduced water column heights in each reservoir would result in reduced soil pore pressures in the reservoir bottom sediments, which has been associated with the sudden release of bubbles (ebullition) of methane (CH_4) into the water and to the atmosphere. In a recent study examining the effects of reservoir water level drawdown upon CH_4 emissions, Harrison et. al (2017) made direct measurements of J.C. Boyle Reservoir during daily water level variations, as well as measurements of Keno Reservoir under constant water levels, during August of 2013. CH_4 emissions ranged from 50–400 mg/m^2/d during periods of stable water levels to as much as 50–1,000 mg/m^2/d during drawdown periods. To assess potential CH_4 emissions due to drawdown-induced bubble ebullition from the Lower Klamath Project reservoirs, the measured rates reported in Harrison et al. (2017) were applied to the areas of each of the reservoirs for the expected duration of drawdown.

Additionally, reservoir drawdown under the Proposed Project is anticipated to mobilize a large amount of sediment in the six months following the initiation of drawdown, and potentially a considerably lesser amount within 18 months of drawdown (Section 3.2.4.2 *Suspended Sediments*). This sediment mobilization is expected to result in the oxidation of sediment-associated organic matter that has been held under anerobic (low oxygen) or anoxic (no oxygen) conditions in the reservoir bottoms (Section 3.2.4.4 *Dissolved Oxygen*). Recognizing that natural organic matter from Upper Klamath Lake and other surface waters is composed of both easily oxidized carbon (labile carbon) as well as more recalcitrant carbon (refractory carbon) (Sullivan et al. 2010, Richardson et al. 2013), the potential GHG contributions from sediment oxidation were assessed under the Proposed Project using the results of laboratory measured 30-day biochemical oxygen demand (BOD) from Lower Klamath Project reservoir sediment samples (Stillwater Sciences 2011).

The average measured BOD per mass of sediments for Copco No. 1 and Iron Gate reservoir sediments (3.52×10^{-3} milligram oxygen per milligram sediments, dry weight) (Stillwater Sciences 2011) was applied to the estimated total mass of sediments in the reservoir footprints to estimate the amount of CO_2 that could be produced as a result of sediment mobilization and exposure under the Proposed Project. Because the sediment samples collected for BOD testing were not separated into component grain sizes, the measured BOD was applied to the total mass of sediments in the reservoir footprints, including fine sediment (with a grain diameter less than 0.063 millimeters) and sand sediment (with a grain diameter between 0.063 and 2 millimeters) (see also Table 2.7-11). The total mass of sediments in the reservoir footprints was estimated for the year 2022 (i.e., dam removal year 2, when drawdown would primarily occur) based on the KRRC's most recent update to the Proposed Project (KRRC 2019b). The calculations assume that the sediment volume (and mass) present behind the dams in 2020 would increase by approximately 19,600 cubic yards per year (39,200 cubic yards for two years) in J.C. Boyle Reservoir, 81,300 cubic yards per year (162,600 cubic yards for two years) in Copco No. 1 Reservoir, and 100,000 cubic yards per year (200,000 cubic yards for two years) in Iron Gate Reservoir, based on estimates of annual sedimentation rates for each reservoir (USBR 2012b. GHG emissions from the total sediment mass were conservatively assumed to result from the stoichiometric conversion of sediment BOD to CO_2. That is, for each O_2 molecule reduced, one molecule of CO_2 is generated from the reservoir sediments, resulting in a mass equivalent of 1.375 mg of CO_2 per mg of O_2. Estimates of GHG mass emissions as CO_2 equivalents due to sediment release were thus calculated to be 1.375 times the BOD.

This approach for estimating GHG emissions resulting from exposure and mobilization of reservoir sediment deposits following the initiation of reservoir drawdown provides a conservative (high) estimate of the potential for temporary GHG emissions for the following reasons: a) incomplete oxidation of refractory carbon in sediments would result in lower oxygen consumption and CO_2 emissions compared with the idealized laboratory conditions used to develop the BOD values in the calculations; b) within the reservoir footprint, sediment deposits that remain may only partially oxidize at surface and near-surface locations where oxygen can readily permeate in the sediment profile; and c) the estimated total mass of reservoir sediment deposits is used for the calculations, rather than using only the estimated mass of the fine sediments (i.e., with a diameter less than 0.063 millimeters) which contain the vast majority of the organic matter that would be subject to BOD and subsequently would be converted to CO_2.

To assess GHG emissions from the Lower Klamath Project reservoirs under existing conditions, minimum and maximum GHG production estimates from hydroelectric reservoirs reported in Deemer et. al (2016) were multiplied by the areas of Iron Gate, Copco No. 2, Copco No. 1, and J.C. Boyle. The reservoir production estimates reported in Deemer et al. (2016) represent a synthesis of studies conducted over the past two decades to ascertain the contribution of reservoir emissions to global GHG budgets. The various studies included in Deemer et al. (2016) have collectively measured GHG emissions from more than 200 reservoirs, including emissions from more than 80 hydroelectric reservoirs (Barros et al. 2011, Hertwich 2013), such that the resulting GHG production estimates, as applied to the Lower Klamath Project reservoirs, represent a reasonable range of values for consideration of potential impacts.

Similarly, minimum and maximum GHG production estimates from rivers reported in the Deemer et al. (2016) synthesis, as well as a broad-reaching study of CO_2 emissions from rivers by Butman and Raymond (2011), were multiplied by the area of the riverine reaches with (existing conditions) and without (Proposed Project) the Lower Klamath Project reservoirs in place. Further, because several habitats are expected to develop in the reservoir footprint in the decades following drawdown, estimates of future GHG emissions of wetlands, grasslands, and forests were adapted from a recent USGS assessment of changes in carbon storage and GHG emissions from ecosystems of the western U.S. through 2050 (Zhu et. al 2012). Since Deemer et al. (2016) also reports wetland GHG emissions, the range of GHG production estimates for wetlands uses data from both Zhu et al (2012) and Deemer et al. (2016). In general, because quantification of GHG emissions from ecosystems is still a developing scientific field, ecosystems, by definition, occur everywhere on the globe, and there are numerous variables that control GHG emissions from ecosystems, reported emissions in the aforementioned sources can vary by a factor of ten or more between similar habitat types. Thus, the estimates of existing conditions and future GHG emissions for wetlands, grasslands, and forests are presented to provide a general understanding of the direction of change in emissions under the Proposed Project.

All GHG emissions have a global warming potential (GWP) which represents the degree of impact from different gases. Furthermore, GWP is a measure of how much energy is absorbed by one ton of a certain gas in the atmosphere over a given time, in comparison to one ton of CO_2 (EPA 2019). Each GHG emission inventoried in this report has an applied GWP which is expressed in carbon dioxide equivalent (CO_2e). Due to advances in science, the GWPs are modified regularly according to the Intergovernmental Panel on Climate Change's (IPCC) Assessment Reports. For this report, GWP is based on the Fourth Assessment Report to be consistent with the latest version of CalEEMod version 2016.3.2. All Proposed Project emissions for CO_2, CH_4, and N_2O, were converted to metric tons of CO_2e ($MTCO_2e$).

Energy

Appendix F of the *State CEQA Guidelines* requires that an EIR 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." Since the Proposed Project involves the removal of the Lower Klamath Project hydroelectric facilities, it is also relevant to include a discussion of whether the Proposed Project will impact local and regional energy supplies and require additional capacity or whether it will conflict with or obstruct state or local plans for renewable energy and energy efficiency.

During construction activities related to the Proposed Project, energy would be consumed in the form of petroleum-based fuels used to power off-road construction vehicles and equipment, construction worker travel, hauling truck trips, and to operate generators to provide temporary power for lighting and electronic equipment. This project proposes the removal of the Lower Klamath Project dam complexes and would not result in an increase in long-term energy use.

An estimate of fuel consumption was calculated for construction activities including pre-dam removal activities, dam and powerhouse deconstruction, and restoration activities. The energy calculations for the Proposed Project are provided in Attachment A to Appendix N *Air Emissions Modeling for the Lower Klamath Project*.

For this analysis, energy use under current conditions (i.e., operation of the four Lower Klamath Project facilities and Iron Gate Hatchery) is anticipated to be significantly greater than the reduced operation of Iron Gate Fish Hatchery combined with the re-instated operation of Fall Creek Hatchery. This is because the existing energy used for operation of the four Lower Klamath Project facilities (e.g., employee traffic, maintenance equipment, electronic equipment, lighting, etc.) would be eliminated, and fish production levels at the two hatcheries post-dam removal would decrease relative to current conditions. Thus, although two hatcheries will operate post-dam removal, overall it is anticipated that there would be a net decrease in operational emissions post-dam removal (Section 2.7.6 *Hatchery Operations*).

3.10.5 Potential Impacts and Mitigation

Potential Impact 3.10-1 Generation of direct GHG emissions from construction activity and operations.
Over a two-year period, direct GHG emissions would be generated by the Proposed Project's construction activities, which are associated with pre-dam removal activities, dam and powerhouse deconstruction, and restoration activities. Sources of emissions from these construction activities include on- and off-site construction equipment, construction worker commuting, and haul truck emissions.

The Proposed Project includes construction activities related to the decommissioning of the Lower Klamath Project dam complexes that would be completed within two years of commencement. The direct operational emissions from the Proposed Project are from hatchery operations for eight years following dam removal. The discussion below provides more detailed information about the Proposed Project's construction and operational emissions, including summaries of the anticipated emissions in various phases of construction.

Project Construction-related Emissions
Pre-Dam Removal Activities
Pre-dam removal activities include Fall Creek hatchery modifications; access road, bridge, and culvert improvements; recreation facilities removal; flood improvements; Yreka water supply pipeline relocation; seed collection; invasive exotic vegetation control; and Iron Gate hatchery modifications. Table RE-3.10-7 summarizes unmitigated GHG emissions from the pre-dam removal activities.

Table RE-3.10-7. Unmitigated Direct GHG Emissions Inventories for Pre-Dam Removal Activities.

Project Activity	Emissions (MTCO_2e)
Fall Creek hatchery modification	20
Access, road, bridge, and culvert replacements	335
Recreational facility removal	160
Flood improvements[1]	–
Yreka water supply pipeline relocation	57
Seed collection[1]	–
Invasive Exotic Vegetation control 1	28
Invasive Exotic Vegetation control 2	28
Iron Gate hatchery modification	34
Total Emissions	663

Source: Emissions calculations are provided in Attachment A to Appendix N.
Notes:
[1] Emissions for these items are captured in on-road emissions calculations because there is no heavy equipment associated with these activities. Calculations for all activities and sources are shown in Attachment A to Appendix N.

As shown in Table RE3.10-7, total GHG emissions from pre-dam removal activities are estimated to be approximately 663 MTCO_2e. Pre-dam removal activities would be the smallest contributor of the construction emissions that would occur from the Proposed Project.

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 RE-3.10-8 summarizes unmitigated emissions associated with dam and powerhouse deconstruction.

Table RE-3.10-8. Unmitigated Direct GHG Emissions Inventories for Dam and Powerhouse Deconstruction.

Location	Emissions ($MTCO_2e$)
Iron Gate Dam Removal	4,267
Copco No. 1 Dam Removal	3,772
Copco No. 2 Removal	1,415
J.C. Boyle Removal	7,605
Total Emissions	**17,059**
California Total	9,454
Oregon Total	7,605

Source: Emissions calculations are provided in Attachment A to Appendix N.

As Table RE-3.10.8 shows, deconstruction of the dams would contribute approximately 17,059 $MTCO_2e$ of GHG emissions during the deconstruction period. As indicated by Table RE-3.10-7 and Table RE-3.10.8, 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, where feasible, would come from Lower Klamath Project facilities. Therefore, the GHG emissions associated with cofferdam construction would already be included in the emissions inventory. Demolition of the cofferdams would be included in the emissions inventory for general dam demolition activities. Construction of the cofferdams from materials salvaged from the dam demolition activities would reduce the need for importing new construction materials and would ultimately reduce the amount of GHG emissions generated during the Proposed Project’s construction period. Similarly, the creation and use of nearby, onsite waste disposal areas would reduce the amount of hauling required to move the rubble, rock, and earthen materials from dam removal.

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 aerial fall seeding may be necessary to supplement areas where spring hydroseeding was unsuccessful. Table RE-3.10-9 summarizes unmitigated GHG emissions from restoration activities.

Table RE-3.10-9. Unmitigated Direct GHG Emissions Inventories for Restoration (Seeding).

Location	Emissions ($MTCO_2e$)
Iron Gate Dam	843
Copco No. 1 Dam	451
Copco No. 2 Dam	194
J.C. Boyle Dam	918
Total Emissions	**2,406**

Source: Emissions calculations are provided in Attachment A to Appendix N.

As shown in Table RE-3.10-9, total GHG emissions from restoration activities are estimated to be approximately 2,406 $MTCO_2e$. As indicated in Table RE3.10-9, 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.

Hatchery Operations for Eight Years Following Dam Removal

As discussed in Section 3.10.4 *Impact Analysis Approach*, direct operational GHG emissions under current conditions (i.e., operation of the four Lower Klamath Project facilities and Iron Gate Fish Hatchery) are anticipated to be significantly greater than the reduced operation of Iron Gate Fish Hatchery combined with the re-instated operation of Fall Creek Hatchery. This is due to the fact that the existing emissions generated by operating the four Lower Klamath Project facilities (e.g., employee traffic, maintenance equipment, releases of minor amounts of SF_6 from gas insulated switchgear equipment, emissions from the reservoirs as part of the natural carbon cycle, etc.) would be eliminated Thus, although two hatcheries will operate post-dam removal, overall it is anticipated that there would be a net decrease in operational emissions post-dam removal. Therefore, no increase in GHG emissions would result from the operation of the hatcheries for eight years following dam removal.

Conclusion

Table RE-3.10-10 summarizes the total unmitigated emissions associated with the Proposed Project's construction-related and operational emissions.

Table RE-3.10-10. Unmitigated Direct GHG Emissions Inventories for Construction Activity and Hatchery Operations**.**

Project Activity	Emissions ($MTCO_2e$)
Construction-related and Operational Emissions	
Pre-Dam Removal	663
Iron Gate Dam Removal	4,267
Copco No. 1 Dam Removal	3,772
Copco No. 2 Removal	1,415
J.C. Boyle Removal	7,605
Restoration	2,406
Operation of Two Hatcheries for Eight Years	No net increase[1]
Total Emissions	**20,128**

Source: Construction emissions calculations are provided in Attachment A to Appendix N.

[1] As noted above, direct operational GHG emissions under current conditions (four Lower Klamath Project facilities and Iron Gate Fish Hatchery) are anticipated to be greater than the reduced operation of Iron Gate Fish Hatchery combined with the re-instated operation of Fall Creek Hatchery. Therefore, no increase in GHG emissions would result from operation of the hatcheries for eight years following dam removal.

As shown in Table RE-3.10-10, the Proposed Project would result in 20,128 $MTCO_2e$ of emissions from construction activity. As shown in Table RE-3.10-10 and discussed above, no net increase in emissions would result from operation of the hatcheries following dam removal for eight years. While exceedance of the no net increase threshold for GHG emissions from Proposed Project's construction activity would be a significant impact without mitigation, with mitigation described below the Proposed Project would meet the no net increase threshold.

The Global Warming Solutions Act of 2006 (AB 32) directed 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), and to maintain such reductions thereafter. CARB approved the Scoping Plan in 2008 and first updated it in May 2014. The second update in November 2017 also address the actions necessary to achieve the further GHG emissions reduction goal of reducing GHG emissions to 40 percent below 1990 levels by 2030, as described in Senate Bill 32 (SB 32).

