

7 Climate Change Considerations

This chapter evaluates the potential effects of climate change on and/or related to the Santa Cruz Water Rights Project (Proposed Project). Pursuant to the California Environmental Quality Act (CEQA) Guidelines Section 15125(a)(1), Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, evaluates the impacts of the Proposed Project as compared to the baseline physical environmental conditions, which are the conditions that existed at the time the Notice of Preparation for this environmental impact report (EIR) was published (2018). CEQA Guidelines Section 15125(a)(1) also indicates that lead agencies can use baselines consisting of both existing and projected future conditions that are supported by reliable projections based on substantial evidence in the record. This chapter considers projected future conditions that could result with climate change, which are based in part on hydrologic, water supply, and fisheries habitat modeling conducted for the Proposed Project (see Appendix D). Projected future climate change conditions could also potentially affect how the Proposed Project is implemented over time and therefore this chapter also considers whether changes in the implementation of the Proposed Project could result in additional direct, indirect or cumulative impacts.

7.1 Introduction and Background

7.1.1 Potential Effects of Climate Change

Section 4.6, Greenhouse Gas Emissions, describes the potential effects of climate change on environmental resources, which is also provided below.

Globally, climate change has the potential to affect numerous environmental resources through uncertain impacts related to future air temperatures and precipitation patterns. The 2014 Intergovernmental Panel on Climate Change (IPCC) Synthesis Report (IPCC 2014) indicated that warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. Signs that global climate change has occurred include warming of the atmosphere and ocean, diminished amounts of snow and ice, rising sea levels, and ocean acidification (IPCC 2014).

In California, climate change impacts have the potential to affect sea-level rise, agriculture, snowpack and natural availability of water, forestry, wildfire risk, public health, frequency of severe weather events, and electricity demand and supply. The primary effect of global climate change has been a rise in average global tropospheric temperature. Reflecting the long-term warming trend since pre-industrial times, observed global mean surface temperature for the decade 2006–2015 was 0.87°C (1.6°F) (likely between 0.75°C [1.4°F] and 0.99°C [1.8°F]) higher than the average over the 1850–1900 period (IPCC 2018). Scientific modeling predicts that continued emissions of greenhouse gases (GHGs) at or above current rates would induce more extreme climate changes during the twenty-first century than were observed during the 20th century. Human activities are estimated to have caused approximately 1.0°C (1.8°F) of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C (1.4°F to 2.2°F) (IPCC 2018). Global warming is likely to reach 1.5°C (2.7°F) between 2030 and 2052 if it continues to increase at the current rate (IPCC 2018).

Although climate change is driven by global atmospheric conditions, climate change impacts are felt locally. A scientific consensus confirms that climate change is already affecting California. The Office of Environmental Health Hazard Assessment identified various indicators of climate change in California, which are scientifically based measurements that track trends in various aspects of climate change. Many indicators reveal discernible evidence that climate change is occurring in California and is having significant, measurable impacts in the state. Changes

in the state's climate have been observed, including an increase in annual average air temperature with record warmth from 2012 to 2016, more frequent extreme heat events, more extreme drought, a decline in winter chill, an increase in cooling degree days and a decrease in heating degree days, and an increase in variability of statewide precipitation (OEHHA 2018).

Warming temperatures and changing precipitation patterns have altered California's physical systems—the ocean, lakes, rivers, and snowpack—upon which the state depends. Winter snowpack and spring snowmelt runoff from the Sierra Nevada and southern Cascade Mountains provide approximately one-third of the state's annual water supply. Impacts of climate on physical systems have been observed such as high variability of snow-water content (i.e., amount of water stored in snowpack), decrease in snowmelt runoff, glacier change (loss in area), rise in sea levels, increase in average lake water temperature and coastal ocean temperature, and a decrease in dissolved oxygen in coastal waters (OEHHA 2018).

Impacts of climate change on biological systems, including humans, wildlife, and vegetation, have also been observed, including climate change impacts on terrestrial, marine, and freshwater ecosystems. As with global observations, species responses include those consistent with warming: elevational or latitudinal shifts in range, changes in the timing of key plant and animal life cycle events, and changes in the abundance of species and in community composition. Humans are better able to adapt to a changing climate than plants and animals in natural ecosystems. Nevertheless, climate change poses a threat to public health as warming temperatures and changes in precipitation can affect vector-borne pathogen transmission and disease patterns in California as well as the variability of heat-related deaths and illnesses. In addition, since 1950, the area burned by wildfires each year has followed an increasing trend overall.

The California Natural Resources Agency (CNRA) has released four California Climate Change Assessments (2006, 2009, 2012, and 2018), which have addressed the following: acceleration of warming across the state, more intense and frequent heat waves, greater riverine flows, accelerating sea-level rise, more intense and frequent drought, more severe and frequent wildfires, more severe storms and extreme weather events, shrinking snowpack and less overall precipitation, and ocean acidification, hypoxia, and warming. To address local and regional governments' need for information to support action in their communities, the Fourth Assessment (2018) includes reports for nine regions of the state.

Key projected climate changes for the Central Coast Region (which includes Santa Cruz County where the Proposed Project is located) include the following from the CNRA (CNRA 2018), unless otherwise indicated:

- Maximum and minimum temperatures for the Central Coast will continue to increase through the next century, with greater increases in the inland region relative to the coast.
- Precipitation is expected to increase slightly, but precipitation variability will increase substantially. (For example, the frequency of abrupt shifts from dry to wet years is expected to increase roughly 35% by 2075, the frequency of extremely dry years is expected to increase roughly 100%, and the frequency of extremely wet years is expected to increase by more than 100% [Swain et al., 2018]).
- The future of fog is uncertain because system feedbacks and their response to climate change are not well characterized. Fog can be intercepted by coastal zone flora (which obtain up to one-third of their moisture from fog) and can also prevent low stream flows, which can keep salmonids from desiccating during dry periods.
- Periodic El Niño events dominate coastal hazards across the Central Coast while atmospheric rivers, expected to increase, are the dominant drivers of locally extreme rainfall events.
- Recently observed and projected acceleration in sea-level rise poses a significant threat to the regions' coastal communities. Future flooding is also a serious concern.

