CHAPTER 7
Climate Change

7.1 Introduction

This section discloses how the project would maintain resiliency and adaptability to climate change. Three fundamental questions relating to climate change are addressed in this EIR:

1. **What is the impact of the proposed project on climate change? How will GHG emissions from construction and operation activities associated with the proposed project contribute to elevated GHG concentrations in the atmosphere?**

   An analysis of impacts attributed to GHG emissions associated with construction and operation of the proposed project is provided in Section 3.7 Greenhouse Gases. As described under Impact 3.7-1, the proposed project's incremental contribution to the cumulative impact of increasing atmospheric levels of GHGs is less than cumulatively considerable and, therefore, less than significant. Impact 3.7-2 concludes the proposed project's total construction emissions of approximately 5,066 MT CO_2e would not exceed DWR's total emissions threshold of 25,000 MT CO_2e, as identified in their Greenhouse Gas Emissions Reduction Plan (GGERP).

2. **How will the operation of the proposed project be affected by climate change? Are future changes in climate likely to exacerbate identified proposed project impacts?**

   Operation of the proposed project could be affected by features of climate change that include changes in temperature, precipitation, humidity, and hydrology. Due to the proximity of the project within western Riverside County, 60 miles inland from the coast and greater than 1,400 feet above mean sea level, impacts from sea level rise (SLR) are not anticipated. Increased temperatures could increase the rate of evapotranspiration of water contained in Lake Perris, resulting in decreased surface water levels. In addition, changes in precipitation and humidity would cause the surface water levels within the reservoir to fluctuate according to the amount of rainfall received in the project watershed. Given the size of the watershed and ability to convey water from the reservoir to other reservoirs in the region, even a substantial increase in precipitation over the facility would not substantially increase water volume within the reservoir that could result in an overflow over the dam.

3. **How will the proposed project's resiliency and adaptability meet the challenges of climate change?**

   The response to Question 3 presents the following: (1) basic background on scientific efforts to evaluate the degree and impacts of future climate changes; (2) a discussion of observed

climatological changes over the past several decades, and expected future changes during the rest of this century globally, in California, and for the project area; and (3) an evaluation of the ability of the project to remain stable or adapt in response to the effects of climate change. This analysis focuses on the major impacts of climate change and the clear and measurable ways that the project would ameliorate impacts from climate change or add flexibility to the system. The project would not be able to completely counteract all of the effects of climate change; however, as shown below, the project would provide resilience and adaptability to many of the expected changes. Effects for which the project provides no additional benefit or for which the benefit is minimal, or not documentable, are not discussed.

7.2 Climate Change Background and Environmental Setting

Climate is the average weather over many years, measured most often in terms of temperature, precipitation, and wind. The climate of southern California is a Mediterranean climate, which is hot and dry during the summer and cool and damp in winter, with the majority of precipitation falling as rain in the winter months. Climate is unique to a particular location and changes timescales of decades to centuries or millennia.

Climate change generally refers to a "change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer" (Intergovernmental Panel on Climate Change (IPCC), 2013). Although the climate can change, and has changed, in the past in response to natural drivers, recent climate change has been more rapid than previous episodes and has been unequivocally linked to increasing concentrations of greenhouse gases (GHGs) in Earth's lower atmosphere and the rapid timescale on which these gases have accumulated (IPCC, 2013). The major causes of this rapid loading of GHGs into the atmosphere include the burning of fossil fuels since the beginning of the industrial revolution, agricultural practices, increases in livestock grazing, and deforestation (Gilbert, 2012). More background information on GHG emissions and the relationship to climate change is provided in Section 3.7, Greenhouse Gases.

The project area exhibits a Mediterranean climate characterized by hot, dry summers and cool, rainy winters. From 1971 to 2000, average monthly temperatures in Perris ranged from 34.4°F (1.3°C) in December to 97.3°F (36.3°C) in July, with average monthly rainfall ranging from a low of 0.04 inches (0.10 centimeters) in July to a high of 1.83 inches (4.6 centimeters) in January (Western Regional Climate Center, 2013), with an annual average precipitation of approximately 6.8 inches (17 centimeters).

7.3 Global Climate Change Effects

The IPCC has found that, "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (IPCC, 2013). Global annual surface temperatures have increased at a rate of 0.13°C (0.23°F) per decade during the period 1950–2000.