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 2018b):

> "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."

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. CARB's 2017 updates to the Scoping Plan address a statewide approach across a wide range of sectors, in order to meet the 2030 goals in SB 32, and to substantially advance achieving reductions contemplated in Executive Order S-3-05.

The CARB Scoping Plan recommends that, in the absence of an adequate geographically specific GHG reduction plan, projects incorporate design features and GHG reduction measures, to the degree feasible, to minimize GHG emissions. As noted above, the re-use of materials removed from the dams to build cofferdams and the selection of on-site waste disposal sites reduce construction-related GHG emissions. Due to the nature of the Proposed Project (decommissioning of the Lower Klamath Project facilities) as a large construction project, there are minimal additional opportunities to incorporate onsite design features to reduce GHG emissions. Nonetheless, air quality mitigation measures requiring that certain on-road and off-road emissions standards be met for construction equipment and vehicles (Mitigation Measure AQ-1 through Mitigation Measure AQ-3) may provide small GHG emission benefits.

The CARB Scoping Plan also identifies the purchase of carbon offsets as a viable method to reduce or eliminate the impact of GHG emissions, as long as the offsets represent real reductions in GHG (CARB 2017b). To mitigate the estimated emissions from construction activity, the KRRC has agreed to purchase carbon offsets per GHG Mitigation Measure ENR-1. With implementation of GHG Mitigation Measure ENR-1, the GHG emissions impact from construction activity would meet the no net increase threshold and be less than significant.

No emissions from the Proposed Project are expected to occur prior to 2021, well after the 2020 goal set in AB 32. For this reason, it is more appropriate to consider whether the Proposed Project would conflict with the goals in SB 32 and Executive Order S-3-05. As noted above, GHG reduction measures were incorporated into the Proposed Project. Additionally, the KRRC has agreed to implement Mitigation Measures AQ-1, AQ-2, and AQ-3 that are likely to further reduce GHG emissions, and the implementation of GHG Mitigation Measure

ENR-1 would offset all construction-related GHG emissions from the Proposed Project. As discussed above in Section 3.10.4 *Impact Analysis Approach*, Proposed Project hatchery operations are not expected to cause an increase in GHG emissions over baseline operational conditions for the Lower Klamath Project, and are anticipated to cease after eight years. The CARB Scoping Plan states that achieving a no net increase in GHG emissions is an appropriate overall objective for new developments, which typically involve construction emissions. The Proposed Project includes GHG reduction measures, additional on-site air quality measures that are likely to further reduce GHG emissions, and mitigation through purchase of carbon offsets to meet the no net increase threshold for GHGs. Furthermore, operational emissions post-dam removal would be reduced relative to current conditions. Therefore, the construction and operational emissions from the Proposed Project with mitigation would not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Mitigation Measure ENR-1 – Purchase of Carbon Offsets

Prior to the start of pre-dam removal activities and any construction activities, the KRRC shall purchase and retire carbon offsets for the estimated 20,128 $MTCO_2e$ of construction GHG emissions that will be generated by the Proposed Project. The purchase of carbon offsets for the Proposed Project shall occur according to the following criteria:

- “Carbon Offset” shall mean an instrument issued by any of the following: CARB, Climate Action Reserve, California Air Pollution Control Officers Association, the APCD, or any other equivalent or verifiable registry.
- Any carbon offset that is used to reduce the Project’s GHG emissions shall meet the requirements of CEQA Guidelines Section 15126.4(C)(3) and meet the following criteria:
    1) Real – They represent reductions actually achieved (not based on maximum permit levels).
    2) Additional/surplus – They are not already planned or required by regulations or policy (i.e., not double counted).
    3) Quantifiable – They are readily accounted for through process information and other reliable data.
    4) Enforceable – They are acquired through legally binding commitments/agreements.
    5) Validated – They are verified through the accurate means by a reliable third party.
    6) Permanent – They will remain as GHG reductions in perpetuity.

Significance

No significant impact with mitigation for GHG emissions from construction activities

No significant impact from operation of the hatcheries following dam removal for eight years

Potential Impact 3.10-2 Generation of direct GHG emissions from reservoir sediments during drawdown that would exceed a no net increase threshold.

Following initiation of reservoir drawdown, temporary emissions of GHGs would result from changes in reservoir sediment pore pressures due to drawdown, as well as exposure of previously submerged sediment-associated organic matter to aerobic conditions and subsequent transport of 1/3 to 2/3 of the reservoir sediment deposits through the Middle and Lower Klamath River and into the Pacific Ocean Nearshore Environment. Organic matter in remaining sediment deposits would also partially oxidize once exposed to air. The majority of the aforementioned temporary GHG emissions would occur within six months of drawdown. The discussion below provides additional detail regarding GHG emissions associated with these two drawdown-related processes under the Proposed Project.

Harrison et. al (2017) conducted a 2013 assessment of methane (CH_4) ebullition (gas bubble release from sediment pore waters and/or the water column) from J.C. Boyle Reservoir during summertime periods of hydropower-related reservoir drawdown. Based upon CH_4 ebullition rates in this study, between approximately 28 and 549 $MTCO_2e$ of CH_4 could be released from Lower Klamath Project reservoir sediments as water levels are drawn down under the Proposed Project (Table RE-3.10-11). Note that the estimates presented in Table RE-3.10-11 may either overestimate or underestimate CH_4 emissions under the Proposed Project compared with the 2013 rates measured in J.C. Boyle Reservoir. This is because the seasonality and timing of drawdown are important variables that influence the amount of CH_4 emissions released from reservoirs (Harrison et al. 2017, Tuser at el. 2017). In the J.C. Boyle Reservoir study, the reported CH_4 emissions were measured under repeated, partial-drawdown, summertime conditions (Harrison et al. 2017), when warm water temperatures and repeated water-level fluctuations would stimulate microbial activity and potentially CH_4 production and ebullition. In contrast, drawdown under the Proposed Project would occur as a one-time, complete drawdown event that begins in the winter and ends by early spring (January through March), thus following an extended period of low temperatures, relatively low microbial activity, and correspondingly low CH_4 production and ebullition. Alternatively, the estimates in Table RE-3.10-11 may underestimate CH_4 emissions under the Proposed Project because the J.C. Boyle Reservoir emission rates, which were measured in association with more regular and substantial reservoir water fluctuation, are applied to the larger and deeper Copco No. 1 and Iron Gate reservoirs that do not experience substantial water level fluctuation and could experience a build-up and release of larger amounts of CH_4 from anoxic bottom waters and sediments. Thus, although the available measurements from J.C. Boyle Reservoir (Harrison et al. 2017) provide a reasonable estimate of CH_4 that could be released from Lower Klamath Project reservoir sediments as water levels are drawn down for dam removal, there remains considerable uncertainty associated with the values in Table RE-3.10-11.

Table RE-3.10-11. Estimated Range of Methane Emissions from Reservoir Sediments During Drawdown Based on Measurements from J.C. Boyle Reservoir Water Level Fluctuations.

Reservoir	**Area (km^2)**	**Days of Drawdown**	**GHG Emissions $MTCO_2e$**	**GHG Emissions $MTCO_2e$**
			50 mg $CH_4/m^2/d$	**1,000 mg $CH_4/m^2/d$**
J.C. Boyle Reservoir	1.42	22	1.6	31.2
Copco No. 1 Reservoir	3.93	90	17.7	354.0
Copco No. 2 Reservoir	0.02	1	0.0	0.0
Iron Gate Reservoir	3.81	43	8.2	163.9
Total $MTCO_2e$			**30**	**550**

Note: Estimates apply the range of rates (50−1,000 mg $CH_4/m^2/d$) measured in J.C. Boyle Reservoir in 2013 (Harrison et. al 2017) to the areas of other Lower Klamath Project reservoirs and express the rates as a range of $MTCO_2e$. Although the rates measured by Harrison et al. (2017) provide reasonable order-of-magnitude estimates of CH_4 that could be released from reservoir sediments as water levels are drawn down under the Proposed Project, there is considerable uncertainty associated with these estimates due to the seasonal timing of drawdown and differences in the amount of drawdown between the 2013 study (partial) and the Proposed Project (full). Totals rounded to the nearest 10 $MTCO_2e$.

In addition to CH_4 ebullition from sediment pore waters, large amounts of temporary CO_2 emissions are expected from the biochemical oxidation of organic matter associated with historical sediment deposits that would be exposed to oxygen in air and water as a result of reservoir drawdown, particularly during the six month period (November dam removal year 1 through May dam removal year 2) when approximately 1/3 to 2/3 of the sediment deposits would be transported downstream with the water during drawdown (see also Section 2.7.2 *Proposed Project – Reservoir Sediment Deposits and Erosion During Drawdown*). Additional periods of elevated suspended sediments and associated biochemical oxidation of reservoir sediment carbon would be expected to occur during November dam removal year 2 through May post-dam removal year 1 (see also Potential Impact 3.2-3, Figures RE-3.2-11 through Figure RE-3.2-17). Sediments remaining within the reservoir footprints would be expected to partially oxidize from dewatering and air exposure, although the degree of partial oxidation of the newly exposed reservoir sediment deposits is unknown. Thus, as a conservative estimate, stoichiometric conversion of calculated biochemical oxygen demand (BOD) to CO_2 for the estimated total mass of reservoir sediment deposits present in 2022 (dam removal year 2, when the majority of sediment transport and exposure to air would occur) suggests that temporary GHG emissions of up to approximately 18,800 $MTCO_2e$ from biochemical oxidation of the sediments would occur under the Proposed Project (Table RE-3.10-12).

As discussed in Section 3.10.4 *[Greenhouse Gas Emissions and Energy] Impact Analysis Approach*, assuming that the total mass of reservoir sediment deposits present in 2022 would fully oxidize to CO_2 provides a conservative (high) estimate of the potential for temporary GHG emissions for the following reasons: a) incomplete oxidation of refractory carbon in sediments would result in lower oxygen consumption and CO_2 emissions compared with the idealized laboratory conditions used to develop the BOD values in the calculations; b) within the reservoir footprint, sediment deposits that remain may only partially oxidize at surface and near-surface locations where oxygen can readily permeate in the sediment profile; and c) the estimated total mass of reservoir sediment deposits is used for the calculations, rather than using only the estimated mass of the fine sediments (i.e., with a diameter less than 0.063 millimeters) which contain the vast majority of the organic matter that would be subject to BOD and subsequently would be converted to CO_2.

Table RE-3.10-12. Estimated Temporary CO_2 Emissions from Oxidation of Sediment-Associated Organic Matter Through Biochemical Oxygen Demand (BOD) for the Total Sediment Mass in the Reservoir Footprints Under the Proposed Project.

Reservoir	2020 Total Sediment Volume (yd^3)[1,2,3]	2022 Total Sediment Volume (yd^3)[1,2,3]	2020 Total Sediment Mass (tons, dry weight)[1,2,3,4]	2022 Total Sediment Mass (tons, dry weight)[1,2,3,4]	BOD (tons)[5]	CO_2 (tons)[6]	CO_2 ($MTCO_2$ Eq.)[7]
J.C. Boyle	1,190,000	1,229,200	340,000	351,000	1,200	1,700	1,500
Copco No. 1	8,250,000	8,412,600	2,090,000	2,131,000	7,500	10,300	9,400
Iron Gate	5,690,000	5,890,000	1,730,000	1,791,000	6,300	8,700	7,900
Total[8,9]	15,130,000	15,531,800	4,160,000	4,273,000	15,100	20,700	18,800

1 Total sediment volume and mass estimated to be in the reservoir footprints for the year 2020, including fine sediment and sand, is from Section 2.7.3, Table 2.7-11.

2 Between 2020 and 2022 (i.e., dam removal year 2, when drawdown would primarily occur), the sediment volume present behind the dams would increase by approximately 19,600 cubic yards per year (39,200 cubic yards for two years) in J.C. Boyle Reservoir, 81,300 cubic yards per year (162,600 cubic yards for two years) in Copco No. 1 Reservoir, and 100,000 cubic yards per year (200,000 cubic yards for two years) in Iron Gate Reservoir, based on estimates of annual sedimentation rates for each reservoir (USBR 2012b).

3 Amount of sediment with a diameter greater than 2 millimeters is negligible (< 0.5 percent) for all the reservoirs, within the uncertainty of the sediment estimates, and would not be likely to be associated with large amounts of organic matter that could be oxidized to CO_2 upon exposure to oxygen in air.

4 Ton, dry weight is defined as equal to 2000 pounds.

5 Sediment oxidation uses laboratory measured 30-day biochemical oxygen demand (BOD) per mass of reservoir sediments from Lower Klamath Project reservoir sediment samples (Stillwater Sciences 2011).

6 Assumes stoichiometric conversion of BOD to CO_2, approximately 1.375 gCO_2/gO_2.

7 Metric ton (MT) is defined as 1.10231 tons.

8 Amounts of sediment (volumes and masses) from individual reservoirs may not equal the total amounts indicated because all volumes and masses taken from USBR (2012a) were rounded to the nearest 10,000 yd^3 (volume) or 10,000 tons, dry weight (mass). Copco No. 2 Reservoir does not retain measurable amounts of sediment and therefore is not included in the estimates of total stored sediment.

9 Amounts of BOD, CO_2, $MTCO_2e$ from individual reservoirs may not equal the total amounts indicated because all amounts were rounded to the nearest 100 tons or 100 MT. Copco No. 2 Reservoir does not retain measurable amounts of sediment and therefore is not included in the estimates of total stored sediment.

As shown in Table RE-3.10-11 and Table RE-3.10-12, the combined temporary GHG emissions associated with reservoir sediments would be up to approximately 19,350 $MTCO_2e$. Although this represents a relatively large amount of temporary emissions, it should be noted that oxidation of organic matter in land and riverine systems is part of the natural 'fast carbon cycle' that includes GHG emissions from terrestrial and aquatic ecosystems (Ciais et al. 2013) (see also Section 3.10.2 *Greenhouse Gas Emissions – Greenhouse Gas Emissions and Global Climate Change*). Much of the estimated temporary GHG emissions associated with the Lower Klamath Project reservoir sediments during and following drawdown would have occurred gradually on an annual basis if the dams had not been built, and instead detrital algae and other sources of natural organic matter had been relatively rapidly oxidized to CO_2 in the free-flowing river (Tranvik et al. 2009, Butman and Raymond 2011, Raymond et al. 2013, Deemer et al. 2016). In addition to the release of captured organic matter from upstream, some of the anticipated temporary GHG emissions associated with dam removal would be due to the oxidation of carbon sequestered in Iron Gate and Copco No. 1 reservoirs through direct uptake of CO_2 from the atmosphere during reservoir phytoplankton blooms and subsequent burial in reservoir bottom sediments at the end of the growth season. Regardless, the temporary GHG emissions associated with Lower Klamath Project reservoir sediments are part of the natural fast carbon cycle where streams and rivers are among the large sources of CO_2 (Tranvik et al. 2009, Butman and Raymond 2011, Raymond et al. 2013, Deemer et al. 2016).