- Estuarine systems will be affected by accelerated sea-level rise, warming of water and air, ocean acidification, and changes in runoff. Some Central Coast marshes may drown or become shallow mudflats, leading to a loss of the ecosystem services that marshes provide, including carbon sequestration.
- Many beaches will narrow considerably. As many as two-thirds will be completely lost over the next century, along with the ecosystems supported by those beaches. The landward erosion of beaches will be driven by accelerating sea-level rise combined with a lack of ample sediment, effectively drowning the beaches between the rising ocean and the backing cliffs and/or urban hardscape.
- Projected future droughts are likely to be a serious challenge to the region's already stressed water supplies.
- Water supply shortages, already common during drought, will be exacerbated. Higher temperatures may result in increases in water demand for agriculture and landscaping. Reduced surface water will lead to increases in groundwater extractions that may result in increased saltwater intrusion (also known as seawater intrusion). Lower surface flows will lead to higher pollutant concentrations and will impact aquatic species.
- Frequent and sometimes large wildfires will continue to be a major disturbance and post-fire recovery time may be lengthened.
- Central Coast native plants are a large part of the world's floristic provinces. Plant species' responses to climate change will in general depend on the climate in which a population evolved and its own unique climate tolerances. Coastal shrubland resilience depends on climate effects to physiological responses that are modified by biotic interactions and the extent of anthropogenic land use. Grasslands closer to the coast will be less affected than interior grasslands where warming is already documented.
- Climate change outcomes for forests will depend largely on multiple abiotic drivers (increased air temperatures, altered fog patterns, changes in winter precipitation), and biotic factors (invasive species and insect and pest outbreaks).
- Terrestrial wildlife is already experiencing local extinctions. Species may have robust climate refugia in the region's mountains characterized by cooler temperatures and higher levels of precipitation.
- The aquatic life of streams and rivers is threatened by projected extreme swings from drought to floods, and exacerbated by fire and erosion that buries habitat in sediments. Climate impacts can threaten the survival of already endangered steelhead and coho salmon, and further reduce the diversity and abundance of sensitive aquatic insects.
- Impacts to the region's public health include increases in heat-related illnesses for agricultural workers, harmful particulate matter from wildfires, and an increase in ground-level O₃. Infectious/vector-borne diseases such as Valley Fever and Pacific Coast tick fever are expected to increase, and an increase in harmful algal blooms will have detrimental effects on animals and people exposed to toxins released from the algae.
- Residential electricity demand is likely to be affected by more frequent heat waves due to increases in cooling requirements, and warming temperatures are likely to affect electricity supply from gas-fired plants.
- Agricultural production is highly sensitive to climate change, including amounts, forms, and distribution of precipitation, changes in temperatures, and increased frequency and intensity of climate extremes.

Average annual air temperature in California has increased through the 20th century with the rate of increase accelerating since the 1980s (OEHHA 2018). Air temperature projections for the 21st century show continued increases from 2 to 4 °C in the San Francisco Bay Area (Flint and Flint 2012). The increase in minimum (nighttime) temperatures have increased at a faster rate than maximum (daytime) temperatures. Since air temperature is the major determining factor for water temperature, temperature of aquatic systems is likely to show similar trends. The ability of aquatic species to persist in presently occupied habitats will depend on the rate of increase and the ability of the species to adapt to changing conditions.

7.1.2 Building Climate Change into Water Supply Planning

Prior to approximately 2013, water supply planning and the estimation of future water shortages for the City of Santa Cruz (City) was based on the 73 years of hydrologic record available for the Santa Cruz region. Using temperature and precipitation data and resulting hydrology from the past 73 years, the City used available tools and experience to predict future conditions. While this approach allowed the City to simulate longer droughts by synthetically creating time-sequences of dry periods, it was not capable of incorporating more severe droughts in terms of dryer, warmer climates.

Ongoing studies including evaluations of paleoclimate records and future climate model projections indicate that longer-term drought conditions have occurred in the past and are likely to occur again. Additionally, the 73-year period of record is characterized by rainfall patterns well above long-term averages and therefore the worst droughts reflected in the past 73 years likely understate future conditions.

The incorporation of climate change into water supply planning began during the Water Supply Advisory Committee (WSAC) process. A goal of the WSAC was to develop a supply augmentation work plan that was adaptable to future climate conditions (WSAC 2015). Through the supply planning work of the WSAC and the initial development of the pending Anadromous Salmonid Habitat Conservation Plan (ASHCP), the City focused on a worst-case climate change dataset, which for the Cal-Adapt datasets is the downscaled Geophysical Fluid Dynamics Laboratory Coupled Model (GFDL2.1 or CMIP3) for the A2 emissions scenario (see Section 7.1.3, Climate Change Modeling, for additional information). It should be noted that the Cal-Adapt program was just getting up and running at that time to help state agencies respond to climate change.

The experiences and insights of the WSAC technical team have shown that the City's current supply system is vulnerable to future climate conditions projected in this region. By relying on local sources that are dominated by surface water and limited by a single reservoir, the City water system is vulnerable to any combination of conditions that result in drier or warmer climate, more intense rainfall over shorter periods of time, etc., which will likely result in significant impacts to the City's ability to meet demands.

After completion of the WSAC process, the City continued the evaluation of supply reliability under climate change conditions with additional model scenarios including but not limited to the use of the Coupled Model Intercomparison Project 5 (CMIP5) data set. An objective of this work is to understand the reasonable boundaries of future climate conditions with respect to timing, duration, and depth of supply deficits. The findings, whereas different in terms of magnitude of shortage and reliability of existing supplies among the scenarios, all conclude that the City's current water supply situation is inadequate for meeting the longer-term challenges of climate change.

To respond to a future that includes drier and warmer conditions, the degree to which we cannot accurately predict, the City is doing two things:

1. Framed by the WSAC findings, the City is considering water supply alternatives that can be implemented incrementally to meet a future climate that is unknown. Aquifer storage and recovery (ASR) facilities for example can be constructed incrementally to meet demands. If and when surface water sources decline and can no longer meet the needs of a groundwater replenishment system, recycled water or seawater desalination may also be needed (see Section 3.2.1, Water Supply Planning Background, for a description of the City's Water Supply Augmentation Strategy).
2. Adopting a new approach to assessing the vulnerability of our system in future work that incorporates an exhaustive exploration of future conditions to stress test the water system. What is expected to come from this analysis is a better understanding of the capabilities of the current system to meet future climate conditions, and under what conditions the current system begins to break down.

7.1.3 Climate Change Modeling

As described in Chapter 3, Project Description, to both develop and analyze the Proposed Project presented in this EIR, the City has utilized a modeling system comprised of a hydrologic model, a water supply model, and a biological effects model. Together, these tools have allowed the City to understand the potential effects of Proposed Project features on both water supply availability and anadromous fisheries. Improved understanding of potential effects allowed for refinements in the Proposed Project that are reflected in Chapter 3, Project Description, to maximize available water supply while protecting local anadromous fisheries. The same modeling tools were utilized during development of the Agreed Flows and WSAC Water Supply Augmentation Strategy, providing for consistency and stability across planning efforts.