This rate is double the rate observed during the period 1900–1950. Further, 11 of the 12 years during the period 1995–2006 rank among the 12 warmest years in the instrumental record of global surface temperature (since 1850) (IPCC, 2013). Much of the Western United States has experienced warming during the 20th century (roughly 2°F [1.1°C]) and is projected to experience further warming during the 21st century with central estimates varying from roughly 5 to 7°F (2.8°C to 3.8°C), depending on location (Bureau of Reclamation, 2011).Historical trends in annual precipitation are less apparent. Future projections suggest that the Northwestern and north-central portions of the United States gradually may become wetter (e.g., Columbia Basin and Missouri River basin) while the Southwestern and south-central portions gradually become drier (e.g., San Joaquin, Truckee, and Rio Grande River basins and the Middle to Lower Colorado River Basin). Areas in between have median projected changes closer to no change, meaning they have roughly equal chances of becoming wetter or drier (e.g., Klamath and Sacramento basins and the Upper Colorado Basin).

Climate models indicate that global average surface temperature will increase at a rate of approximately 0.4°F (0.2°C) per decade for the period 2000–2020, and will increase by at least that amount per decade during the period 2020–2080. Based on a number of emissions scenarios, the IPCC projected an average increase in surface temperatures of 3.2 to 7.2°F (1.7 to 4°C) by 2100 compared to 1980 through 1999 levels, with a likely range of 2.0 to 11.5°F (1.1 to 2.2°C) when accounting for the uncertainty in climate science (IPCC, 2013). Approximately half of this warming is the result of past GHG emissions and will occur even if GHG emissions were halted at 2000 levels.

7.4 Climate Change Effects on California

Scientific measurements and observations indicate that California's climate is already changing in a manner consistent with what would be expected from global climate change. Since 1920, California's average temperature has been increasing, although this change, or any climate change impact, is not uniform across California. Nighttime temperatures are rising across California and at a higher rate than day-time temperatures. Furthermore, daytime and nighttime heat wave events throughout California have increased in intensity, particularly the nighttime component (Moser et al., 2009). During the last century, sea level along the California coast has increased approximately 7 inches (17-20 centimeters), with higher rates of increase occurring since 1993 (Cayan et al., 2012).

California's water supply system is dependent on snowpack storage in the Sierra Nevada. Temperatures over the Sierra Nevada have increased during the last 100 years, resulting in less snowfall (and more rainfall) and an earlier snowmelt (Moser et al. 2009). The average early spring snowpack in the Sierra Nevada has decreased by about 10 percent during the last century, a loss of 1.5 million acre-feet (MAF) of snowpack storage (DWR, 2008). Reductions in water supply can adversely affect hydropower reserves, decreasing hydropower generation in the summer months when peak demand is highest (California Natural Resources Agency, 2013).

Data also show evidence for the following additional changes to California climate and conditions during the last 50 years: the warming of Lake Tahoe; decreasing chill hours and increased stresses on California agriculture; shifts and disturbances in managed landscapes; increased frequency of wildfire; changes in Santa Ana winds; increases in photochemical smog production in southern California; increased frequency and intensity of heat wave and drought events; changes in ENSO and the impact on California temperatures; and changes in extreme precipitation events and daily average precipitation (California Energy Commission, 2014).[1]

Average annual surface temperatures for California are projected to increase by between 2 and 5°F (1.1 and 2.8°C) by 2050 and between 4 and 9°F (2.2 and 5.0°C) by 2100, depending on the GHG emissions scenario assumed. Warming will not be uniform temporally or geographically across the state. Climate models project a greater amount of warming during summer months, especially during nighttime, and in the interior regions of California. Chill hours in the Central Valley are expected to decrease, but unprecedented extremes of cold weather are still possible (Gershunov, 2011). Changes in temperature and humidity have implications for agriculture in the Central Valley; as the climate warms and dries, crop diversity and production may slow (Jackson et al. 2011). Extreme events will also stress California's energy system (Auffhammer, 2011).

Best available data indicate that California, as a whole, will experience changes in precipitation. It is likely that some areas in California will experience higher annual rainfall amounts whereas precipitation in other regions will decrease (Gershunov, 2011). Cayan et al., (2012) estimates California, particularly southern California, will have 16–23% less precipitation by 2100. Snowpack volumes are expected to diminish by 25% by 2050 (DWR, 2010b).