To provide context for the estimated 19,350 $MTCO_2e$ potentially associated with the transport and exposure of reservoir sediments following initiation of drawdown, reported natural CO_2e emissions from rivers in the Western United States (Zhu and Reed 2012), throughout the United States (Butman and Raymond 2011), and throughout the world (Deemer et al. (2016), suggest that the Klamath River from Link River Dam (RM 259.7) to the Klamath River Estuary (RM 0) would naturally produce between approximately 48,000 to 311,000 $MTCO_2e$ per year, (Table RE-3.10-2). Contributions to CO_2e from the Lower Klamath Project reservoirs (Table RE-3.10-5) increase the range to 49,000 to 313,000 $MTCO_2e$ per year. Estimated total emissions from Table RE-3.10-2 and Table RE-3.10-5 are based on a literature compilation of emission data from other river systems and range over a factor of six. However, this range represents results from multiple studies of rivers in the United States and across the globe, using a variety of methods for quantifying CO_2e, and is therefore a reasonable basis of comparison between estimated annual background production of CO_2e for the Klamath River as a whole and the anticipated temporary sediment CO_2e emissions that would occur as a result of dam removal. Further, given the relatively high seasonal levels of BOD measured in the upstream Keno Reservoir (Sullivan et al. 2010), it is reasonable to assume that at least portions of the Klamath River may exhibit relatively high background CO_2e emissions compared with other rivers across the globe, resulting in whole-river rates on the higher end of the range in Table RE-3.10-2. Overall, the

$MTCO_2e$ that would potentially be released in association with reservoir sediments under the Proposed Project represents a possible increase in natural whole-river GHG emissions for one to two years ranging from 6 percent to 37 percent. Since any amount above existing conditions would represent a net increase in GHG emissions, this would be a significant impact.

As discussed in Potential Impact 3.2-3, the release of reservoir sediment deposits due to dam removal cannot be avoided or substantially decreased through feasible mitigation, including consideration of dredging of the reservoir sediment deposits prior to drawdown, slower drawdown to potentially mobilize less sediment, or altering the timing of drawdown to lessen the potential for precipitation after drawdown and before plantings have stabilized the remaining sediment deposits. Regardless of the feasibility of removing the sediment deposits by dredging, or changing the rate or timing of drawdown without increasing impacts to other environmental resources, oxidation of organic matter associated with the reservoir sediments would produce CO_2 emissions as soon as the overlying reservoir water was drained and the sediments were exposed to water with higher levels of dissolved oxygen and oxygen in atmosphere. The potential for CH_4 emissions during drawdown would not be reduced by dredging or altering the timing of drawdown, and they may be increased if water level fluctuations continued over several years.

As noted under Potential Impact 3.10-1, the CARB Scoping Plan identifies the purchase of carbon offsets as a viable method to reduce or eliminate the impact of GHG emissions from new development (CARB 2017b). However, purchase of offsets for sediment emissions is presently not feasible in light of federal preemption. While the applicant has proposed to purchase carbon credits to offset direct construction emissions, it is not clear that the applicant will agree to offset emissions generated as part of the natural ‘fast carbon cycle’ as opposed to anthropogenic emissions generated during fossil fuel combustion that short-circuit the ‘slow’ part of the carbon cycle and intensify GHG effects (see also Section 3.10.2.1 *Greenhouse Gas Emissions – Greenhouse Gas Emissions and Global Climate Change*). In the absence of applicant agreement, such a mitigation measure would not be enforceable, and therefore not feasible.

Overall, the temporary GHG emissions that would occur in association with reservoir sediments following initiation of reservoir drawdown, with the majority of these temporary emissions occurring within six months of drawdown (November dam removal year 1 through May dam removal year 2) under the Proposed Project, would be a significant and unavoidable impact.

As noted above, the CARB Scoping Plan primarily focuses on anthropogenic sources of GHG emissions from construction and ongoing operational emissions from stationary industrial projects with high rates of fossil fuel combustion emissions or the construction and increased power and transportation needs from newly constructed residential or commercial projects. Other than mitigating any related construction emissions, the CARB Scoping Plan does not contain guidance on assessing or mitigating the potential GHG emissions impacts from dam removal and habitat restoration activities. Generally, the Scoping Plan encourages the rehabilitation of natural ecosystems as part of the state's climate solution. The sediment release associated with this restoration project would result in the release of methane and oxidation of the sediment deposits, which is conservatively estimated to result in a one-time release of 19,350 $MTCO_2e$ of GHG emissions. The majority of these emissions would occur within six months of reservoir drawdown. As noted above, these GHG emissions would have occurred gradually on an annual basis if the dams had not been built. As such, the temporary GHG emissions associated with Lower Klamath Project reservoir sediments are part of the natural 'fast carbon cycle'. Although these GHG emissions would exceed the no net increase threshold, reductions of emissions from the natural fast carbon cycle are not part of the Scoping Plan strategies for achieving the GHG reductions for 2030 and beyond. Therefore, the emissions from reservoir sediments during drawdown would not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Significance
Significant and unavoidable impact

Potential Impact 3.10-3 Generation of direct GHG emissions from conversion of the reservoir areas to riverine, wetland, and terrestrial habitat types, that would exceed a no net increase threshold.
Conversion of the impounded areas of the four Lower Klamath Project reservoirs to free-flowing riverine habitats has the potential to result in long-term changes in total annual GHG emissions from aquatic and terrestrial habitats within the reservoir footprint. To assess the potential changes in GHG emissions due to habitat conversion under the Proposed Project, GHG production estimates from Deemer et. al (2016) were multiplied by the water surface areas of the four reservoirs (J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate) as well as the areas of riverine habitat with and without the reservoirs in place (Table RE-3.10-13). In addition, because wetland and terrestrial habitats are expected to develop in the reservoir footprint in the decades following drawdown, estimates of future GHG emissions of wetlands, grasslands, and forests were adapted from a recent USGS assessment of changes in carbon storage and GHG production and/or sequestration associated with ecosystems of the Western U.S. through 2050 (Zhu et. al 2012).

Table RE-3.10-13. Estimated Changes in Annual GHG Emissions Due to Conversion of the Lower Klamath River Project Reservoirs to Riverine, Wetland, and Terrestrial Habitat Types.

Land Use/Waterbody	Estimated Emission Flux by Land Use ($CH_4+CO_2+N_2O$) as $CO_{2\text{-eq}}$ ($TgCO_{2\text{-eq}}/km^2$-yr)		Existing	Existing Emissions ($MTCO_{2\text{-eq}}$/yr)		Future	Future Emissions ($MTCO_{2\text{-eq}}$/yr)		Emissions Change ($MTCO_{2\text{-eq}}$/yr)	
	Min	**Max**	**Area[1] (km^2)**	**Min**	**Max**	**Area[1] (km^2)**	**Min**	**Max**	**Min**	**Max**
Riverine [2]	1.02E-02	2.09E-02	2.1	21,423	43,688	3.4	34,907	71,187	13,485	27,500
Hydroelectric Reservoirs [2]	1.02E-04	2.86E-04								
J.C. Boyle Reservoir			1.4	144	404	0	0	0	-144	-404
Copco No. 1 Reservoir			3.9	401	1,123	0	0	0	-401	-1,123
Copco No. 2 Reservoir			0.0	2	6	0	0	0	-2	-6
Iron Gate Reservoir			3.8	389	1,088	0	0	0	-389	-1,088

Land Use/Waterbody	Estimated Emission Flux by Land Use (CH_4+CO_2+N_2O) as $CO_{2\text{-eq}}$ ($TgCO_{2\text{-eq}}/km^2$-yr)		Existing	Existing Emissions ($MTCO_{2\text{-eq}}$/yr)		Future	Future Emissions ($MTCO_{2\text{-eq}}$/yr)		Emissions Change ($MTCO_{2\text{-eq}}$/yr)	
	Min	**Max**	**Area[1] (km^2)**	**Min**	**Max**	**Area[1] (km^2)**	**Min**	**Max**	**Min**	**Max**
Wetland [2,3]	1.15E-04	6.6E-04	0.5	60	346	0.7	83	481	23	135
Grassland [3]	1.08E-06	2.27E-06	4.8	5	11	6.5	7	15	2	4
Riparian (Forest) [3]	-4.84E-05	-1.28E-05	4.7	-228	-60	10.7	-516	-137	-288	-76
Totals [4]			**21.3**	**22,200**	**46,600**	**21.3**	**34,500**	**71,500**	**12,300**	**24,900**

1 Spatial analysis includes the Klamath River Hydroelectric Reach and the Middle Klamath River to approximately Hornbrook, within approximately 200 feet from the riverbanks and the Lower Klamath Project reservoir shorelines, as well as existing habitats within the Project Boundary that would be affected by the Proposed Project. All Land Use/Waterbody areas are approximate. For non-reservoir existing conditions areas that were not part of 2019 KRRC wetland delineation efforts, the future condition for wetland and riparian habitats is assumed to be the same as the existing condition.

2 Production estimates for CH_4, CO_2, and N_2O from river reaches, the Lower Klamath Project reservoirs, and wetlands adapted from Deemer et. al (2016) and reported as CO_2e.

3 Production estimates of GHGs from wetlands, grasslands, and riparian (forest) habitats adapted from Zhu et. al (2012) and reported as CO_2e.

4 Totals may not sum due to rounding.

As shown in Table RE-3.10-13, the existing annual emissions from the Lower Klamath Project reservoirs are estimated to range from approximately 940 to 2,620 $MTCO_2e$. Although Iron Gate, Copco No. 1, and J.C. Boyle reservoirs currently settle out organic material transported into the reservoirs from the upstream Klamath River before it can be converted to CO_2, and the reservoirs sequester carbon through direct uptake of CO_2 from the atmosphere into phytoplankton, followed by subsequent burial in reservoir bottom sediments, overall the reservoirs are net producers of CO_2, CH_4, and N_2O. This condition is consistent with hydroelectric reservoirs in general (Deemer et al. 2016) and with eutrophic hydroelectric reservoirs during periods of reservoir drawdown (Harrison et al. 2017). However, while the Lower Klamath Project reservoirs are net producers of GHGs, they produce considerably less GHGs than the riverine portions of the Hydroelectric Reach. The reservoirs also produce more GHGs than the small areas of wetlands and uplands (grasslands) associated with the reservoirs within the Hydroelectric Reach (see also Table RE-3.10-13).

Compared to existing conditions, future GHG emissions from the Lower Klamath Project reservoirs are estimated to increase, with new emission levels ranging from approximately 34,500 to 71,500 $MTCO_2e$ annually (Table RE-3.10-13). While the reservoir contribution to GHG production would be zero under the Proposed Project, and the increase in riparian (forest) areas in the Hydroelectric Reach would result in more carbon sequestration compared with existing conditions, the addition of restored riverine habitat would result in roughly 60 percent more annual GHG emissions from the Hydroelectric Reach area under the Proposed Project. This would be an exceedance of the no net increase threshold for GHG emissions and would be a significant impact.

However, as discussed in Potential Impact 3.10-2, freshwater streams and rivers serve as large, natural sources of CO_2 in regional and global carbon budgets (Tranvik et al. 2009, Butman and Raymond 2011, Raymond et al. 2013, Deemer et al. 2016). Riverine oxidation of organic matter to produce CO_2 is part of the natural cycling of carbon between the atmosphere and freshwater and terrestrial ecosystems. As the focus of the Lower Klamath Project is to restore the Klamath River and the habitat that it provides for anadromous fish, it would not be reasonable or feasible to reduce the amount of restored riverine habitat, or to interfere with the natural processing of carbon in the river, as a means of reducing annual GHG emissions under the Proposed Project.

As noted under Potential Impact 3.10-1, the CARB Scoping Plan identifies the purchase of carbon offsets as a viable method to reduce or eliminate the impact of GHG emissions (CARB 2017b). However, purchase of offsets for sediment emissions is not feasible here, in light of federal preemption. While the applicant has proposed to purchase carbon credits to offset direct construction emissions, it is not clear that the applicant will agree to offset emissions generated as part of the natural 'fast carbon cycle' as opposed to anthropogenic emissions generated during fossil fuel combustion that short-circuit the 'slow' part of the carbon cycle and intensify GHG effects (see also Section 3.10.2.1 *Greenhouse Gas Emissions – Greenhouse Gas Emissions and Global Climate Change*). In the absence of applicant agreement, such a mitigation measure would not be enforceable, and therefore not feasible.

While the additional GHG emissions above the current baseline cause a significant impact based on the no net increase emissions threshold, it does not conflict the CARB Scoping Plan or other applicable plans, policies, or regulations adopted for the purpose of reducing the emissions of GHGs. The nature of the GHG emissions that would result from the conversion of the reservoir areas to restored natural systems under the Proposed Project differs from the human-caused or fossil-fuel-based emissions that are inventoried under state emissions assessments, and for which CARB has developed comprehensive emissions reductions plans in order to reach statewide goals. 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 (CARB 2017b). In these cases, ongoing emissions from combustion and transportation are likely to be cumulatively considerable.

As indicated in the CARB Scoping Plan, the rehabilitation and maintenance of natural and working lands is identified as part of the state's climate solution. As stated in the Scoping Plan:

> "These lands support clean air, wildlife and pollinator habitat, rural economies, and are critical components of the California's water infrastructure. Keeping these lands and water intact and at high levels of ecological function (including resilient carbon sequestration) is necessary for the well-being and security of Californians in 2030, 2050, and beyond. Forests, rangelands, farms, wetlands, riparian areas, deserts, coastal areas, and the ocean store substantial carbon in biomass and soils."

The Proposed Project is consistent with the goals of the Scoping Plan related to the rehabilitation of natural and working lands, since it proposes to remove the Lower Klamath Project dam complexes and restore the various habitat types associated with this section of the Klamath River watershed, and since reductions of emissions from the natural 'fast carbon cycle' are not part of the Scoping Plan strategies for achieving the GHG reductions for 2030 and beyond.

However, due to the potential for there to be a natural increase in annual GHG emissions that exceeds a no net increase emissions threshold, the potential GHG impact from the conversion of the Lower Klamath Project facilities to riverine, wetland, and terrestrial habitat types, would be significant and unavoidable.

<u>Significance</u>
Significant and unavoidable impact

Potential Impact 3.10-4 Generation of indirect GHG emissions from continued power production for the PacifiCorp PCA.
The Proposed Project's removal of a renewable source of energy by removing the dams has the potential to result in increased GHG emissions over current conditions as electricity needs will continue to be served from alternate sources of power generation. GHG emissions could occur in the event that the alternative energy sources used to augment loss of energy supplied by the Lower Klamath Project use fossil fuels for generation in the PacifiCorp PCA.

As described above, the average annual electricity generation from the Lower Klamath Project is 686,000 MWh (Table RE-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. As shown in Table RE-3.10-6, the Lower Klamath Project dam complexes in California (Copco No. 1, Copco No. 2, and Iron Gate) have a nameplate generation capacity of approximately 65 MW of electricity and produce an average of 279,168 MWh (32 MW) of electricity annually. In the EIR baseline year of 2016, the actual power generation from these three facilities was 286,508 MWh (32.7 MW). The Lower Klamath Project facilities in California account for approximately 56 percent of the Lower Klamath Project total electrical production. As noted above, the three Lower Klamath Project facilities in California are defined as small hydropower plants that qualify as renewable energy under the State's Renewable Portfolio Standard (RPS), since they individually have a generating capacity of less than 30 megawatts (MW) (CEC 2018b).

The 2015 electricity generation resource mix for PacifiCorp's PCA was dominated by coal (62 percent), natural gas (15.4 percent), wind (7.1 percent), and hydroelectricity (5.2 percent) (PacifiCorp 2017). In 2017, the owned electrical generation resources mix for PacifiCorp's PCA included 54.4 percent coal, 25.4 percent natural gas, and 20.2 percent renewable energy resources (PacifiCorp 2019a). Electricity produced from the Lower Klamath Project, if removed, would likely be replaced within the PacifiCorp PCA, rather than through purchase of power from outside the 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).