Given the potential implications of climate change on the City's water supply, climate change modeling reported here includes scenarios using the historical hydrologic record (1937 to 2015) (historic hydrology) and a climate change hydrologic record (2020 to 2070) (climate change hydrology). Specifically, three different climate change projections that represent plausible future conditions for the Santa Cruz region were analyzed and included precipitation, minimum air temperature and maximum air temperature. Values for each of these three climate parameters represent spatial averages over model grid cells which contribute runoff to the Big Trees gaging station on the San Lorenzo River. Projection 1 (CMIP3) reflects dry and warm conditions, but generally lacks year to year rainfall variability, a climate attribute that is expected for Central California during the climate change projection period. Projection 2 (CMIP5) reflects more variable conditions in terms of precipitation, but air temperatures are generally cool. Projection 3 (climate catalog approach developed as part of the Santa Cruz Mid-County Groundwater Basin Groundwater Sustainability Plan) is similar to Projection 1, but with greater proportion of winter months that are wet and warm.

Projection 1 (CMIP3) was used during the WSAC process. Projection 2 (CMIP5) was used for the Proposed Project and represents a statistical combination of four different climate projections of precipitation, minimum air temperature and maximum air temperature. Using a combination of more than one climate projection is advantageous because it helps to mediate risks associated with, in particular, future uncertainty of year-to-year precipitation patterns and magnitudes. By comparison, an evaluation of 10 different climate projections for the Santa Cruz region at the Cal-Adapt website reveals ten distinctly different future plausible conditions. Use of Projection 2 reduces the risks of relying on any one climate projection and supports more informed decisions. (As an aside, Projection 3 was considered during the development of the Proposed Project from the standpoint of understanding water supply impacts with greater proportion of winter months that are wet and warm as represented in Projection 3. However, because the resulting water supply gap was similar to that projected using Projection 2, Projection 2 remained the scenario around which the Proposed Project was developed.)

Where relevant, Chapter 4 refers to modeling results using the historical hydrologic record. This chapter refers to modeling results using the climate change hydrologic record (2020 to 2070), where relevant to the analysis. See Section 3.5, Proposed Project Modeling, for additional information about the modeling of the Proposed Project and Appendix D for hydrologic, water supply, and fisheries habitat modeling of the effects of the proposed water rights modifications based on the reasonably foreseeable operations of the City's water system.

7.1.4 Proposed Project Implementation with Climate Change

With some exceptions explained below, key modeling assumptions reflecting City water-system operations for the 2018 baseline and the Proposed Project are the same for the modeling conducted based on the historic hydrology and for the modeling conducted based on climate change hydrology. Specifically, water demand, water rights, bypass flow requirements, infrastructure assumptions, and operational constraints remain consistent for Proposed Project modeling with the historical hydrologic record or climate change hydrologic record.

Chapter 3, Project Description, indicates that ASR would have a total proposed injection infrastructure capacity of 4.5 million gallons per day (mgd) and a proposed extraction infrastructure capacity of 8.0 mgd, which is defined to meet the agreed-upon worst-year gap of 1.2 billion gallons per year and based on the water supply modeling using historic hydrology provided in Appendix D. Based on the results of the climate change modeling in Appendix D, it is possible that ASR injection and extraction capacities needed to achieve the same water supply reliability goal for the Proposed Project under climate change conditions could be greater for injection capacity and less for extraction capacity (i.e., 6.0 mgd and 7.0 mgd, respectively). Likewise, peak diversions could also be greater at times to provide for potentially larger ASR injection capacity. Other elements of the Proposed Project would remain unchanged based on the climate change modeling.

The City will continue to refine its water supply planning over time in response to ongoing assessments of the vulnerability of the system under future climate conditions. Such refinements could modify the approach to implementing the Proposed Project and/or lead to the pursuit of additional water supply options as defined in the City's Water Supply Augmentation Strategy (see Section 3.2.1, Water Supply Planning Background, for a description of the City's Water Supply Augmentation Strategy).

7.2 Environmental Analysis

7.2.1 Impacts Not Found to be Significant

Section 4.1, Impacts Not Found to be Significant, indicates that issues related to aesthetics, population and housing, and public services were found not to be significant for the project and programmatic components of the Proposed Project. Given that the same number and type of project and programmatic infrastructure components would be needed for the Proposed Project, impacts related to aesthetics would also be less than significant under climate change conditions. No impacts related to population and housing would result under climate change conditions as the project and programmatic infrastructure components would not displace existing people or housing and would not require the construction of replacement housing elsewhere. Additionally, impacts related to public services would also be less than significant under climate change conditions, as the Proposed Project would not include any new land uses that would generate a substantial new demand for public services that would require new or physically altered public service facilities to meet acceptable performance objectives. There are no climate change conditions that would modify the reported conclusions presented in Section 4.1.

7.2.2 Air Quality

While the impacts of climate change on the region's public health include increases in harmful particulate matter from wildfires and an increase in ground-level ozone as described in Section 7.1.1, Potential Effects of Climate Change, the Proposed Project would not increase these risks. The less-than-significant impacts identified and evaluated in Section 4.2, Air Quality (Impacts AIR-1 through AIR-5), are due to construction emissions associated with the project and programmatic infrastructure components. Limited operational emissions from the Proposed Project were also identified related to vehicle trips primarily associated with routine inspection and maintenance activities at infrastructure locations by City staff. Given that the same number and type of project and programmatic infrastructure components would be needed for the Proposed Project, the impacts would be the same under climate change conditions, as reported in Section 4.2. There are no climate change conditions that would modify the reported conclusions presented in Section 4.2.

7.2.3 Biological Resources

7.2.3.1 Operational Impacts on Special-Status Fish

Effects of projected hydrology with climate change are evaluated for several special-status fish species below. In general, the climate change scenario used in this analysis has greater variability than the historic hydrology and results in higher flows during wet and normal years compared to the historic hydrology and lower flows during dry and critical years. Other changes anticipated under climate change include sea-level rise, which is likely to significantly alter lagoon conditions, and temperature increases (see Section 7.2.8, Hydrology and Water Quality). These changes, however, are unrelated to City operations and will occur regardless of the Proposed Project. The following analysis only considers the effects of the Proposed Project in relation to the 2018 baseline under climate change hydrology. The impacts presented are in comparison to those presented for historic hydrology in Impact BIO-1A (see Section 4.3, Biological Resources). There are no climate change conditions that would modify the reported conclusions presented in Section 4.3, Biological Resources.