Frequency and intensity of precipitation events may be influenced by changes in ARs. In California, nearly all major historic flood events have been associated with the presence of ARs along the Pacific coast. It is estimated that future changes in climate will increase the frequency of years with AR storms, but the number of storms per year is not likely to be affected. More importantly, occasional "much-larger-than-historical-range storm intensities" are projected to occur under most warming scenarios. Changes in the frequency and magnitude of ARs may result in increases in major flood and storm events (Dettinger, 2011).

Climate change and increasing temperatures are expected to increase energy demand in California, particularly during the summer months. The California Natural Resources Agency (2013) predicts that higher temperatures in the next decade could increase demand by up to 1 gigawatt. Increased energy demand would require additional generation resources or the purchase of peak power from external sources.

Potential effects of climate change anticipated in California include (California Natural Resources Agency, 2009, 2013):

[1] The State of California under the auspices of the California Energy Commission (CEC) is conducting comprehensive and detailed research into a range of climate change impacts in California as well as research aimed at developing adaptation strategies to deal with impacts already underway and that can no longer be avoided. The majority of this research is available through the California Climate Change Portal. Available at: <http://www.climatechange.ca.gov/>.

- Increased average temperatures (air, water, and soil)
- Changes in annual precipitation amounts.
- Change from snowfall (and spring snowmelt) to rainfall
- Decreased Sierra snowpack (earlier runoff, reduced maximum storage)
- Changes in evapotranspiration
- Increased frequency and intensity of Pacific storms (flood events)
- Increased severity of droughts
- Increased frequency and severity of extreme heat events
- Increased energy demand (particularly during peak summer periods)
- Increased frequency and severity of wildfire events
- Increased sea level rise
- Changes in species distribution and ranges
- Decreased number of species
- Increased number of vector-borne diseases and pests (including impacts to agriculture)
- Altered timing of animal and plant lifecycles (phenology)
- Disruption of biotic interactions
- Changes in physiological performance, including reproductive success and survival of plants and animals
- Changes in invasive species
- Altered migration patterns of fishes, aquatic-breeding amphibians, birds and mammals
- Changes in food (forage) base
- Changes in habitat, vegetation structure, and plant and animal communities

These changes have significant implications for water quality, water supply, flooding, aquatic ecosystems, energy generation, and recreation throughout the state. Several guidance documents have been drafted or have been published to discuss strategies to protect resources from climate change in California such as the 2009 California Climate Adaptation Strategy (California Natural Resources Agency, 2009).

7.5 Climate Change Effects on the Project Area

As described above, average annual average air temperatures in California have increased by about 1.5°F since 1895. The annual minimum temperature averaged over the project area has increased 0.44°F per decade during the period 1920 to 2003, while the average annual maximum temperature has increased 0.36°F per decade (California Energy Commission, 2008). Sea level along the California coast has risen approximately 7 inches (18 centimeters) over the last 100

years. The average early spring snowpack in the Sierra Nevada has decreased by about 10% during the last century, a loss of 1.5 MAF of snowpack storage (California Department of Water Resources 2008).

Projections indicate the rate of increase in global mean annual temperature will nearly double before 2100, and that increases in summer temperatures will be greater than winter (IPCC, 2007). Increasing temperatures will result in a greater number of days above 95°F in the future. By 2070, it is projected that the number of days above 95°F will nearly double in Riverside County, from 43 days to 82 days. The changing climate in California could potentially result in lower stream flow, lower reservoir storage, and decreased water supply reliability in the 21st century. Drought in the Southwest may no longer be driven by precipitation, but rather by temperature (Bureau of Reclamation, 2013).

Precipitation projections for Riverside County show less snowfall in the mountains and more rainfall, less snowpack development and earlier runoff, and more intense and heavy rainfall interspersed with longer dry periods (Bureau of Reclamation, 2013). These projected conditions in the project area could result in more flash flood warnings during heavy rainfall events and lower surface water levels in Lake Perris during longer dry periods.

7.6 Resiliency Analysis

As described in Chapter 2, Project Description, the project proposes to modify the existing emergency release structure for the Perris Dam and to construct a water conveyance facility to connect with the Perris Valley Channel in the event DWR executes an emergency drawdown of the reservoir. The analysis below describes expected changes from climate change in the region, potential issues resulting from those changes, and how the project would achieve adaptability to climate change.