As discussed above in Section 3.10.3 *Significance Criteria*, SB 350 requires California utilities to develop IRPs that incorporate a GHG emission reduction planning component. Compliance with the California RPS requires PacifiCorp to develop and implement an IRP that demonstrates they are on schedule to comply with the State requirements of providing 33 percent renewable sources by 2020 and 60 percent renewable sources by 2030. As noted above, to ensure retail sellers meet their RPS requirement, the CPUC is responsible for establishing enforcement procedures and imposing penalties for non-compliance with the program (CPUC 2018). Since 2015, PacifiCorp has been preparing IRPs that detail how the company will increase other renewable energy sources to enable the company to continue lowering GHG emissions and decommission the Lower Klamath Project facilities.

According to the 2015 PacifiCorp IRP, the projected GHG emissions for the PacifiCorp PCA in the EIRs baseline year of 2016, were projected to be approximately 50,000 $MTCO_2e$ (PacifiCorp 2015). According to the PacifiCorp Sustainability Report (2019), the total GHG emissions from power generation (owned and purchased) in 2017 was 43,314 $MTCO_2e$. In addition, 89,520 $MTCO_2e$ of fugitive SF_6 emissions were emitted in 2017 from gas insulated switchgear equipment within the PacifiCorp PCA. The Sustainability Report also indicates that GHG emissions from power generation decreased by 12.3 percent between 2005 and 2017 (PacifiCorp 2019a).

The most recent IRP prepared by PacifiCorp was in 2019 (dated October 18, 2019)(PacifiCorp 2019b). The 2019 PacifiCorp IRP accounts for the loss of the Lower Klamath Project facilities and assumes a removal date of January 1, 2021. Figure RE-3.10-4 provides a comparison of the carbon dioxide (CO_2) emission forecasts between the 2019 IRP and the 2017 IRP (PacifiCorp 2019b). Figure RE-3.10-4 contains a projected power mix over the 20-year planning period of the IRP (PacifiCorp 2019b).

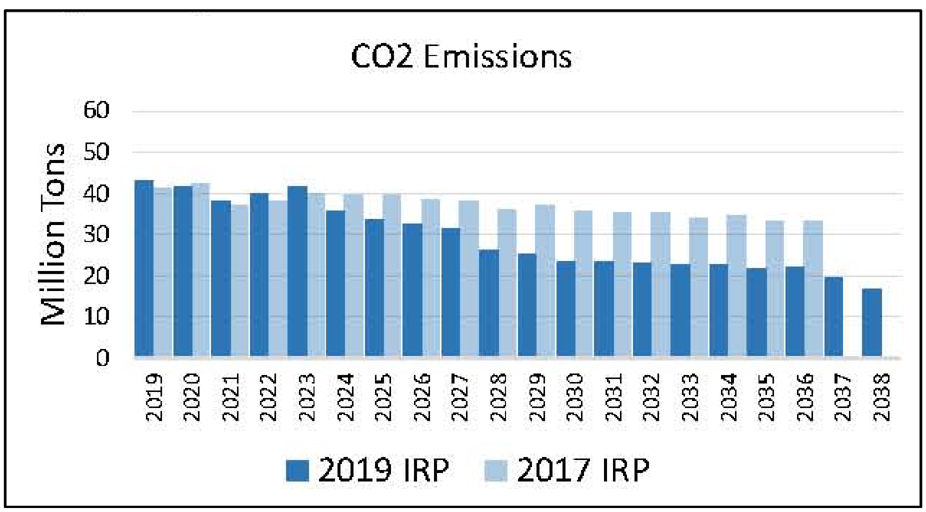

Figure RE-3.10-4. Comparison of CO2 Emission Forecasts Between the 2019 IRP Preferred Portfolio and the 2017 IRP Preferred Portfolio.

Figure RE-3.10-4 indicates that by the end of the planning horizon, system CO_2 emissions are projected to fall from 43.1 million tons in 2019 to 16.7 million tons in 2038—a reduction of 61.3 percent. Figure RE-3.10-4 also indicates that CO_2 emissions will decrease by several million tons in 2021, which, as noted above, is the assumed removal year for the Lower Klamath Project facilities in the 2019 IRP.

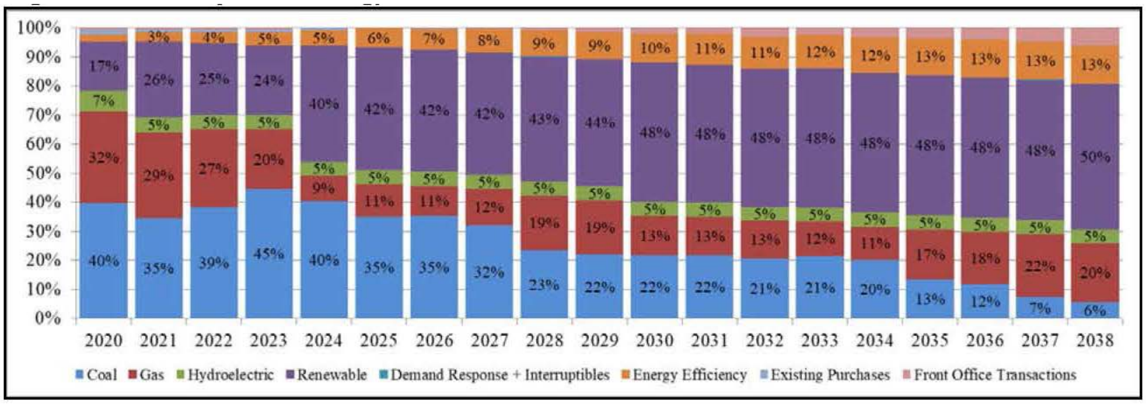

Figure RE-3.10-5. Projected Energy Mix with 2019 IRP Preferred Portfolio Resources.

Figure RE-3.10-5 indicates that coal generation is projected to decrease from 40 to 6 percent of the system-wide power mix over the 19-year planning period (2020 through 2038), while renewable power sources are projected to increase from 16 to 50 percent over the planning period. It also indicates that hydroelectric energy is projected to decrease from 7 to 5 percent of the system-wide power mix from 2020 to 2021, which is the assumed time period in the 2019 IRP for removal of the Lower Klamath Project facilities. During this same 2020 to 2021 time period, renewable energy sources in the system-wide power mix are projected to increase from 17 to 26 percent.

The estimates of CO_2 emissions from removal of the Lower Klamath Project facilities included in prior environmental analyses prepared by FERC (2007) and USBR and CDFG (2012), were based on the conservative assumption that the power from the Lower Klamath Project facilities would be replaced with gas-fired steam generation (FERC 2007) or with a power mix that is not reflective of the projected power mix in the 2019 IRP (USBR and CDFG 2012). For example, the estimates of emissions from replacement power sources in compliance with the California RPS requirements (33 percent renewable sources by 2020) in the 2012 KHSA EIS/EIR (USBR and CDFG 2012), assumed that 64 percent of power would be generated on-peak using natural gas, and the remaining 36 percent would be generated off-peak using a resource mix that meets the 33 percent RPS requirement. Under these conservative assumptions, the estimated GHG emissions from the removal of the four dams in the prior environmental analyses ranged from 71,680 metric tons to 396,575 metric tons annually. The estimated GHG emissions from the removal of the three dams in California ranged from 55,245 metric tons to 206,380 metric tons annually. This EIR does not rely on these early estimates because the generation assumptions are not supported in light of the more recent system-wide planning documents (e.g., PacifiCorp 2019 IRP) that are aimed at meeting more aggressive GHG reduction and renewables standards in California and in other states covered by PacifiCorp's PCA. For example, SB 100 now requires PacifiCorp to plan for providing 60 percent renewable energy sources by 2030 as opposed to the 33 percent RPS requirement analyzed in the 2012 KHSA EIS/EIR. Additionally, the method this EIR adopts provides a more contextualized picture of the impact of the removal of renewable energy facilities in the context of planned increases in renewable energy, and in light of the baseline conditions.

As shown in Figure RE-3.10-5, PacifiCorp projects that it will increase renewable sources in its system-wide power mix by 7 percent from 2020 to 2023. This would also be an approximately 10 percent increase in renewable sources (including hydroelectricity) from the power-mix provided by PacifiCorp in 2015. This increase in renewable sources would offset the loss of the Lower Klamath Project facilities, which provides only approximately 2 percent of the PacifiCorp system-wide power mix. Although there is the potential that conventional power sources in the PacifiCorp PCA may be used each year during peak demand periods after removal of the Lower Klamath Project facilities, the potential for periodic reliance on conventional power sources is part of the existing condition for the PacifiCorp PCA and thus is not an effect of the Proposed Project. Further, according to PacifiCorp's 2019 IRP, use of conventional power sources for peak energy generation will be reduced in frequency over the planning horizon of the 2019 IRP.

Since it is planned in the 2019 IRP for PacifiCorp to timely add new sources of renewable power or purchase RECs to comply with the California RPS, it is not anticipated that the replacement of the hydroelectric energy from the Lower Klamath Project dam complexes would result in a net increase in GHG emissions.

As discussed above, compliance with the California RPS requires PacifiCorp to develop and implement an IRP that demonstrates they are on schedule to comply with the State requirements of providing 33 percent renewable sources by 2020 and 60 percent renewable sources by 2030. The most recent IRP prepared by PacifiCorp was in October 2019 and accounts for the loss of the Lower Klamath Project facilities with an assumed removal date of January 1, 2021. The IRP indicates that with the decommissioning of the Lower Klamath Project facilities, system-wide GHG emissions are projected to continue decreasing throughout the planning period. The IRP specifically indicates that CO_2 emissions will decrease by several million tons in 2021, which, as noted above, is the IRP-assumed removal year for the Lower Klamath Project facilities. Although the Proposed Project would result in the loss of renewable energy sources, overall PacifiCorp would be increasing the percentage of renewable energy sources in its power mix to comply with the California RPS, and increasing renewable energy at a rate that more than covers the loss from the baseline condition. Since it is planned in the 2019 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.

Significance
No significant impact

Potential Impact 3.10-5 Result in the wasteful, inefficient, or unnecessary consumption of energy resources during project construction or operations.
Energy Use During Construction
An estimate of fuel consumption was calculated for construction activities, which include pre-dam removal activities, dam and powerhouse deconstruction, and restoration activities. The energy calculations for the Proposed Project are provided in Appendix O *[Greenhouse Gas and Energy Modeling for the Lower Klamath Project]*.

As shown in Table RE-3.10-14, construction activity associated with the Proposed Project is estimated to consume a total of approximately 4,790,332 gallons of diesel fuel and a total of approximately 246,859 gallons of gasoline over the Proposed Project's construction period. This would result in approximately 610.8 billion British thermal units (Btu) of energy use. These fuels would be consumed over a period of two years and would represent a small percentage of the total energy used in the state. In 2017, the total energy consumption in California was 7,881 trillion Btu (USEIA 2018). The estimated energy use from the entire two-year construction period for the Proposed Project represents approximately 0.008 percent of the energy used in California in 2017.

Table RE-3.10-14. Summary of Energy Use for the Proposed Project.

	Total Diesel (gallons)	Total Gasoline (gallons)
Proposed Project	4,790,332	246,859

Source: Emission calculations are provided in Attachment A to Appendix N.

The Proposed Project integrates measures to reduce waste and materials hauling—a key source of energy consumption. As noted above, where possible, 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. Construction of the cofferdams from materials salvaged from the dam demolition activities would reduce the need for importing new construction materials and has reduced the estimated amount of energy consumed during the Proposed Project's construction period. Similarly, the creation and use of nearby, onsite waste disposal areas similarly reduces the amount of energy required to move the concrete rubble, rock and earthen materials from dam removal.

There are no unusual project characteristics that would need construction equipment or practices that would be less energy efficient than at comparable construction sites in the region or state. Construction activity would be temporary and fuel consumption would cease once construction ends. Further, various equipment would be supplied by onsite generators, and would not require permanent connections to or otherwise burden local utilities. Due to the temporary nature of construction activities, and the incorporation of materials re-use and onsite disposal that will reduce energy consumption, the fuel and energy needed during Proposed Project construction would not be considered a wasteful or inefficient use of energy. Therefore, it is expected that construction energy consumption associated with the Proposed Project would be comparable to other similar construction projects, and would therefore not be inefficient, wasteful, or unnecessary.

Energy Use During Operation
The Proposed Project would remove the Lower Klamath Project dam complexes and would not result in an increase in long-term, operational energy use. The only long-term energy use that would result from the Proposed Project includes the operation of two hatcheries for eight years following dam removal. Energy use under current conditions (i.e., operation of the four Lower Klamath Project facilities and Iron Gate Hatchery) is anticipated to be significantly greater than the reduced operation of Iron Gate Fish Hatchery combined with the re-instated operation of Fall Creek Hatchery. This is due to the fact that the existing energy used for operation of the four Lower Klamath Project facilities (e.g., employee traffic, maintenance equipment, electronic equipment, lighting, etc.) would be eliminated, and production levels at the two hatcheries post-dam removal would decrease relative to current conditions. Thus, although two hatcheries will be operating post-dam removal, overall it is anticipated that there would be a net decrease in energy use post-dam removal (Section 2.7.6 *Hatchery* Operations). Therefore, no increase in energy use from current conditions would result from the operation of the hatcheries post-dam removal.

Therefore, the Proposed Project would not result in the wasteful and inefficient use of energy resources during long-term operation of the Proposed Project.

Significance
No significant impact

Potential Impact 3.10-6 Result in a substantial impact on local and regional energy supplies and/or on requirements for additional capacity.
This potential impact assesses whether the Proposed Project's removal of the hydroelectric facilities would result in impacts on local and regional energy supplies and require additional capacity to be added.

As noted above, PacifiCorp is a utility company that provides electricity to 1.9 million customers across 141,000 square miles in six western states. The

PacifiCorp net-owned generation capacity is 10,887 MW and the owned renewable and noncarbon capacity is 2,198 MW. The PacifiCorp PCA, which is a region of the power grid in which all power plants are centrally dispatched, includes portions of the states of Utah, Oregon, Wyoming, Washington, Idaho, and California. Each power generating facility in the control area contributes to an interconnected electrical grid that delivers energy to consumers throughout the PacifiCorp PCA (PacifiCorp 2019c). PacifiCorp participates in the Western Energy Imbalance Market (EIM) in partnership with the California Independent System Operator. This market allows utilities across the West to access the lowest-cost energy available in near real time, making it easier for zero fuel-cost renewable energy to go where it is needed (PacifiCorp 2019b).

According to the 2019 PacifiCorp IRP, the company owns 1,135 MW of hydroelectric generation capacity and purchases 89 MW of other hydroelectric resources (PacifiCorp 2019b). The PacifiCorp 2019 IRP describes the benefits of hydroelectric energy, which states the following:

> "Hydroelectric projects can often provide unique operational flexibility because they can be called upon to meet peak customer demands almost instantaneously and back up intermittent renewable resources such as wind. In addition to operational flexibility, hydroelectric generation does not have the emissions concerns of thermal generation and can also often provide important ancillary services, such as spinning reserve and voltage support, to enhance the reliability of the transmission system."

The PacifiCorp PCA includes seven mainstem hydroelectric facilities on the Upper Klamath River and one tributary hydroelectric development on Fall Creek. These facilities serve PacifiCorp residential and commercial customers in southern Oregon and northern California (PacifiCorp 2004). The Lower Klamath Project proposes the removal of the four mainstem hydroelectric facilities. This includes three facilities in California (Copco No. 1 Dam, Copco No. 2 Dam, Iron Gate Dam) and one facility in Oregon (J.C. Boyle Dam). As described above, the average annual electricity generation from the Lower Klamath Project is 501,088 MWh (Table RE-3.10-6). As shown in Table RE-3.10-6, the Lower Klamath Project dam complexes in California have a nameplate generation capacity of approximately 65 MW of electricity and produce an average of 279,168 MWh (32 MW) of electricity annually. In the EIR baseline year of 2016, the actual power generation from these three facilities was 286,508 MWh (32.7 MW). The Lower Klamath Project facilities in California account for approximately 56 percent of the Lower Klamath Project total electrical production.