Tidewater Goby

Analysis of the Proposed Project's effects on Tidewater goby presented in Section 4.3, Biological Resources, indicates that changes in inflow to the San Lorenzo River lagoon are not of sufficient magnitude to result in a substantial adverse effect on tidewater goby in the lagoon under historical hydrological conditions. Under projected climate change hydrology, the Proposed Project's effects compared to the baseline are similar to historical hydrology. Hydrologic modeling results for residual flow below the Tait Diversion (see Appendix D) indicate that the water rights modifications would result in some reduction in inflows to the San Lorenzo River lagoon with the greatest effect in wet and normal years when inflows are relatively high. The largest changes are a 7.2% reduction in average lagoon inflows in spring (April through June) of normal years, and a 7.4% reduction in average inflows in summer (July through September) of wet years (Table 7-1). Changes in dry and critical years range from an increase in average lagoon inflow of 0.8% in spring of critically dry years to a 1.2% decrease in summer of dry years. The lagoon is generally open in the winter (October through March) with relatively high inflow so changes during this period have little influence on habitat for gobies. Generally, the San Lorenzo River lagoon does not close for any extended period (more than a few days) until inflows drop to between 18 cubic feet per second (cfs) and 24 cfs or less (HES 2010 - 2019). Reduced inflow to the San Lorenzo River lagoon in spring of wet, normal, and dry years does not bring flows into the range where the mouth is likely to close so there would not likely be effects on gobies due to change in lagoon closure timing or extent. The magnitude of the reduction at these times is likely too small to affect goby habitat. Average flow reductions in summer of all year types and increase in spring of critical years are also small and not likely to substantially affect habitat conditions or lagoon closure timing. Changes in inflow to the San Lorenzo River lagoon are not of sufficient magnitude to result in a substantial adverse effect on tidewater goby in this lagoon.

Hydrologic model output indicates that inflow to Laguna Creek lagoon would increase with the Proposed Project in spring of normal and wet years and would decrease slightly in winter in dry and critical years. Changes at other times would be insignificant (less than 0.5%). Much of the increase in spring is related to the provision of bypass flows for adult migration in April, as part of the Agreed Flows. The increase in lagoon inflow may result in later closure of the lagoon in spring of wetter years; however, this condition is closer to the natural streamflow pattern that would occur with no City diversion. Change in inflow to the Laguna Creek lagoon under the Proposed Project would not result in a substantial adverse effect on tidewater goby in this lagoon.

Given the above considerations and under a climate change scenario, the Proposed Project would not result in a substantial adverse effect on tidewater goby, cause goby population to drop below self-sustaining levels, or threaten

to eliminate or substantially reduce the number or restrict the range of goby. Therefore, the water rights modification component would have a less-than-significant impact on tidewater goby under a climate change hydrologic scenario.

Table 7-1. Average Inflow to the San Lorenzo River and Laguna Creek Lagoons under Climate Change Hydrology (cfs)

Season	Year Type	San Lorenzo River Lagoon		Laguna Creek Lagoon	
		<i>Baseline</i>	<i>Proposed Project</i>	<i>Baseline</i>	<i>Proposed Project</i>
Spring	Wet	344.7	333.3	11.9	12.8
	Normal	86.2	80.0	3.3	4.1
	Dry	10.6	10.5	0.9	0.9
	Critical	9.5	9.5	0.8	0.8
Summer	Wet	73.3	67.9	2.7	2.7
	Normal	17.4	16.4	1.3	1.3
	Dry	7.3	7.3	0.5	0.5
	Critical	5.7	5.7	0.4	0.4

Note: cfs = cubic feet per second.

Pacific Lamprey

Analysis of the Proposed Project's impacts on Pacific lamprey indicates that changes in flows in the San Lorenzo River are not of sufficient magnitude to result in adverse effects on Pacific lamprey either as rearing juveniles or migrating adults or juveniles under historical hydrological conditions. Pacific lamprey have not been reported from the North Coast streams (Liddell, Laguna, and Majors Creeks). Pacific lamprey may use the reach between the Felton Diversion and the Tait Diversion, and the reach downstream of the Tait Diversion for migration, spawning, and rearing. With climate change hydrology, the flows between the Felton Diversion and the Tait Diversion would be very similar under the 2018 baseline and Proposed Project conditions (Table 7-2). Flows downstream of the Tait Diversion would be slightly lower with the Proposed Project at higher flows (10% to 60% exceedance) but very similar at lower flows (70% to 100% exceedance) (Table 7-3). Flow changes of this magnitude would not be likely to significantly affect lamprey migration, spawning, or rearing.

Table 7-2. Daily Flow Exceedance Frequency Downstream of Felton Diversion under Climate Change Hydrology (cfs)

Percentile	Baseline	Proposed Project
10%	407.2	407.3
20%	179.9	179.9
30%	87.6	86.8
40%	47.5	47.6
50%	29.3	31.6
60%	21.3	21.6
70%	15.9	15.9
80%	11.1	11.1
90%	7.9	7.9
100%	3.6	3.6

Note: cfs = cubic feet per second.

Table 7-3. Daily Flow Exceedance Frequency Downstream of Tait Diversion under Climate Change Hydrology (cfs)

Percentile	Baseline	Proposed Project
10%	452.1	441.1
20%	197.3	188.4
30%	92.7	85.7
40%	46.1	40.4
50%	25.9	25.7
60%	17.1	14.8
70%	11.6	10.5
80%	8.5	8.5
90%	8.3	8.3
100%	3.6	3.6

Note: cfs = cubic feet per second.

Given the small differences in flows between the baseline and Proposed Project under climate change hydrology, the Proposed Project would not likely have a substantial adverse effect on Pacific lamprey, cause lamprey populations to drop below self-sustaining levels, or threaten to eliminate or substantially reduce the number or restrict the range of lamprey. Therefore, the Proposed Project would have a less-than-significant impact on Pacific lamprey.

Monterey Roach

Analysis of the Proposed Project's effects presented in Section 4.3, Biological Resources, concluded that the relatively small flow differences under the Proposed Project and historical hydrology would not likely have a significant effect on Monterey roach. Similarly, differences in flow between the 2018 baseline and the Proposed Project under projected climate change conditions are also small (Table 7-2, Table 7-3). Roach are tolerant of a range of environmental conditions. The relatively small flow changes under the Proposed Project with climate change hydrology would not likely have a substantial adverse effect on Monterey roach, cause roach populations to drop below self-sustaining levels, or threaten to eliminate or substantially reduce the number or restrict the range of roach. Therefore, the Proposed Project would have a less-than-significant impact on Monterey roach.