Precipitation and Hydrology Changes

Earlier runoff as a result of a change from snowfall to rainfall in the Sierra Nevada and a decreased Sierra snowpack would reduce the maximum snowpack storage for water supply delivery. Lake Perris reservoir receives its water supply from the State Water Project, which receives most of its water from snowmelt in the Sierras. Earlier runoff and decreased snowpack would affect the timing of water availability and could reduce the reliability of the State Water Project (SWP) to deliver water supplies to Perris Reservoir.

Future hydrologic changes are expected to result in more years of critical dryness and will make water management more challenging and more constrained in the future. DWR’s modeling of future conditions suggests that with current management and level of demand, major reservoirs could reach extremely low storage levels more often. In these instances, critical water shortages could occur leading to potentially extreme impacts to agriculture, municipal, industrial and ecological water uses. Managing effective use of available water supplies will become more complex as precipitation trends and water demand priorities shift. Perris Reservoir would exhibit periods of normal supply and periods of reduced supply. Perris Reservoir receives very little

natural runoff from its relatively small watershed. Instead, the reservoir serves as a terminal reservoir for SWP deliveries. As such, the reservoir will continue to be filled when water in the SWP system is available. The reservoir serves as an important component of the state's surface water storage capacity, providing storage when water in the system is available. The reservoir is therefore a crucial component of the state's approach to climate change adaptability and resiliency.

The proposed emergency relief facility would not be affected by these potential climate change impacts or management complexities. An emergency drawdown operation of the reservoir would only be required in the aftermath of a major seismic event that renders the dam structurally unsound. Since seismic activity is not linked to climate change, climate change would not diminish the likelihood for the need to use and operate the emergency release structure.

The effects of climate change would not impact the stability of the emergency release structure and conveyance facilities. The structures are designed to safely maintain a maximum release capacity of 3,800 cfs to the Perris Valley Channel. In the event of heavy precipitation, as described in Section 3.9, Hydrology, the existing water delivery facilities would be able to accommodate large storm water contributions without any flood risk or damage to the facilities. The project is being proposed to reduce the risk of inundating downstream properties of the reservoir, with the anticipation to never need to use and operate the emergency release facilities. Therefore, its components have been designed to endure long-term stability, with or without the future effects of climate change.

Compatibility with Existing Climate Change Plans and Policies

The USFWS, EPA, U.S. Forest Service, U.S. Department of Agriculture, U.S. Department of the Interior, U.S. Army Corp of Engineers, CVFMP, DWR, CDFW, CDFA, DPH, California Natural Resources Agency, California Department of Forestry and Fire Protection, and Caltrans have developed frameworks or initiatives to ensure their respective resources are made more resilient to climate change. Construction and operation of the Perris Dam ERF would not affect the ability of these agencies to implement these plans and proactive measures. Accordingly, the project would be compatible with these federal and state plans to address climate change. The project is therefore compatible with the CEQA guidance on climate change.

Executive Order B-30-15 issued on April 29, 2015 established a California greenhouse gas reduction target of 40 percent below 1990 levels by 2030 in order to meet the established levels needed in the United States to limit global warming below 2°C (Office of Governor Edmund G. Brown Jr., 2015). The order requires that:

6. State agencies shall take climate change into account in their planning and investment decisions, and employ full life-cycle cost accounting to evaluate and compare infrastructure investments and alternatives.
7. State agencies' planning and investment shall be guided by the following principles:

8. Priority should be given to actions that both build climate preparedness and reduce greenhouse gas emissions;
9. Where possible, flexible and adaptive approaches should be taken to prepare for uncertain climate impacts;
10. Actions should protect the state's most vulnerable populations; and
11. Natural infrastructure solutions should be prioritized.

The project would be compatible with this state order due to its considerations and preparedness for climate change impacts, its protection of vulnerable populations, and its contribution to climate change resiliency. In addition, Executive Order S-13-8, California Water Code, Section 85320 (b)(2)(C), CALFED Independent Science Board Memorandum, and the OPC SLR Task Force Interim Guidance Document address expected risk and vulnerability to future SLR in California. Because potential effects of SLR on the project were considered as part of this analysis, the project is compatible with applicable SLR guidance documents. Regulations associated with the mitigation of GHG emissions (e.g., AB-32) are discussed in Section 3.7, Greenhouse Gases, and are not repeated here.

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