Since at least 2015, PacifiCorp has been preparing IRPs that detail how the company will increase other renewable energy sources to enable PacifiCorp to continue serving its PCA and comply with state RPS requirements. The 2019 PacifiCorp IRP accounts for the loss of the Lower Klamath Project facilities and assumes a removal date of January 1, 2021. Figure RE-3.10-5 from the 2019

IRP indicates that hydroelectric energy is projected to decrease from 7 to 5 percent of the PacifiCorp system-wide power mix from 2020 to 2021, which is the assumed time period in the 2019 IRP for removal of the Lower Klamath Project facilities. During this same time period, renewable energy sources in the system-wide power mix are projected to increase from 17 to 26 percent. As discussed in Section 3.10.2 *Environmental Setting*, in 2014 PacifiCorp facilitated the development of the Western Energy Imbalance Market (EIM) in partnership with the California Independent System Operator. This market allows utilities across the West to access available lowest-cost energy in near real time, making it easier for zero fuel-cost renewable energy to be delivered where it is needed. As stated in the 2019 IRP, "If excess solar energy in California, excess wind from Wyoming or hydropower from Washington and Oregon is available, PacifiCorp will harness it and transport it instantly across the company's 16,500-mile grid" (PacifiCorp 2019b).

PacifiCorp analyzed the energy implications of license denial in documents submitted in 2004 for FERC licensing for the Klamath Hydroelectric Project (FERC Project No. 2082). The analysis indicated that if generation of the hydroelectric facilities on the Klamath River were to cease, they would still be able to service their local customers (PacifiCorp 2004). However, the local transmission system has been designed to service customers using power from the hydroelectric facilities on the Klamath River, transmission adjustments would be needed to provide reliable service to customers in the Klamath Basin following implementation of the Proposed Project (PacifiCorp 2004). These improvements are identified in the 2004 filing with FERC as the following: 1) install two additional capacitors in the project area; 2) install a transformer at Copco; and 3) reconductor of two 230-kilovolt (kV) lines.

In 2006, the CEC conducted an economic analysis of the relicensing and decommissioning options for the Lower Klamath Project facilities (CEC 2006b). The report provided the following conclusions:

> "The Klamath Project is small compared to the total power requirements of PacifiCorp's customers and to the systems-level scale of new generation needed to meet load, reserve margins and transmission system reliability in the utility's service territory. In its 2003 *Preliminary Assessment of Energy Issues Associated with the Klamath Hydroelectric Project*, staff from the Energy Commission concluded that decommissioning some or all of the Klamath facility was a feasible alternative that should be further examined during relicensing. Given the size of the PacifiCorp system, the relatively large amount of capacity and energy already procured (approximately 22 percent), and the amount of additional capacity and energy needed to meet projected load growth, the report also concluded that loss of the Klamath Hydroelectric Project "would not have a demonstrably significant effect on resource adequacy."

PacifiCorp's energy planners are also assessing how to replace the energy and capacity from the Klamath Project. The August update to its Preferred Portfolio in the *2006 Integrated Resource Plan* identifies "Replace Klamath hydro units with alternative resources." According to PacifiCorp's Final License Application to FERC, local transmission improvements totaling $5.6 million could allow replacement power to be brought in from the grid. Since 1999 PacifiCorp has decided to remove dams totaling 28.5 MW of capacity at four other FERC-licensed projects rather than retrofit existing facilities as a condition of operating under new licenses.

Power plants are routinely retired when they are no longer economically competitive or environmentally compliant (e.g., a coal-fired generator may be retired if there is a new requirement for a scrubber, and replacing the generation may be less costly than retrofitting the old plant), or when the equipment has outlived its design life (natural gas, nuclear, wind turbines, etc.). For example, in the state of California 3,810 MW has been retired for various reasons since 2001. The Klamath Project is relatively small compared to the type of large thermal plants that have been retired in California.

From a review of the PacifiCorp filings with FERC and with the Public Utility Commissions in Oregon and California, it is apparent that the Klamath Hydro Project primarily serves as a low cost energy resource with little firm capacity or peaking dispatch flexibility. This type of replacement energy is readily available from other PacifiCorp generating resources and from the grid. In a brief to the California Public Utilities Commission, PacifiCorp explains that it uses Klamath energy, when available, to displace higher cost, fossil generation. In its Final License Application to FERC, PacifiCorp states that if generation were to cease at Klamath it would still be able to service its local customers."

The Lower Klamath Project facilities are a small element of PacifiCorp's larger electric generation and transmission system. These facilities do not provide capacity support needed for local reliability or voltage support. These facilities are not so large relative to PacifiCorp's system or so critical that a specific new resource would be required for replacement.

In May 2007, PacifiCorp launched the Energy Gateway Transmission Expansion- a multi-year investment plan to add approximately 2,000 miles of new transmission line across the West. Included in this plan were transmission system upgrades and additions to that would connect the Klamath Basin to existing power sources in the region. Specifically, PacifiCorp was proposing a new transmission line that would connect eastern Idaho to Southern Oregon at the Captain Jack substation outside of Klamath Falls, Oregon. The line would help balance and transfer power generated in the PacifiCorp East Side region with demand in the West. In 2012, this proposal was amended when PacifiCorp entered into an agreement with Idaho Power and Bonneville Power Administration to construct a 500-kilovolt line that would run approximately 300 miles from a new substation proposed near Boardman, Oregon, to the Hemingway substation near Melba, Idaho (PacifiCorp 2019d). In 2017, PacifiCorp constructed the Snow Goose substation in southern Oregon, which is designed to strengthen the power reliability around the Klamath Basin (Pacific Power 2018). The Snow Goose substation will transfer power up and down the West Coast, improving the reliability of the power grid from Canada to Mexico and to the Klamath Basin. These and other transmission improvements planned by PacifiCorp will ensure the reliability of the transmission system in the project area after the removal of the Lower Klamath Project facilities.

As such, the Proposed Project would not result in a substantial impact on local and regional energy supplies and/or on requirements for additional capacity.

Significance

No significant impact

Potential Impact 3.10-7 Conflict with or obstruct a state or local plan for renewable energy or energy efficiency.

Local plans related to renewable energy or energy efficiency include the County of Siskiyou General Plan Energy Element (Energy Element), which was developed in 1993. Although the Energy Element is past the planning period described in the General Plan Element (20 years), it is still relevant to assess consistency with the Energy Element for a renewable energy related project. The policies in the Energy Element encourage the development of renewable energy facilities, while minimizing potential environmental and land use effects (Siskiyou County 1993). The Energy Element identifies the environmental and land use effects of the construction and operation of larger hydroelectric facilities including, but not limited to, changes in the hydrologic regime, water quality impacts, erosion and sedimentation, migration barrier for anadromous fish, loss of recreation, cultural, and scenic resources, and cumulative effects. As discussed throughout this EIR, construction and operation of the Lower Klamath Project facilities have resulted in a number of such effects which have motivated removal of these facilities. The Energy Element focuses on energy efficiency and minimizing the impacts of any future renewable development. The Energy Element is primarily forward looking and does not specifically address the removal of the Lower Klamath Project facilities or contain any policies related to maintaining such facilities. Nevertheless, the Energy Element generally promotes further development of renewable energy sources in the county, and removal of an existing renewable energy source could conservatively be considered to conflict with such policies in the Energy Element. Such a conflict would not be an impact that can be feasibly mitigated. Therefore, this would be a significant and unavoidable impact.

As discussed in Section 3.10.3 *Significance Criteria*, California established an RPS in 2002 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 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 the program's inception. Most recently, Governor Jerry Brown signed into law Senate Bill (SB) 100 in September 2018, which requires utilities to procure 60 percent of their electricity from renewables by 2030, and sets as a state policy that state agencies and end-use retail customers receive 100 percent of energy from renewable and zero-carbon resources by 2045. In addition, SB 350 requires California utilities to develop IRPs that incorporate a GHG emission reduction planning component. Compliance with the California RPS requires PacifiCorp to develop and implement an IRP that demonstrates they are on schedule to comply with the goals of providing 33 percent renewable sources by 2020 and 60 percent renewable sources by 2030.

As described in the PacifiCorp 2019 IRP, PacifiCorp plans to transition to additional renewable energy sources, or purchase RECs, to provide a power mix that complies with the California RPS. Although the Proposed Project would result in the loss of renewable energy sources, overall PacifiCorp will be increasing the percentage of renewable energy sources in its power mix to comply with the California RPS. As noted above, to ensure retail sellers meet their RPS requirement, the CPUC is responsible for establishing enforcement procedures and imposing penalties for non-compliance with the program (CPUC 2018).

As noted above, other states within PacifiCorp's PCA also have GHG reduction goals that similarly require reductions in the generation of GHG emissions. As a result, PacifiCorp is also required to transition to renewable energy sources to comply with the RPS of other states within its PCA. This additional increase in renewable energy sources in the PacifiCorp PCA will further offset the relatively small loss (approximately 2 percent of the system-wide power mix) of the Lower Klamath Project facilities.

Therefore, the Proposed Project would conflict with a local plan supporting renewable energy sources, but would not conflict with or obstruct a state plan for renewable energy or energy efficiency.

Significance

Significant and unavoidable impact for conflicting with a local plan

No significant impact for conflicting with a state plan

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Section 3.24.9 Air Quality Cumulative Effects

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3.24.9 Air Quality

The geographic scope for cumulative air quality effects is the same as the Area of Analysis for air quality (Section 3.9.1 *[Air Quality] Area of Analysis*) (Figure RE-3.9-1). This includes areas within the Limits of Work and Siskiyou County as a whole.

Existing conditions are defined in Section 3.9.2 *[Air Quality] Environmental Setting*. A summary of annual ambient air quality data at a Yreka monitoring station is provided in Table RE-3.9-1, and the attainment status for air pollutants in Siskiyou County is provided in Table RE-3.9-2. Siskiyou County is designated as attainment or unclassified for all federal and state ambient air quality standards. Section 3.9.2 *[Air Quality] Environmental Setting* includes consideration of major past or ongoing projects that have impacted, or currently impact, air quality resources.

This cumulative impact analysis focuses on the potential impacts of the Proposed Project combined with other closely related projects that are not already considered in the analysis of air quality resource area effects (Section 3.9). Non-project activity types within the air quality Area of Analysis with the potential for significant cumulative air quality impacts are included in Table RE-3.24-1.

Significance criteria for cumulative air quality impacts are the same as defined in Section 3.9.3 *[Air Quality] Significance Criteria*. As indicated in Section 3.9.5 *[Air Quality] Potential Impacts and Mitigation*, the Proposed Project, as mitigated, would result in significant and unavoidable air quality impacts from emissions of NO_X exceeding SCAPCD emissions thresholds (Potential Impact 3.9-1). Other potential air quality impacts from the Proposed Project, including exposure of sensitive receptors to substantial toxic air contaminant concentrations, would not be significant and adverse (Potential Impacts 3.9-2 through 3.9-5).

Potential Cumulative Impact 3.24-33: Short-term increases in criteria air pollutant emissions under the Proposed Project in combination with forest and wildfire management projects.
During the Proposed Project construction period (Table 2.7-1), there are proposed wildfire management activities, including prescribed or controlled burning, on national forest lands in Siskiyou County. These projects potentially include the Somes Bar Integrated Fire Management, Crawford Vegetation Management, and Harlan Vegetation Management and Fuels Reduction projects (Table RE-3.24-1). If these burning activities temporally overlap the Proposed Project construction period and produce substantial quantities of smoke near the Area of Analysis for air quality, they would result in significant and adverse emissions of criteria air pollutants within the air quality Area of Analysis. However, given that the Proposed Project would be well below thresholds for other criteria pollutants with mitigation, including PM_{10}, $PM_{2.5}$, CO, SO_x, and ROG, the incremental impact of the Proposed Project would not be cumulatively considerable with respect to those pollutants. Given the Proposed Project

exceeds criteria thresholds for NO_X after the implementation of mitigation, the incremental impact of the Proposed Project to the total emissions would be cumulatively considerable.

Significance

Cumulatively considerable impact with mitigation for NO_X emissions

No significant cumulative impact with mitigation for PM_{10} emissions

No significant cumulative impact for ROG, CO, SO_2, and $PM_{2.5}$ emissions

Potential Cumulative Impact 3.24-34 Short-term increases in criteria air pollutant emissions under the Proposed Project in combination with wildfires.

If wildfires were to produce substantial quantities of smoke near the proposed Limits of Work during the Proposed Project construction and restoration period, there would be an adverse air quality impact. However, if the Area of Analysis is disaster-stricken, it is likely that Proposed Project construction and restoration activities would be placed on hold to protect the health and safety of workers until the wildfire is under control. This is because the Proposed Project includes a Fire Management Plan that is focused on prevention of fire caused by Proposed Project activities. The Fire Management Plan would also include fire watch activities and fire response methods consistent with related policies and standards in local, county, state, and federal jurisdictions (Section 2.7.8.9 *Fire Management*). The Fire Management Plan process and actions means that any wildfires in Siskiyou County large enough to have a significant impact on air quality and that would temporally overlap with scheduled air quality emissions from the Proposed Project would be unlikely to overlap with actual air quality emissions from the Proposed Project since the latter would be placed on hold; therefore, the cumulative impact would be less than significant.

Significance

No significant cumulative impact

Potential Cumulative Impact 3.24-35 Short-term increases in criteria air pollutant emissions under the Proposed Project in combination with industrial development projects.

There are also two industrial projects in Yreka that have the potential to result in cumulative air quality impacts in combination with the Proposed Project. These include a Nanocellulose Facility (microscopic timber processing) and the Sousa Ready Mix Concrete Batch Plant Project (Table RE-3.24-1). Both of these projects would be located at least 15 miles southwest of the Limits of Work for the Proposed Project. Development of the nanocellulose facility is currently in the planning stages and it is unknown if the facility would be operational during the construction period for the Proposed Project (Table 2.7-1). An analysis of potential environmental impacts from the proposed nanocellulose facility has not been conducted, and the assessment of potential air quality impacts of nanocellulose production in general is in its infancy. For these reasons, it is currently speculative to determine if potential cumulative air quality impacts would result from operation of the proposed nanocellulose facility during the construction term for the Proposed Project.

In March 2016, a CEQA Initial Study/Mitigated Negative Declaration (IS/MND) was prepared for the Sousa Ready Mix Concrete Batch Plant Project. According to the IS/MND analysis, the batch plant project would result in less than significant air quality impacts during both construction and operation. From review of aerial photography (Google Earth™), it appears that the batch plant was constructed in 2016 and is currently operational. Due to the distance of the plant from the proposed Limits of Work, and the determination of less than significant air quality impacts from operations of the batch plant project, significant cumulative impacts would not result from operation of the batch plant during the construction period for the Proposed Project.

On this basis, the potential air quality impact of the Proposed Project, in combination with industrial development projects, would be less than significant.

Significance

No significant cumulative impact

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Section 3.24.10 Greenhouse Gas Emissions and Energy Cumulative Effects

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3.24.10 Greenhouse Gas Emissions and Energy

Greenhouse Gas Emissions

As discussed in Section 3.10.1 *Area of Analysis* and 3.10.2 *Environmental Setting*, the impact of GHG emissions on global climate change is a global issue. GHGs have long atmospheric lifetimes (one year to several thousand years). GHGs persist in the atmosphere for enough time to be dispersed around the globe. The effects of climate change—discussed in Section 3.10.2.1 *Greenhouse Gas Emissions* on a global, statewide and regional scale – are similarly broad. The GHG contribution of any one project to this phenomenon cannot by itself cause climate change—the phenomenon is inherently cumulative. Evaluating Proposed Project GHG emissions for conformity with plans for GHG reduction is inherently an analysis of the contribution of Proposed Project emissions to the cumulative climate change problem, in combination with past, present, and future emissions. Therefore, the discussion in Section 3.10 is a discussion of the cumulative impact.