Steelhead and Coho

Habitat Effects of Proposed Project

Habitat modeling was conducted to evaluate effects of the Proposed Project on steelhead and coho as compared to 2018 baseline conditions under projected climate change conditions (Appendix D-3). The Proposed Project was defined the same as for analysis of historical hydrology (Section 4.3, Biological Resources, Analytical Methods and Appendix D-3). Table 7-4 provides a summary of the habitat effects of the Proposed Project for steelhead and coho life stages in each of the stream reaches influenced by City diversions, based on projected climate change conditions for the region. Changes in habitat indices of less than 2% are well within the inherent statistical error in the habitat models and are not considered biologically significant or "substantial" under CEQA standards of significance. Changes greater than 2% may also be biologically insignificant or not significant under CEQA standards of significance but changes at this level are discussed in more detail.

Table 7-4. Listed Fish Habitat Effects of the Proposed Project Compared to Baseline under Climate Change Hydrology

Stream Reach	Year Type	Steelhead				Coho			
		Adult migration (m)	Spawning/incubation (i)	Rearing (r)	Smolt migration (s)	Adult migration (m)	Spawning/incubation (i)	Rearing (r)	Smolt migration (s)
Laguna Anadromous	Wet	9.4%	3.3%	○	○	○	+	-2.9%	○
	Normal	12.3%	6.5%	○	○	○	+	-2.0%	○
	Dry	○	-	○	○	○	+	○	○
	Critically dry	○	-	○	○	○	+	○	○
Liddell Anadromous	Wet	8.2%	4.7%	-	○				
	Normal	8.0%	2.0%	○	○				
	Dry	○	○	-	○				
	Critically dry	○	○	-	○				
Majors Anadromous	Wet	○	+	-	○				
	Normal	○	+	○	○				
	Dry	○	○	○	○				
	Critically dry	○	○	○	○				
San Lorenzo below Tait Street	Wet	○		-	○	○			○
	Normal	○		-	○	○			○
	Dry	4.0%		-	-4.0%	○			-4.0%
	Critically dry	7.1%		-	○	3.2%			○
San Lorenzo below Felton	Wet	+	2.5%	○	○	4.3%	-	-	○
	Normal	7.4%	5.9%	-	○	13.0%	+	-	○
	Dry	42.5%	28.6%	○	○	29.4%	2.7%	○	○
	Critically dry	48.4%	22.5%	○	○	32.0%	2.5%	○	○
Newell Anadromous	Wet	4.9%	2.1%	○	2.9%	24.5%	+	-	2.9%
	Normal	7.3%	6.2%	+	6.2%	○	9.5%	+	6.2%
	Dry	○	17.2%	7.6%	○	○	35.7%	+	○
	Critically dry	○	10.7%	8.3%	○	○	18.1%	+	○

Source: Appendix D-3 (Hagar Environmental Science 2020).

Notes: - = <2% decrease in habitat index; + = <2% increase in habitat index; ○ = no change in habitat index or change of 1 day or less in migration periods.

Values for coho spawning and rearing below Felton (**bold italic**) based on change in flow rather than habitat indices.

The results for climate change hydrology have similar patterns to the results for historical hydrology. The majority of effects of the Proposed Project involve an improvement in habitat conditions for steelhead and coho compared to the baseline (Table 7-4). Negative effects are limited to coho rearing in Laguna Creek in normal and wet years and smolt migration in the San Lorenzo River downstream of the Tait Diversion in dry years. The decrease in habitat value for rearing coho is due to increases in flow during April for adult migration. Optimal conditions for coho rearing occur at lower flow than required for adult migration. This minor effect on rearing habitat is not likely to be biologically meaningful and would not be considered “substantial” under CEQA standards of significance. Specifically, a change of this magnitude in the rearing index would not substantially reduce the habitat of coho salmon, interfere substantially with the movement or migration of coho, cause the coho population to drop below self-sustaining levels, threaten to eliminate coho in Laguna Creek, or substantially reduce the number or restrict the range of coho.

The smolt index downstream of the Tait Diversion is decreased in dry years with the Proposed Project and climate change due to modification of the smolt bypass flows during very dry conditions (see Appendix C). The increased capacity at the Tait Diversion under the Proposed Project results in more frequent flows below the smolt threshold on the four days per week when smolt bypass flows are not required. There would still be a relatively large number of days (about 120 out of 150 possible) when conditions are suitable for smolt migration under the Proposed Project. This would be a minor effect on smolt migration that is unlikely to have biological significance. It would not be considered a “substantial effect” under CEQA standards of significance. Specifically, a change of this magnitude in the smolt index would not substantially reduce the habitat of coho, interfere substantially with the movement or migration of coho, cause the coho population to drop below self-sustaining levels, threaten to eliminate coho in Laguna Creek, or substantially reduce the number or restrict the range of coho.

Habitat modeling indicates that, although there are isolated instances of minor effects to some life stages in some reaches relative to the baseline, the Proposed Project would result in a net beneficial effect on both species under climate change hydrology as it would under historic hydrology (see Table 7-4). Based on climate change hydrology, the habitat modeling indicates that the Proposed Project would not have a substantial adverse effect on habitat indices for steelhead or coho, interfere substantially with migration of steelhead or coho, cause steelhead or coho population to drop below self-sustaining levels, threaten to eliminate steelhead or coho, or substantially reduce the number or restrict the range of steelhead or coho. Therefore, the Proposed Project would have a less-than-significant impact on steelhead and coho habitat. There are no climate change conditions that would modify the reported operational impact conclusions in Section 4.3, Biological Resources, for Impacts BIO-1A.

Water Temperature Effects of Proposed Project

As described in Appendix D-3, steelhead are generally expected to survive and grow well at temperatures up to about 19°C to 21°C if food is abundant, but at temperatures in excess of 21°C, mortality is expected to increase. Temperatures of 25°C to 26°C are generally considered lethal for steelhead. Coho require cooler temperature than steelhead. As indicated in Appendix D-3 and Section 4.3, Biological Resources, operation of the Loch Lomond Reservoir (reservoir spill and the existing required 1 cfs fish release) is the only City activity associated with the Proposed Project that has the potential to influence water temperatures.

Average annual air temperature in California has increased through the 20th century with the rate of increase accelerating since the 1980s (OEHHA 2018). Air temperature projections for the 21st century show continued increases from 2 to 4°C in the San Francisco Bay Area (Flint and Flint 2012). The increase in minimum (nighttime) temperatures have increased at a faster rate than maximum (daytime) temperatures. Since air temperature is the major determining factor for water temperature, temperature of aquatic systems is likely to show similar trends.