Section 3.10 measures four potential sources of GHG emissions against two significance thresholds: a highly conservative no net increase threshold and a threshold of conflict with existing plans for GHG reductions. The four potential sources of emissions are: temporary direct construction and operations emissions (Potential Impact 3.10-1); temporary emissions from reservoir drawdown (Potential Impact 3.10-2); long-term emissions from conversion of the reservoir system to a riverine system (Potential Impact 3.10-3); and indirect emissions from continued electricity generation absent the Lower Klamath Project hydroelectric facilities (Potential Impact 3.10-4).

As described in Section 3.10.5 *Potential Impact and Mitigation*, none of the four potential sources of emissions conflict with existing plans for reduction of GHG emissions. The CARB Climate Change Scoping Plan (Scoping Plan) presents the state's plan to achieve the necessary emission reductions to meet state goals for GHG gas reductions (CARB 2017a). These reductions, in turn, are aimed at lowering the state's contribution to the global emission of GHG gases. The CARB Scoping Plan is available at:
https://ww3.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf.

However, there are GHG emissions from the Proposed Project that would result in a net increase in GHGs, and a significant and unavoidable impact above a "no net" significance criterion: these result from land-use and river system conversion and from reservoir drawdown (Potential Impacts 3.10-2 and 3.10-3). Construction and operational emissions result in no significant impact with mitigation (Potential Impact 3.10-1). Electricity-generation after removal of the Lower Klamath Project facilities does not result in a net increase in emissions (Potential Impact 3.10-4). Thus, under this more stringent threshold for measuring the effect of this project in combination with other past, present, and future projects that emit GHGs, the Proposed Project, as a whole, results in a

GHG net increase and is therefore a cumulatively considerable contribution to GHG emissions.

In terms of compliance with applicable plans, Potential Impact 3.10-1 has the potential to conflict with the CARB Scoping Plan, but feasible mitigation will avoid a conflict. None of the emissions discussed in Potential Impacts 3.10-1 through 3.10-4 conflict with the CARB Scoping Plan. The CARB Scoping Plan presents the state's plan to achieve the necessary emission reductions to meet state goals for GHG gas reductions. These reductions, in turn, are aimed at lowering the state's contribution to the global emission of GHG gases. Therefore, the Proposed Project with mitigation would not result in a cumulative impact related to conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Energy

As indicated in Section 3.10.5 *[Greenhouse Gas Emissions and Energy] Potential Impacts and Mitigation,* the Proposed Project would not result in the wasteful or inefficient use of nonrenewable resources during construction or long-term operation (Potential Impact 3.10-5) and would not result a substantial impact on local and regional energy supplies and/or on requirements for additional capacity (Potential Impact 3.10-6). The Proposed Project was conservatively determined to conflict with a local plan generally supporting renewable energy sources (Siskiyou County General Plan Energy Element), and determined not to conflict or obstruct a state plan for renewable energy or energy efficiency (Potential Impact 3.10-7). Outside of the transmission adjustments described in Section 3.10.5 no other reasonably foreseeable future energy-related projects have been identified within the primary Area of Analysis for GHGs in California.

As discussed under Potential Impact 3.10-5, it is expected that construction energy consumption associated with the Proposed Project would be comparable to other similar construction projects, and therefore would not be considered inefficient, wasteful, or unnecessary. As discussed under Potential Impact 3.10-5, the Proposed Project would remove the Lower Klamath Project dams and associated facilities and would not result in an increase in long-term, operational energy use. Since the construction and operation of the Proposed Project would not result in the inefficient, wasteful, or unnecessary use of energy resources, the Proposed Project would not incrementally contribute to a cumulatively considerable inefficient, wasteful, or unnecessary use of energy.

As discussed under Potential Impact 3.10-6, PacifiCorp has indicated that if generation of the hydroelectric facilities on the Klamath River were to cease, PacifiCorp would continue to have sufficient energy generation capacity to service all their customers. PacifiCorp has committed to continue to provide electrical services, and has the expertise and the experience necessary to install and remove facilities that requires electric transmission infrastructure changes.

PacifiCorp has implemented transmission improvements in the Klamath Basin and across its service area, and has planned for additional electric transmission infrastructure improvements. PacifiCorp has already constructed or is planning to construct infrastructure improvements to ensure it's able to provide reliable electric service to the Klamath Basin without interruption. Therefore, the Proposed Project will not result in cumulative impacts on local and regional energy supplies when viewed with past, present, and future projects, and the contribution of the Proposed Project would not be cumulatively considerable.

As discussed under Potential Impact 3.10-7, the Proposed Project would result in the loss of renewable energy sources. However, PacifiCorp will be increasing the percentage of renewable energy sources in its power mix to comply with the California Renewable Portfolio Standard. Therefore, the Proposed Project would not conflict with or obstruct a state plan for renewable energy or energy efficiency. However, the Siskiyou County Energy Element generally promotes further development of renewable energy sources in the county, and removal of an existing renewable energy source could conservatively be considered to conflict with such policies in the county's Energy Element. Such a conflict would not be an impact that can be feasibly mitigated. Therefore, the Proposed Project would conflict with a local plan supporting renewable energy sources. This would result in a cumulative energy impact and the incremental contribution of the Proposed Project would be cumulatively considerable.

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Section 4.2.9 Air Quality – No Project Alternative

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4.2.9 Air Quality

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

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Section 4.2.10 Greenhouse Gas Emissions and Energy – No Project Alternative

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4.2.10 Greenhouse Gas Emissions and Energy

In the short term under the No Project Alternative, there would be no change to the level of power production, no anticipated change to operational energy requirements or related GHG emissions, no significant sediment release with associated GHG emissions, no conversion of reservoirs to a riverine system, and no additional construction above existing conditions, described in Section 3.10.2 *[Greenhouse Gas Emissions and Energy] Environmental Setting*. In addition, there would be no change to short-term emissions with the potential to conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs. Without removal of the dams, in the short term, under the No Project Alternative, there would be no impact to PacifiCorp's PCA. Therefore, unlike under the Proposed Project (Potential Impacts 3.10-1–3.10-4), there would be no net increase in GHG emissions relative to existing conditions.

Similarly, there would be no changes to operational energy requirements from the current baseline, and no additional construction emissions or changes to energy infrastructure in the short term. Therefore, No Project Alternative would not result in changes to energy use that could result in wasteful, inefficient, or unnecessary consumption of energy resources that would cause potentially significant environmental impacts or cause a substantial impact on local and regional energy supplies and/or on requirements for additional capacity. Because the energy facilities are renewable energy, their continued operation in the short term would not have the potential to conflict with or obstruct a state or local plan for renewable energy or energy efficiency.

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Section 4.3.9 Air Quality – Partial Removal Alternative

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4.3.9 Air Quality

Although there would be a decrease in construction-related activities under the Partial Removal Alternative due to several of the Lower Klamath Project structures remaining in place (Table 4.3-1 through Table 4.3-6), the degree of difference would not be sufficient to significantly reduce the potential effects of dam removal on construction-related air quality impacts described for the Proposed Project (Potential Impacts 3.9-1 through 3.9-5). With respect to potential exceedances of the Siskiyou County Air Pollution Control District (SCAPCD) emissions thresholds in Rule 6.1 (Construction Permit Standards for Criteria Air Pollutants) (Potential Impact 3.9-1), estimated total daily emissions from the Partial Removal Alternative would still exceed the SCAPCD's significance thresholds for NO_X after the implementation of mitigation (Table RE-4.3-1). While there would be less excavation and cut/fill activities than the Proposed Project due to the smaller construction footprint, emissions associated with the other project activities would be relatively unaffected because the peak number of truck trips, amount of construction equipment, and number of temporary workers does not substantially change between the Proposed Project and this alternative. As such, the construction emissions from the Partial Removal Alternative would be significant. Similar to the Proposed Project, the Partial Removal Alternative would not result in an increase in operational emissions as it is anticipated that operational emissions under current conditions are greater than operational emission post-dam modification.

As with the Proposed Project, since the pre-dam removal activities (Fall Creek Hatchery modification; access, road, bridge, and culvert improvements; recreation facility removal; flood improvements; Yreka water supply pipeline relocation; seed collection; invasive exotic vegetation control; and Iron Gate Hatchery modification) would occur prior to initiating the major construction activities associated with the Partial Removal Alternative (i.e., dam and powerhouse deconstruction, blasting, and restoration of the reservoir footprints and disturbed upland areas), the construction emissions from these activities do not have the potential to occur at the same time as the major construction activities and are considered separately. As shown in Table RE-4.3-1, the emissions from the pre-dam removal activities would be below the significance criteria.

Table RE-4.3-1. Unmitigated Emissions Inventories for the Partial Removal Alternative.

Project Activity	**Peak Daily Emissions (pounds per day)**[1]					
	ROG	**CO**	**NO_X**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Iron Gate Dam Removal	35	204	**312**	1	61	17
Copco No. 1 Dam Removal	22	131	183	13	21	10
Copco No. 2 Dam Removal	15	122	127	21	51	12
J.C. Boyle Dam Removal	52	311	**474**	14	25	18
Blasting	-	13	3	<1	-	-
Restoration	45	200	222	19	24	10
Maximum Daily Emissions	170	981	**1,320**	68	182	67
Pre-Dam Removal Activities	17	88	89	<1	8	4
Significance Criterion[1]	250	2,500	250	250	250	250

Source: Appendix N

Notes:

[1] Values shown in bold font exceed the Siskiyou County Air Pollution Control District's (SCAPCD) thresholds of significance in Rule 6.1 (Construction Permit Standards for Criteria Air Pollutants).

Key:

ROG = reactive organic gases
CO = carbon monoxide
NO_X = nitrogen oxides
SO_2 = sulfur dioxide
PM_{10} = inhalable particulate matter
$PM_{2.5}$ = fine particulate matter

As discussed for the Proposed Project (Potential Impact 3.9-1), with the implementation of Mitigation Measures AQ-1 through AQ-5, construction emissions from the Proposed Project would still result in significant and unavoidable impacts from NO_X. Therefore, the emissions of NO_X from the Partial Removal Alternative are found to be significant and unavoidable.

As shown in Table RE-4.3-1, the emissions of the other criteria air pollutants (i.e., ROG, CO, SO_X, PM_{10}, and $PM_{2.5}$) would be below the significance criteria.

Section 4.3.10 Greenhouse Gas Emissions and Energy – Partial Removal Alternative

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4.3.10 Greenhouse Gas Emissions and Energy

Greenhouse Gas Emissions

The Partial Removal Alternative would remove portions of the four dams and powerhouse facilities as listed in Table 4.3-1 through 4.3-6. Table RE-4.3-2 shows the total construction-related emissions from the Partial Removal Alternative. As indicated, this alternative requires the same construction phases and activities as the Proposed Project, but with less intensity as some facilities or portions thereof being removed under the Proposed Project would remain in place under the Partial Removal Alternative. For this alternative, equipment operating hours and volumes of material to be hauled were reduced, therefore resulting in less emissions than the Proposed Project.

Table RE-4.3-2. Summary of GHG Emissions from the Partial Removal Alternative.

Construction Phase	$MTCO_2e$
Pre-Dam Removal	663
Copco No. 1 Dam Removal	3,134
Iron Gate Dam Removal	128
J.C. Boyle Dam Removal	5,924
Copco No. 2 Dam Removal	1,163
Restoration	2,406
Total Emissions	**13,417**

Notes: Emissions calculations are provided in Attachment A.

Since the Partial Removal Alternative would involve construction activity related to the modification of the Lower Klamath Project dam complexes, the purchase of carbon offsets as mitigation would also be a way to achieve a no net increase threshold for construction activity and comply with applicable GHG reduction plans (Potential Impact 3.10-1). Because the Partial Removal Alternative is an alternative that achieves the applicant's stated goals, and is an alternative that the applicant specifically requested that the EIR analyze, it is likely that the applicant would agree to purchase construction GHG offsets for the lower number of emissions anticipated under the Partial Removal Alternative. Mitigation Measure ENR-1 would therefore still be a feasible mitigation measure for this alternative. Therefore, like the Proposed Project the Partial Removal Alternative would result in no significant impact with mitigation from construction GHG emissions.

Similar to the Proposed Project, operational emissions under existing conditions (i.e., four Lower Klamath Project facilities and Iron Gate Hatchery) were anticipated to be substantially greater than the reduced operation of Iron Gate Fish Hatchery combined with the re-instated operation of Fall Creek Hatchery. Therefore, the Partial Removal Alternative would result in no net increase in GHG emissions from the operation of the hatcheries for eight years following dam removal (Potential Impact 3.10-1).

Similar to the Proposed Project, other direct sources of emissions from the Partial Removal Alternative include one-time emissions from the reservoir sediment during drawdown and long-term annual emissions from the conversion of the reservoir areas to riverine, wetland, and terrestrial habitat types. As would occur for the Proposed Project, the Partial Removal Alternative would result in significant and unavoidable impacts related to these sources of direct GHG emissions, with no meaningful changes anticipated in the amount of GHGs anticipated for release (Potential Impacts 3.10-2 and 3.10-3).

The removal of power production is the same under both the Proposed Project and the Partial Removal Alternative. The potential for indirect production of GHG emissions under the Partial Removal Alternative would be less than significant because this alternative would not affect PacifiCorp plans to add new sources of renewable power or purchase renewable energy credits (RECs) to comply with the California Renewable Portfolio Standard (RPS) (PacifiCorp 2019b)(Potential Impact 3.10-4).

Energy

The energy use from the Partial Removal Alternative would be reduced compared to the Proposed Project (approximately 14 percent less), since it would require reduced construction activity and operational emissions would be less than current conditions. Similar to the Proposed Project, the Partial Removal Alternative would not result in a substantial impact on local and regional energy supplies and/or on requirements for additional capacity. Similar to the Proposed Project, the Partial Removal Alternative would conflict with a local plan supporting renewable energy sources (Siskiyou County General Plan Energy Element), but would not conflict or obstruct a state plan for renewable energy or energy efficiency.

Section 4.4.9 Air Quality – Continued Operations with Fish Passage Alternative

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4.4.9 Air Quality

Under the Continued Operations with Fish Passage Alternative, construction activities to install fish ladders would occur at all four Lower Klamath Project dam complexes. Construction activities would result from the development of structures to support these fish passage options; however, the overall area of ground disturbance would be reduced as less structures would be removed and less debris would be created as compared to the Proposed Project (see also Section 4.4.1 *[Continued Operations with Fish Passage Alternative] Alternative Description*). Under this alternative, fugitive dust emissions would be caused by movement of construction equipment on the soil and internal haul roads and a small amount of cut/fill activities. As construction activities required for implementing fish passage would be less than those necessary for removal of the Lower Klamath Project dam complexes under the Proposed Project, the level of overall construction activities and thus peak daily emissions of air pollutants (i.e., ROG, CO, NO_X, SOs, PM_{10}, $PM_{2.5}$) in the Hydroelectric Reach in California would be less than those described under the Proposed Project (Potential Impact 3.9-1). Further, since the construction activities may occur over a period of four to eight years for all of the fish passage facilities, the estimated maximum daily emissions would be less than the subtotal of activities for each dam (Table RE-4.4-1). Construction-related emissions would not exceed the Siskiyou County Air Pollution Control District's (SCAPCD) thresholds of significance in Rule 6.1 (Construction Permit Standards for Criteria Air Pollutants) for the Continued Operations with Fish Passage Alternative (Table RE-4.4-1).