The ability of aquatic species to persist in presently occupied habitats will depend on the rate of increase and the ability of the species to adapt to changing conditions.

The Santa Cruz mountains currently represent the southern margin for the range of coho with temperature and associated habitat features (redwood forest) being a major determinant, if not the major determining factor, in the extent of their range. Coho do not presently maintain viable populations in the San Lorenzo River and its tributaries in the southern part of Santa Cruz County where the City has its water supply operations. Water temperature in many of the streams in Santa Cruz County are presently at or near the level limiting coho persistence (City of Santa Cruz 2021) and may partially explain why coho are no longer present. Increasing temperatures will only exacerbate these effects. Steelhead have slightly greater tolerance of high temperature than coho but they are also near the southern edge of their present range and, at least in the San Lorenzo River, near their upper thermal tolerance range.

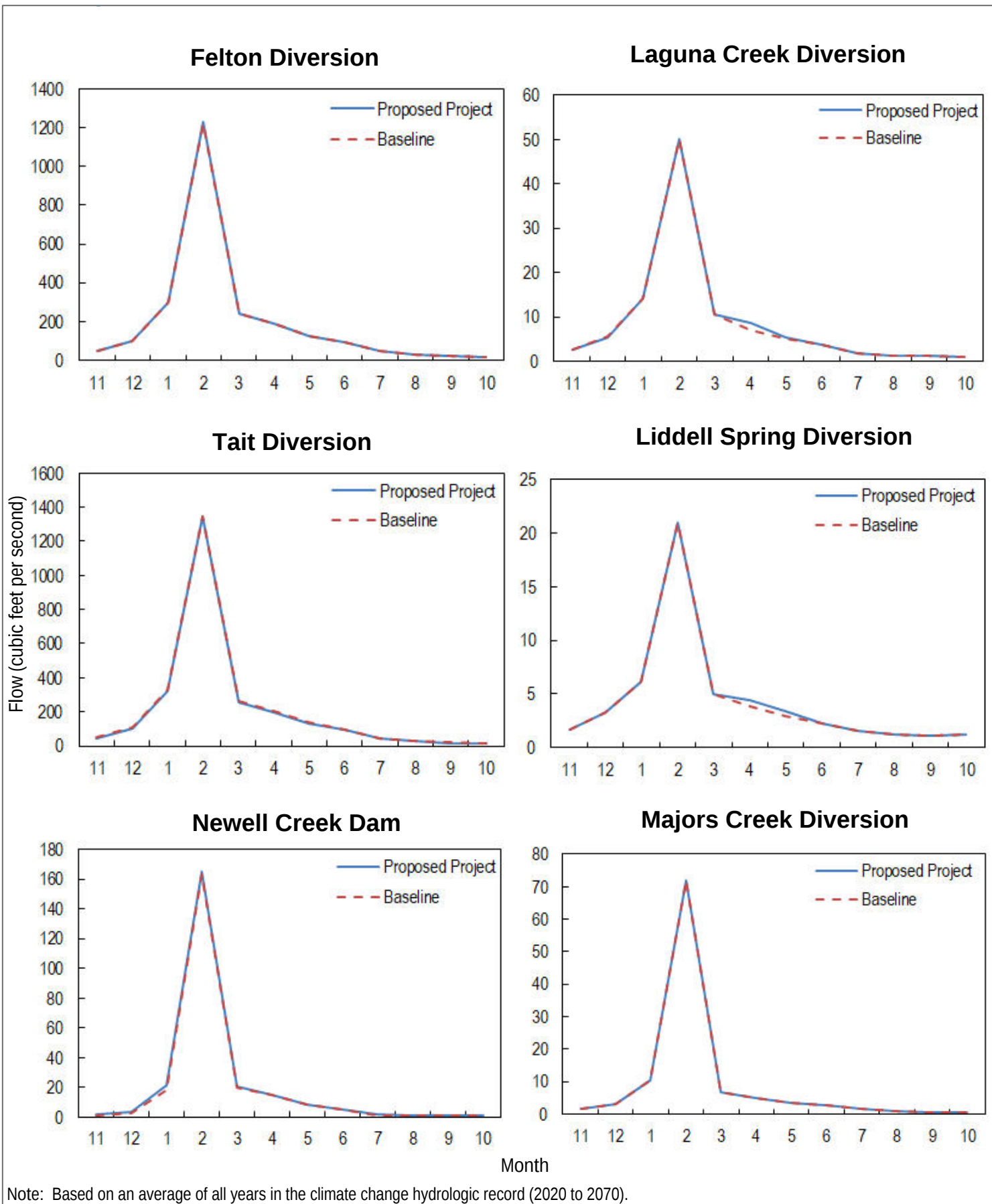
These effects are unrelated to and will occur regardless of the Proposed Project. However, there may be synergies between aspects of the Proposed Project and climate change that have an effect on steelhead or coho. With the Proposed Project, storage in Loch Lomond Reservoir is predicted to be high with greater frequency than under the baseline, with the result that spill from the reservoir would be more frequent with the Proposed Project (see Section 7.2.8, Hydrology and Water Quality [Table 7-5]). This could benefit steelhead and coho during the adult migration, spawning, and smolt migration life-stages, though the increase in spill frequency is relatively small.

At times when the reservoir is spilling and the existing 1 cfs fish release is not sufficient to maintain temperature in Newell Creek below 21°C, Operational Practice #6 presented in Chapter 3, Project Description, requires the City to release additional flow through the fish release to achieve a maximum instantaneous temperature of less than 21°C as measured in the anadromous reach of Newell Creek and verified at the City stream gage in Newell Creek below the dam. With the implementation of this operational practice, potential adverse temperature effects in Newell Creek and the San Lorenzo River due to an increase in spill frequency with the Proposed Project would be avoided. As a result, the Proposed Project would not substantially reduce the habitat of coho and steelhead, or otherwise substantially reduce the number or restrict the range of these species. Therefore, the Proposed Project would have a less-than-significant impact on steelhead and coho habitat. There are no climate change conditions that would modify the reported operational impact conclusions in Section 4.3, Biological Resources, for Impact BIO-1A.

7.2.3.2 Operational Impacts on Other Special-Status Species and Habitats

Operational impacts of the water rights modifications to habitat for riparian-dependent special-status wildlife and plant species (Impacts BIO-1B and BIO-1C), riparian and sensitive vegetation communities (Impact BIO-2), jurisdictional aquatic resources (Impact BIO-3), and wildlife movement (Impact BIO-4) could potentially result if there are substantial alterations in residual flows and associated water levels in the San Lorenzo River, Newell Creek, and the North Coast streams.

The difference in residual flows with Proposed Project operations would be minimal relative to 2018 baseline conditions, based on climate change hydrology (see Figure 7-1). This conclusion is similar to that for the Proposed Project based on historic hydrology. As residual flows would not be substantially altered with climate change hydrology, operational impacts to riparian-dependent special-status wildlife and plant species, riparian and sensitive vegetation communities, jurisdictional aquatic resources, and wildlife movement would also be less than significant. There are no climate change conditions that would modify the reported operational impact conclusions in Section 4.3, Biological Resources, for Impacts BIO-1 through BIO-5.



SOURCE: Gary Fiske and Associates 2021

FIGURE 7-1

Average Monthly Residual Flows Under Climate Change Conditions

Santa Cruz Water Rights Project

7.2.3.3 Construction Impacts

Given that the same number and type of project and programmatic infrastructure components would be needed for the Proposed Project, construction impacts would be the same under climate change conditions, as reported in Section 4.3, Biological Resources. There are no climate change conditions that would modify the reported construction impact conclusions in Section 4.3 for Impacts BIO-1 through BIO-5 or required mitigation measures (MM BIO-1 through MM BIO-14).

7.2.4 Cultural Resources

All less-than-significant or potentially significant impacts identified and evaluated in Section 4.4, Cultural Resources and Tribal Cultural Resources, are due to construction of project and programmatic infrastructure components. Given that the same number and type of project and programmatic infrastructure components would be needed for the Proposed Project, the impacts would be the same under climate change conditions. There are no climate change conditions that would modify the reported impact conclusions presented in Section 4.4 for Impacts CUL-1 through CUL-4 or required mitigation measures (MM CUL-1 and MM CUL-2).

7.2.5 Geology and Soils

All less-than-significant or potentially significant impacts identified and evaluated in Section 4.5, Geology and Soils, are due to construction and operation of project and programmatic infrastructure components. Given that the same number and type of project and programmatic infrastructure components would be needed for the Proposed Project, the impacts would be the same or the similar under climate change conditions, as reported in Section 4.5 for Impacts GEO-1 through GEO-6.

Impact GEO-2 indicates that if ASR operations were to raise water elevations to within 40 feet of the ground surface and the soils are prone to liquefaction (as illustrated in Figure 4.5-3), liquefaction would potentially occur due to the operation of new ASR facilities. ASR-induced liquefaction could result in damage to existing overlying structures and infrastructure, including utilities. As a result, Section 4.5, Geology and Soils indicates that this programmatic component would potentially cause substantial adverse effects, including the risk of loss, injury, or death resulting from liquefaction and associated lateral spreading and impacts would be potentially significant, but could be reduced to a less-than-significant level with the implementation of an identified mitigation measure (MM GEO-1).

As indicated in Section 7.1.1, Potential Effects of Climate Change, it is possible that groundwater levels could decrease with climate change as surface water supply shortages, already common during drought, will be exacerbated, which could lead to increases in groundwater extractions and associated decreases in groundwater levels (CNRA 2018). However, such effects are not necessarily anticipated with the implementation of the Santa Cruz Mid-County Groundwater Sustainability Plan (GSP) and the pending Santa Margarita GSP, which will guide ongoing management of the groundwater basins with a goal to achieve and maintain the sustainability goals of both basins within 20 years (see Section 7.2.8, Hydrology and Water Quality, for additional information). (ASR in the Santa Margarita Groundwater Basin is a programmatic element of the Proposed Project and would not be implemented in that basin until after that basin's GSP is adopted.) Regardless, to be conservative, the impact of the Proposed Project associated with ASR-induced liquefaction under climate change conditions would be still be considered potentially significant, and could be reduced to a less-than-significant level with the implementation of the same identified mitigation measure in Section 4.5, Geology and Soils. Therefore, there are no climate change conditions that would modify the reported impact conclusions presented in Section 4.5 or required mitigation measures (MM GEO-1 and MM GEO-2).

7.2.6 Greenhouse Gas Emissions

All less-than-significant impacts identified and evaluated in Section 4.6, Greenhouse Gas Emissions, are due to construction and operation of project and programmatic infrastructure components. Given that the same number and type of project and programmatic infrastructure components would be needed for the Proposed Project, the impacts would be the same or the similar under climate change conditions, as reported in Section 4.6 for Impacts GHG-1 through GHG-3.

As indicated in Section 7.1.4, Proposed Project Implementation with Climate Change, it is possible that ASR injection and extraction capacities needed to achieve the same water supply reliability goal for the Proposed Project under climate change conditions could be greater for injection capacity and less for extraction capacity (i.e., 6.0 mgd and 7.0 mgd, respectively), based on the results of the climate change modeling presented in Appendix D. If that were the case, electrical energy use would increase by approximately 2% over that estimated in Section 4.6, Greenhouse Gas Emissions, and Appendix E. This increase in energy use would result in a negligible increase in GHG emissions of approximately 3 metric tons of carbon dioxide equivalent (MT CO_{2e}), and therefore the Proposed Project under climate change conditions would also not exceed the applied threshold of 900 MT CO_{2e} per year, as indicated in Impact GHG-1.

GHG emissions from water bodies such as the Loch Lomond Reservoir and coastal lagoons could increase if water temperatures were to increase and worsen eutrophication (Havens 2021).¹ As indicated in Section 7.2.8, Hydrology and Water Quality, the Proposed Project would result in greater storage in Loch Lomond Reservoir under climate change conditions, as would also be the case for historic hydrologic conditions reported in Section 4.8, Hydrology and Water Quality. Therefore, given this greater storage, the Proposed Project would not cause increases in reservoir water temperatures as could result from a drop in reservoir levels. However, increasing air temperatures resulting from climate change could increase water temperatures in the reservoir regardless of the Proposed Project. Given that Loch Lomond Reservoir is maintained for water supply it is treated with chemicals (i.e., copper and hydrogen peroxide) to prevent eutrophication under a permit from Regional Water Quality Control Board for using aquatic pesticides. Therefore, regardless of the Proposed Project, climate change conditions would not result in an increase in GHG emissions from Loch Lomond Reservoir due to eutrophication.

Additionally, as indicated in Section 7.2.3, Biological Resources (Table 7-1), the average inflow into the San Lorenzo River and Laguna Creek lagoons would not be substantially altered with the Proposed Project during wet and normal conditions and would not be altered at all during dry and critical conditions. Therefore, the Proposed Project would not contribute to increased lagoon water temperature and as such would not exacerbate any existing eutrophication processes in coastal lagoons causing an increase in GHG emissions. See Section 7.2.8, Hydrology and Water Quality, for additional information about climate change effects on coastal lagoons. Overall, there are no climate change conditions that would modify the reported impact conclusions presented in Section 4.6.