Table RE-4.4-1. Unmitigated Emissions Inventories for the Continued Operations with Fish Passage Alternative.

Dam	**Peak Daily Emissions (pounds per day)**					
	ROG	**CO**	**NO_X**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Iron Gate Dam Modification and Fish Ladder Construction	9	50	72	19	103	13
Copco No. 1 Dam Modification and Fish Ladder Construction	9	50	73	17	33	14
Copco No. 2 Dam Modification and Fish Ladder Construction	8	46	71	13	69	9
J.C. Boyle Dam Modification and Fish Ladder Construction	8	47	68	14	72	10
Maximum Daily Emissions[1]	9	50	73	19	103	14
Significance Criterion	250	2,500	250	250	250	250

[1] Fish ladder construction at each dam would not overlap consistent with the KHSA 2012 EIS/EIR *Fish Passage at Four Dams Alternative*.

Key:

ROG = reactive organic gases
CO = carbon monoxide
NO_x = nitrogen oxides
SO_x = sulfur oxides
PM_{10} = inhalable particulate matter
$PM_{2.5}$ = fine particulate matter

This alternative would not include operational changes that would affect air emissions in the long term for implementation of fish ladders and there would be no significant impact.

If trap and haul facilities were to be constructed instead of fish ladders, peak daily emissions due to construction activities would be less than those described above. Long-term trap and haul operations would consist of trapping adult upstream migrants downstream of Iron Gate Dam and releasing them in J.C. Boyle Reservoir as an ongoing activity. Similarly, downstream migrating smolts would be trapped at J.C. Boyle Reservoir, and released downstream of Iron Gate Dam. Although the exact extent and timing of these ongoing hauling activities is not known, peak daily air quality emissions would be considerably less than those estimated above because it is unlikely that more than ten truck trips per day would be necessary, including a conservative assumption of round trip (i.e., upstream and downstream) hauling for 60 to 70 miles each way between Iron Gate Dam and J.C. Boyle Reservoir. Therefore, the long-term potential impact on air quality emissions due to trap and haul operations would be less than significant.

Section 4.4.10 Greenhouse Gas Emissions and Energy – Continued Operations with Fish Passage Alternative

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4.4.10 Greenhouse Gas Emissions and Energy

Greenhouse Gas Emissions

Under the Continued Operations with Fish Passage Alternative, construction activities would occur to facilitate upstream and downstream fishways, which may include installing fish ladders, trap and haul, or experimental fish cannons, at all four Lower Klamath Project dam complexes. Since the Continued Operations with Fish Passage Alternative would not remove the dam complexes and would have reduced construction activity, it would produce fewer GHG emissions than the Proposed Project. Table RE-4.4-2 shows the total emissions from the Continued Operations with Fish Passage Alternative. These emissions estimates are based on the construction of fish ladder at the dam complexes. As indicated in Table RE-4.4-2, this alternative excludes pre-dam removal and restoration construction activities. Under this alternative, not all structures and facilities will be removed, and therefore would require less equipment than the Proposed Project and other alternatives. A reduced amount of equipment and less construction activities results in less emissions than the Proposed Project. Additionally, the construction of trap and haul facilities and related hauling activity is discussed qualitatively below.

Table RE-4.4.-2. Summary of Construction GHG Emissions from the Continued Operations with Fish Passage Alternative.

Construction Phase	$MTCO_2e$
Copco No. 1 Dam Modification and Fish Ladder Construction	3,070
Iron Gate Dam Modification and Fish Ladder Construction	2,781
J.C. Boyle Dam Modification and Fish Ladder Construction	827
Copco No. 2 Dam Modification and Fish Ladder Construction	390
Total Emissions	**7,058**

Notes: Emissions calculations are provided in Attachment A.

Since the Continued Operations with Fish Passage Alternative would involve construction activity related to the modification of the Lower Klamath Project dam complexes, the purchase of carbon offsets as mitigation would also be a way to achieve a no net increase threshold for construction activity and comply with applicable plans for reduction of GHGs. However, it is unclear if there would be an applicant that would agree to such mitigation, and it would not, therefore, be feasible for this alternative, in light of federal preemption. Therefore, the Continued Operations with Fish Passage Alternative would result in significant and unavoidable impacts from temporary construction GHG emissions.

If trap and haul facilities were to be constructed instead of fish ladders, GHG emissions due to construction activities would be less than those described above but would exceed the significance threshold of no net increase. Long term trap and haul operations would consist of trapping adult upstream migrants downstream of Iron Gate Dam and releasing them in J.C. Boyle Reservoir as an ongoing activity. Similarly, downstream migrating smolts would be trapped at J.C. Boyle Reservoir, and released downstream of Iron Gate Dam. Although the exact extent and timing of these ongoing hauling activities is not known, minor operational additional GHG emissions would occur from the trap and haul activities. Therefore, the long-term potential operational impact on GHG emissions due to trap and haul operations would be significant and unavoidable unless the applicant were to mitigate for the trap and haul GHG emissions through carbon offsets similar to those described in Mitigation Measure ENR-1 under the Proposed Project or other operational efficiencies in other aspects of continued operations. As it is unclear if there would be an applicant that would agree to carbon offsets as mitigation, and the operational efficiencies needed to fully mitigated GHG emissions from additional trap and haul activities are unknown at this time, neither potential mitigation would be feasible for this alternative.

The Continued Operations with Fish Passage Alternative would not remove a source of renewable power and thus would have no indirect effect on production of GHG emissions relative to existing conditions (Potential Impact 3.10-2).

Energy

The energy use from the Continued Operations with Fish Passage Alternative would be reduced compared to the Proposed Project (approximately 78 percent less), since it would require reduced construction activity. Since the Continued Operations with Fish Passage Alternative would not remove a source of renewable power, it would not have the potential to result in a substantial impact on local and regional energy supplies and/or on requirements for additional capacity, conflict with a local plan supporting renewable energy sources (Siskiyou County General Plan Energy Element), or conflict or obstruct a state plan for renewable energy or energy efficiency.

Section 4.5.9 Air Quality – Two Dam Removal Alternative

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4.5.9 Air Quality

For the reasons discussed below, potential air quality impacts due to construction activities under the Two Dam Removal Alternative would be similar to those described for the Proposed Project (Potential Impacts 3.9-1 through 3.9-5). Construction activities at J.C. Boyle Dam, regardless of whether these would be for dam removal or fish ladder construction, would occur in Oregon. However, as with the Proposed Project, due to the potential for the emissions generated from construction activity in Oregon to have air quality impacts in Siskiyou County, California, the emissions from construction activity in Oregon are conservatively included in the estimate of total emissions due to construction activity under this alternative.

In California, while short-term dam deconstruction activities would not occur at Copco No. 2 Dam under the Two Dam Removal Alternative, construction of upstream and downstream fish passage facilities and a new day use area near Copco No. 2 Dam would occur, and the level of overall construction activities and thus daily emissions of air pollutants (i.e., ROGs, CO, NO_X, SOs, PM_{10}, $PM_{2.5}$) in the Hydroelectric Reach in California would be slightly less than those described under the Proposed Project. However, this alternative would still result in air quality levels that exceed the SCAPCD emissions thresholds for NO_X (Table RE-4.5-1). If instead of fish ladders, trap and haul or some combination of fish passage methods were used, the level of construction activities at J.C. Boyle and Copco No. 2 dams would be further reduced, however this degree of difference would not be sufficient to result in emissions below the SCAPCD emissions thresholds for NO_X (Table RE-4.5-1) and this alternative would result in a significant and unavoidable impact. Similar to the Proposed Project, the Two Dam Removal Alternative would not result in an increase in operational emissions as it is anticipated that operational emissions under current conditions are greater than operational emission post-dam removal.

As with the Proposed Project, since the pre-dam removal activities (Fall Creek Hatchery modification; access, road, bridge, and culvert improvements; recreation facility removal; flood improvements; Yreka water supply pipeline relocation; seed collection; invasive exotic vegetation control; and Iron Gate Hatchery modification) would occur prior to initiating the major construction activities associated with the Two Dam Removal Alternative (dam and powerhouse deconstruction, blasting, and restoration of the reservoir footprints and disturbed upland areas), the construction emissions from these activities do not have the potential to occur at the same time as the major construction activities and are considered separately. As shown in Table RE-4.5-1, the emissions from the pre-dam removal activities would be below the significance criteria.

Table RE-4.5-1. Unmitigated Emissions Inventories for the Two Dam Removal Alternative.

Project Activity	Daily Emissions (pounds per day)[1]					
	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Iron Gate Dam Removal	44	255	**391**	11	73	21
Copco No. 1 Dam Removal	25	146	205	24	10	13
J.C. Boyle Dam Modification and Fish Ladder Construction	8	46	68	14	72	10
Copco No. 2 Dam Modification and Fish Ladder Construction	8	47	71	13	69	9
Blasting	-	13	3	<1	-	-
Restoration	24	108	122	10	13	6
Maximum Daily Emissions[1]	109	615	**860**	71	238	59
Pre-Dam Removal Activities	17	88	89	<1	8	4
Significance Criterion[2]	250	2,500	250	250	250	250

[1] Fish ladder construction at each dam would not overlap consistent with the KHSA 2012 EIS/EIR *Fish Passage at Four Dams Alternative*.
[2] Values shown in bold exceed the Siskiyou County Air Pollution Control District's (SCAPCD) thresholds of significance in Rule 6.1 (Construction Permit Standards for Criteria Air Pollutants).

Key:
ROG = reactive organic gases
CO = carbon monoxide
NO_x = nitrogen oxides
SO_x = sulfur oxides
PM_{10} = inhalable particulate matter
$PM_{2.5}$ = fine particulate matter

Like the Proposed Project, this alternative would not include operational changes that would affect air emissions in the long term for implementation of fish ladders.

If trap and haul facilities were to be constructed instead of fish ladders, peak daily emissions due to construction activities would be less than those described above. Long term trap and haul operations would consist of trapping adult upstream migrants downstream of Copco No. 2 Dam and releasing them in J.C. Boyle Reservoir as an ongoing activity. Similarly, downstream migrating smolts would be trapped at J.C. Boyle Reservoir, and released downstream of Copco

No. 2 Dam. Although the exact extent and timing of these ongoing hauling activities is not known, peak daily air quality emissions would be considerably less than those estimated above because it is unlikely that more than ten truck trips per day would be necessary, including a conservative assumption of round trip (i.e., upstream and downstream) hauling for 30 for 40 miles each way between Copco No. 2 Dam and J.C. Boyle Reservoir. Therefore, the long-term potential impact on air quality emissions due to trap and haul operations would be less than significant.

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Section 4.5.10 Greenhouse Gas Emissions and Energy – Two Dam Removal Alternative

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4.5.10 Greenhouse Gas Emissions and Energy

Greenhouse Gas Emissions

For the reasons described below, GHG impacts under the Two Dam Removal Alternative would be the slightly less than those described for the Proposed Project (Section 3.10.5 *[Greenhouse Gas Emissions and Energy] Potential Impacts and Mitigation*). Construction activities at J.C. Boyle Dam, regardless of whether these would be for dam removal or fish ladder construction (or trap and haul or some combination of fish passage methods) would occur in Oregon. However, as with the Proposed Project, due to the cumulative nature of GHG emissions, the emissions from construction activity in Oregon are conservatively included in the estimate of total emissions due to construction activity under this alternative. In California, construction activities at Copco No. 1 and Iron Gate dams would still occur and this, combined with construction activities at Copco No. 2 Dam (e.g., fishway construction) and at J.C. Boyle Dam in Oregon, means that the detailed discussion of impacts to GHGs provided in the Proposed Project (Potential Impacts 3.10-1 and 3.10-4) also applies to this alternative. Table RE-4.5.-2 provides the total construction emissions from the Two Dam Removal Alternative. The emissions estimates include construction activity for dam removal and fish ladder construction.

Table RE-4.5-2. Summary of Construction GHG Emissions from the Two Dam Removal Alternative.

Construction Phase	$MTCO_2e$
Pre-Dam Removal	663
Copco No. 1 Dam Removal	3,772
Iron Gate Dam Removal	4,267
J.C. Boyle Dam Modification and Fish Ladder Construction	827
Copco No. 2 Dam Modification and Fish Ladder Construction	380
Restoration	1,294
Total Emissions	**11,204**

Notes: Emissions calculations are provided in Attachment A.

Because the Two Dam Removal Alternative would involve construction activity related to the decommissioning of two of the Lower Klamath Project dam complexes, the purchase of carbon offsets as mitigation would also be a way to achieve a no net increase threshold for construction activity and comply with applicable GHG reduction plans (Potential Impact 3.10-1). However, it is unclear if there would be an applicant that would agree to such mitigation, and therefore, it would not be feasible for this alternative. Therefore, the Two Dam Removal Alternative would result in significant and unavoidable impacts from construction GHG emissions.

Similar to the Proposed Project, it is anticipated there would be reduced direct operational emissions relative to current conditions (i.e., operation of the four Lower Klamath Project facilities and Iron Gate Hatchery). However, the reduction would be less under the Two Dam Removal Alternative than expected under the Proposed Project (Potential Impact 3.10-1). Therefore, the Two Dam Removal Alternative would result in no net increase in GHG emissions from the operation of two dams and the hatcheries for eight years following dam removal (Potential Impact 3.10-1).

Similar to the Proposed Project, other direct sources of emissions from the Two Dam Removal Alternative include temporary emissions from the reservoirs' sediments and long-term annual emissions from the conversion of the reservoir areas to riverine, wetland, and terrestrial habitat types. As would occur for the Proposed Project, the Two Dam Removal Alternative would result in significant and unavoidable impacts related to these sources of direct GHG emissions (Potential Impacts 3.10-2 and 3.10-3). However, the impacts of the Two Dam Removal Alternative would be reduced relative to the Proposed Project since less sediment would be released as a result of drawdown and less riverine habitat would be created as result of removing the reservoirs. Compared to the Proposed Project, maintaining J.C. Boyle Dam would remove approximately 1,500 $MTCO_2e$, or 8 percent, of the predicted temporary sediment-related GHG emissions discussed in Potential Impact 3.10-2. For ecosystem-based emissions, maintaining J.C. Boyle Dam and reservoir would likely reduce GHG emissions by approximately 13 percent compared to the future totals discussed in Potential Impact 3.10-3 and shown in Table RE-3.10-13. As noted in Potential Impacts 3.10-2 and 3.10-3, the contribution of Copco No. 2 Dam and reservoir to these emissions is negligible.

If trap and haul facilities were to be constructed instead of fish ladders, GHG emissions due to construction activities would be considerably less than those described above. Long term trap and haul operations would consist of trapping adult upstream migrants downstream of Copco No. 2 Dam and releasing them in J.C. Boyle Reservoir as an ongoing activity. Similarly, downstream migrating smolts would be trapped at J.C. Boyle Reservoir and released downstream of Copco No. 2 Dam. Although the exact extent and timing of these ongoing hauling activities is not known, minor operational additional GHG emissions would occur from trap and haul activities. Therefore, the long-term potential operational impact on GHG emissions due to trap and haul operations would be significant and unavoidable unless the applicant were to mitigate for the trap and haul GHG emissions through carbon offsets similar to those described in Mitigation Measure ENR-1 under the Proposed Project, or other operational efficiencies in other aspects of continued operations. As it is unclear if there would be an applicant that would agree to carbon offsets as mitigation, and the operational efficiencies needed to fully mitigate GHG emissions from additional trap and haul activities are unknown at this time, neither potential mitigation would be feasible for this alternative.

Similarly to under the Proposed Project, removal of a renewable source of energy by removing dams under the Two Dam Removal Alternative was evaluated for the potential to result in increased GHG emissions over current conditions as electricity needs will continue to be served from alternate sources of power. The removal of power production would be less under the Two Dam Removal Alternative, as J.C. Boyle and Copco 2 Dams would continue to produce energy. Similar to the Proposed Project, the potential for indirect production of GHG emissions under the Two Dam Removal Alternative would be less than significant because this alternative would not affect PacifiCorp plans to add new sources of renewable power or purchase renewable energy credits (RECs) to comply with the California Renewable Portfolio Standard (RPS) (PacifiCorp 2019b)(Potential Impact 3.10-4). Without removal of two of the dams, the PacifiCorp transition to increasing renewable energy sources in its PCA would be somewhat accelerated as compared to the Proposed Project and as to the predictions in the IRP, which would also result in an accelerated reduction in GHG emissions.

Energy

The energy use from the Two Dam Removal Alternative would be reduced compared to the Proposed Project (approximately 24 percent less), since it would require reduced construction activity and operational emissions, which would be less than current conditions. Similar to the Proposed Project, the Two Dam Removal Alternative would not result in a substantial impact on local and regional energy supplies and/or on requirements for additional capacity. Similar to the Proposed Project, the Two Dam Removal Alternative would conflict with a local plan supporting renewable energy sources (Siskiyou County General Plan Energy Element), but would not conflict or obstruct a state plan for renewable energy or energy efficiency.

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Section 4.6.9 Air Quality – Three Dam Removal Alternative

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4.6.9 Air Quality

Relative to the Proposed Project, leaving the J.C. Boyle Dam and associated facilities in place would reduce overall construction activities related to dam removal. However, the Three Dam Removal Alternative also includes removing the existing fish ladder and installing a new fish ladder. Although this would be less construction than removing the dam and associated facilities, this difference would not meaningfully decrease the degree of construction activities or the associated impacts to air quality in California. If instead of fish ladders, trap and haul or some combination of fish passage methods were used, the level of construction activities at J.C. Boyle would be further reduced relative to the Proposed Project. Like the Proposed Project, due to the potential for the emissions generated from construction activity in Oregon to have air quality impacts in Siskiyou County, California, the emissions from construction activity in Oregon are conservatively included in the estimate of total emissions due to construction activity under this alternative.

In California, construction activities at Copco No. 1, Copco No. 2, and Iron Gate dams would occur under the Three Dam Removal Alternative in the same manner as under the Proposed Project. Note that the magnitude of estimated emissions due to J.C. Boyle Dam and Powerhouse deconstruction is relatively low compared with the other three dam complexes, such that reducing this estimate for a lesser degree of construction under the Three Dam Removal Alternative would not change the expectation that emissions would exceed the SCAPCD emissions thresholds (see Table RE-3.9-8). Thus, potential air quality impacts due to construction activities under the Three Dam Removal Alternative would be similar to those described for the Proposed Project (Potential Impacts 3.9-1 through 3.9-5). Like the Proposed Project, construction activities occurring under the Three Dam Removal Alternative would exceed the SCAPCD emissions thresholds for NO_X and would result in a significant and unavoidable impact (Table RE-3.10-8). Similar to the Proposed Project, the Three Dam Removal Alternative would not result in an increase in operational emissions as it is anticipated that operational emissions under current conditions are greater than operational emission post-dam removal.

As with the Proposed Project, since the pre-dam removal activities (Fall Creek Hatchery modification; access, road, bridge, and culvert improvements; recreation facility removal; flood improvements; Yreka water supply pipeline relocation; seed collection; invasive exotic vegetation control; and Iron Gate Hatchery modification) would occur prior to initiating the major construction activities associated with the Three Dam Removal Alternative (dam and powerhouse deconstruction, blasting, and restoration of the reservoir footprints and disturbed upland areas), the construction emissions from these activities do not have the potential to occur at the same time as the major construction activities and are considered separately. As shown in Table RE-4.6-1, the emissions from the pre-dam removal activities would be below the significance criteria.

Table RE-4.6-1. Unmitigated Emissions Inventories for the Three Dam Removal Alternative.

Project Activity	**Daily Emissions (pounds per day)[1]**					
	ROG	**CO**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Iron Gate Dam Removal	44	255	**391**	11	73	21
Copco No. 1 Dam Removal	25	146	205	24	10	14
Copco No. 2 Dam Removal	18	449	159	23	73	13
J.C. Boyle Dam Modification and Fish Ladder Construction	8	46	68	14	72	10
Blasting	-	13	3	<1	-	-
Restoration	27	125	144	10	16	7
Maximum Daily Emissions[1]	123	1,034	**969**	82	244	64
Pre-Dam Removal Activities	17	88	89	<1	8	4
Significance Criterion[2]	250	2,500	250	250	250	250

[1] Fish ladder construction at each dam would not overlap consistent with the KHSA 2012 EIS/EIR *Fish Passage at Four Dams Alternative*.

[2] Values shown in bold exceed the Siskiyou County Air Pollution Control District's (SCAPCD) thresholds of significance in Rule 6.1 (Construction Permit Standards for Criteria Air Pollutants).

Key:
ROG = reactive organic gases
CO = carbon monoxide
NO_x = nitrogen oxides
SO_x = sulfur oxides
PM_{10} = inhalable particulate matter
$PM_{2.5}$ = fine particulate matter

Section 4.6.10 Greenhouse Gas Emissions and Energy – Three Dam Removal Alternative

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4.6.10 Greenhouse Gas Emissions and Energy

Greenhouse Gas Emissions

Relative to the Proposed Project, leaving the J.C. Boyle Dam and associated facilities in place would reduce overall construction activities related to dam removal. However, the Three Dam Removal Alternative also includes removing the existing fish ladder and installing a new fish ladder. If instead of fish ladders, trap and haul or some combination of fish passage methods were used, the level of construction activities at J.C. Boyle would be further reduced relative to the Proposed Project. As with the Proposed Project, due to the cumulative nature of GHG emissions, the emissions from construction activity in Oregon are conservatively included in the estimate of total emissions due to construction activity under this alternative. In California, construction activities at Copco No. 1, Copco No. 2, and Iron Gate dams would still occur as described under the Proposed Project and this, combined with lesser degree of construction activities in Oregon, means that the detailed discussion of impacts to GHGs provided in the Proposed Project (Potential Impacts 3.10-1 and 3.10-4) also generally applies to this alternative, albeit with slightly lower overall GHG emissions. Table RE-4.6-2 provides the total construction emissions from the Three Dam Removal Alternative. The emissions estimates include construction activity for dam removal and fish ladder construction at J.C. Boyle Dam.

Table RE-4.6.-2. Summary of Construction GHG Emissions from the Three Dam Removal Alternative.

Construction Phase	$MTCO_2e$
Pre-Dam Removal	663
Copco No. 1 Dam Removal	3,772
Copco No. 2 Dam Removal	1,415
Iron Gate Dam Removal	4,267
J.C. Boyle Dam Modification and Fish Ladder Construction	827
Restoration	1,488
Total Emissions	**12,432**

Notes: Emissions calculations are provided in Attachment A.

Because the Three-Dam Removal Alternative would involve construction activity related to the decommissioning of three of the Lower Klamath Project dam complexes, the purchase of carbon offsets as mitigation would also be a way to achieve a no net increase threshold for construction activity and comply with applicable GHG reduction plans (Potential Impact 3.10-1). However, it is unclear if there would be an applicant that would agree to such mitigation, and it would not, therefore, be feasible for this alternative, in light of preemption. Therefore, the Three-Dam Removal Alternative would result in significant and unavoidable impacts from construction GHG emissions.

Similar to the Proposed Project, it is anticipated there would be reduced direct operational emissions relative to current conditions (i.e., operation of the four Lower Klamath Project facilities and Iron Gate Hatchery). However, the reduction would be less under the Three Dam Removal Alternative than expected under the Proposed Project (Potential Impact 3.10-1). Therefore, the Three Dam Removal Alternative would result in no net increase in GHG emissions from the operation of one of the dams and the hatcheries for eight years following dam removal (Potential Impact 3.10-1).

Similar to the Proposed Project, other direct sources of emissions from the Three Dam Removal Alternative include one-time emissions from the reservoir sediment during drawdown and long-term annual emissions from the conversion of the reservoir areas to riverine, wetland, and terrestrial habitat types. As would occur for the Proposed Project, the Three Dam Removal Alternative would result in significant and unavoidable impacts related to these sources of direct GHG emissions (Potential Impacts 3.10-2 and 3.10-3). However, the impacts of the Three Dam Removal Alternative would be reduced relative to the Proposed Project since less sediment would be released as a result of drawdown and less riverine habitat would be created as result of removing the reservoirs. Compared to the Proposed Project, maintaining J.C. Boyle Dam would remove approximately 1,500 $MTCO_2e$, or 8 percent, of the predicted temporary sediment-related GHG emissions discussed in Potential Impact 3.10-2. For ecosystem-based emissions, maintaining J.C. Boyle Dam and reservoir would likely reduce GHG emissions by approximately 13 percent compared to the future totals discussed in Potential Impact 3.10-3 and shown in Table RE-3.10-13.

Similarly to under the Proposed Project, removal of a renewable source of energy by removing dams under the Three Dam Removal Alternative was evaluated for the potential to result in increased GHG emissions over current conditions as electricity needs will continue to be served from alternate sources of power. The removal of power production would be less under the Three Dam Removal Alternative, as J.C. Boyle Dam would continue to produce energy. Similar to the Proposed Project, the potential for indirect production of GHG emissions under the Three Dam Removal Alternative would be less than significant because this alternative would not affect PacifiCorp plans to add new sources of renewable power or purchase renewable energy credits to comply with the California Renewable Portfolio Standard (PacifiCorp 2019b) (Potential Impact 3.10-4). Without removal of one of the dams, the PacifiCorp transition to increasing renewable energy sources in its PCA would be somewhat accelerated, which would also result in an accelerated reduction in GHG emissions.

Energy

The energy use from the Three Dam Removal Alternative would be reduced compared to the Proposed Project (approximately 21 percent less), since it would require reduced construction activity and operational emissions would be less than current conditions. Similar to the Proposed Project, the Three Dam Removal Alternative would not result in a substantial impact on local and regional energy supplies and/or on requirements for additional capacity. Similar to the Proposed Project, the Three Dam Removal Alternative would conflict with a local plan supporting renewable energy sources (Siskiyou County General Plan Energy Element), but would not conflict or obstruct a state plan for renewable energy or energy efficiency.

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Section 4.7.9 Air Quality – No Hatchery Alternative

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4.7.9 Air Quality

Full removal of Iron Gate Hatchery under the No Hatchery Alternative would result in a similar degree of construction activities and associated impacts related to air pollutants as the Iron Gate Hatchery modifications (i.e., relocation of fish trapping and holding facilities, relocation of the cold-water supply) and Fall Creek Hatchery upgrades included under the Proposed Project. Therefore, the No Hatchery Alternative would have the same short-term construction-related emissions of air pollutants (i.e., ROGs, CO, NO_X, SO_2, PM_{10}, $PM_{2.5}$) as those described for the Proposed Project. Like the Proposed Project, construction activities occurring under the No Hatchery Alternative would exceed the SCAPCD emissions thresholds for NO_X and would result in a significant and unavoidable impact (Potential Impact 3.9-1).

Note that analysis of the Proposed Project conservatively considers construction-related air quality impacts (Section 3.9.4 *[Air Quality] Impact Analysis Approach*). Under the Proposed Project, operational emissions under existing conditions are anticipated to be greater than the reduced operation of Iron Gate Hatchery combined with the re-instated operation of Fall Creek Hatchery (Section 3.9.4 *[Air Quality] Impact Analysis Approach*). Thus, as a matter of general comparison, under the No Hatchery Alternative, operational emissions from the hatcheries would be lower (zero) than those under existing conditions.

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Section 4.7.10 Greenhouse Gas Emissions and Energy – No Hatchery Alternative

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4.7.10 Greenhouse Gas Emissions and Energy

Greenhouse Gas Emissions

The No Hatchery Alternative is the same as the Proposed Project except that operations at the Iron Gate Hatchery would cease at the time of dam removal and would not continue for eight years following dam removal, and the Fall Creek Hatchery would not reopen with upgraded facilities.

Therefore, the No Hatchery Alternative would produce similar but somewhat lesser construction emissions to the Proposed Project, as the major dam deconstruction and restoration activities would occur, but there would not be construction related to modification of the hatcheries. Since the No Hatchery Alternative would involve construction activity, the purchase of carbon offsets could achieve a no net increase threshold for construction activity and comply with applicable GHG reduction plans (as described in Potential Impact 3.10-1). Because the No Hatchery Alternative accomplishes the applicant's stated goals, it is likely that the applicant would agree to purchase construction GHG offsets for construction emissions anticipated under the No Hatchery Alternative. Mitigation Measure ENR-1 would therefore still be a feasible mitigation measure for this alternative. Therefore, like the Proposed Project, the No Hatchery Alternative would result in no significant impact with mitigation from construction GHG emissions.

Similar to the Proposed Project, it is anticipated there would be reduced direct operational emissions relative to current conditions (i.e., operation of the four Lower Klamath Project facilities and Iron Gate Hatchery). However, the reduction would be greater under the No Hatchery Alternative than expected under the Proposed Project, as all existing operational emissions would be eliminated, and no hatchery operations would continue. (Potential Impact 3.10-1). Like the Proposed Project, the No Hatchery Alternative would result in no net increase in operational GHG emissions (Potential Impact 3.10-1).

Like the Proposed Project, other direct sources of emissions from the No Hatchery Alternative include temporary emissions from the reservoir sediment and long-term annual emissions from the conversion of the reservoir areas to riverine, wetland, and terrestrial habitat types. Under the No Hatchery Alternative, these sources of emissions would not materially change from those described for the Proposed Project, Potential Impacts 3.10-2 and 3.10-3. As would occur for the Proposed Project, the No Hatchery Alternative would result in significant and unavoidable impacts related to these sources of direct GHG emissions.

Similar to under the Proposed Project, removal of a renewable source of energy by removing dams under the Three Dam Removal Alternative was evaluated for the potential to result in increased GHG emissions over current conditions as electricity needs will continue to be served from alternate sources of power. The removal of power production would be the same under the No Hatchery

Alternative as described under the Proposed Project, Potential Impact 3.10-4. As under the Proposed Project, the potential for indirect production of GHG emissions under the No Hatchery Removal Alternative would be less than significant because this alternative would not affect PacifiCorp plans to add new sources of renewable power or purchase renewable energy credits (RECs) to comply with the California Renewable Portfolio Standard (RPS) (PacifiCorp 2019b)(Potential Impact 3.10-4).

<u>Energy</u>

The operational energy use from the No Hatchery Alternative would be reduced compared to the Proposed Project (and the baseline), since there would be no energy use from operation of the hatcheries for eight years following dam removal. Regarding construction and facilities removal, the energy effects of the No Hatchery Alternative are materially the same as for the Proposed Project, with only a slight reduction in construction energy used since Fall Creek Hatchery would not be reopened and Iron Gate Hatchery would not be improved (Section 4.7 *No Hatchery Alternative)*. Like the Proposed Project, the No Hatchery Alternative would not result in a substantial impact on local and regional energy supplies and/or on requirements for additional capacity. Similar to the Proposed Project, the No Hatchery Alternative would conflict with a local plan supporting renewable energy sources (Siskiyou County General Plan Energy Element), but would not conflict or obstruct a state plan for renewable energy or energy efficiency.