7.2.7 Hazards, Hazardous Materials, and Wildfire

The less-than-significant or potentially significant impacts identified and evaluated in Section 4.7, Hazards, Hazardous Materials, and Wildfire, are due to construction of project and programmatic infrastructure components. Given that the same number and type of project and programmatic infrastructure components

¹ Eutrophication occurs when the amounts of nutrients such as nitrogen and phosphorus increase in lakes, estuaries, and other ecosystems, and those ecosystems respond with increased growth of plants and algae.

would be needed for the Proposed Project, the impacts would be the same or similar under climate change conditions, as reported in Section 4.7 (Impacts HAZ-1 through HAZ-5).

While frequent and sometimes large wildfires will continue to be a major disturbance in the Central Coast region and post-fire recovery time may be lengthened under climate change conditions, the known infrastructure component sites are not located in a state responsibility area (SRA) and are not located in an area designated as a very high fire hazard severity zone (FHSZ). However, up to four new ASR facilities may be constructed on lands that encompass lands within the SRA but would not be located in an area designated as a very high FHSZ. Construction and operation of the Proposed Project would not exacerbate wildfire risks or include habitable structures that could expose people or structures to wildfire. There are no climate change conditions that would modify the reported impact conclusions presented in Section 4.7 or required mitigation measures (MM HAZ-1 and MM HAZ-2).

7.2.8 Hydrology and Water Quality

The less-than-significant or potentially significant impacts identified and evaluated in Section 4.8, Hydrology and Water Quality, are due to construction and operation of project and programmatic components. Given that the same project and programmatic components would be needed for the Proposed Project, the impacts would be the same or similar under climate change conditions, as reported in Section 4.8 (Impacts HYD-1 through HYD-5).

As indicated in Section 7.1.1, Potential Effects of Climate Change, it is possible that groundwater levels could decrease with climate change as surface water supply shortages, already common during drought, will be exacerbated, which could lead to increases in groundwater extractions and associated decreases in groundwater levels and increased seawater intrusion. Lower surface flows could also lead to higher pollutant concentrations (CNRA 2018). However, as indicated in Section 7.1.2, Building Climate Change into Water Supply Planning, a goal of the WSAC was to develop a supply augmentation work plan that was adaptable to future climate conditions to meet demand and avoid the above conditions. Consistent with Elements 1 and 2 of the City's Water Supply Augmentation Strategy, the Proposed Project includes project and programmatic components to provide for ASR and water transfers and exchanges, which are identified projects in the Santa Cruz Mid-County GSP and will contribute sustainability benefits in both the Santa Cruz Mid-County Groundwater Basin and the Santa Margarita Groundwater Basin. ASR involves active recharge of the groundwater basins using existing infrastructure and potential new infrastructure to inject surface water, treated to drinking water standards, and storage of this water during wetter periods in local groundwater basins, which would act as underground storage reservoirs. This stored water can then be available for use by the City in drier periods via extraction. Water transfers and exchanges include passive recharge of regional aquifers by transferring water to other water districts in the area so they can rest their groundwater wells, help the aquifers recover, and potentially store water for use by the City in dry periods. The intent of these approaches is to store water for use during dry periods to limit reliance on surface water and native groundwater during those periods.

As indicated in Impact HYD-2 the Proposed Project overall would not conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan, as ASR and water transfers and exchanges would be completed in compliance with the Santa Cruz Mid-County Groundwater Basin GSP and, when it is adopted, the Santa Margarita Groundwater Basin GSP, as relevant to the potential site locations for new ASR facilities, per Operational Practice #2 (see Chapter 3, Project Description for details of this practice). (ASR in the Santa Margarita Groundwater Basin is a programmatic element of the Proposed Project and would not be implemented in that basin until after that basin's GSP is adopted.) As required by the Sustainable Groundwater Management Act, both of these GSPs include or would include quantifiable minimum thresholds related to groundwater levels, groundwater quality

(including seawater intrusion), surface/groundwater connection, subsidence, and changes in storage, such that undesirable effects would not occur, and groundwater basin sustainability would be maintained. Part of the sustainability goal of the Santa Cruz Mid-County Groundwater Basin GSP is to account for changing groundwater conditions related to projected climate change and sea-level rise in basin planning and management. Model simulations upon which the GSP was based indicate that supplemental water supplies, such as would be provided by the Proposed Project, or groundwater use curtailment is needed to reach and maintain protective groundwater elevations and achieve groundwater sustainability in the face of climate change (MGA 2019). While the Proposed Project could have potentially significant localized groundwater quality or restrictive impacts² on nearby wells associated with Beltz 12 ASR, these impacts could be reduced to less-than-significant levels with identified mitigation measures (MM HYD-1 and MM HYD-2) and climate change conditions would not modify these conclusions.

Impact HYD-3 in Section 4.8, Hydrology and Water Quality, indicates that in the event that stream diversions resulted in a substantial decrease in stream flows or Loch Lomond Reservoir levels, water quality impacts could occur, including increased temperature due to shallower water, and altered salinity, dissolved oxygen, and pH concentrations. Modeling performed for the Proposed Project based on climate change hydrology indicates that the difference in residual flows with the water rights modifications and other elements of the Proposed Project would be minimal relative to 2018 baseline conditions (see Figure 7-1). As indicated in Section 7.2.3, Biological Resources (Table 7-1), the average inflow into the San Lorenzo River and Laguna Creek lagoons would not be substantially altered with the Proposed Project during wet and normal conditions and would not be altered at all during dry and critical conditions. Additionally, the Proposed Project would increase Loch Lomond Reservoir levels as shown in Table 7-5, which indicates that Loch Lomond would spill more frequently compared to baseline conditions, based on an average of all years in the climate change hydrological record (2020 to 2070). Reservoir spilling in late spring and summer can increase water temperatures below the Newell Creek Dam in Newell Creek but the implementation of Operational Practice #6 would offset the potential warming effects of reservoir spills below Newell Creek Dam at that time of the year.

Table 7-5. Percent of Days that Loch Lomond Reservoir Spills under Climate Change Hydrology

Month	Climate Change Hydrology	
	2018 Existing Conditions	Proposed Project Conditions
Jan	28.1%	38.2%
Feb	54.3%	60.4%
Mar	50.9%	53.0%
Apr	53.0%	53.0%
May	52.5%	53.5%
Jun	45.9%	49.9%
Jul	0.0%	30.0%
Aug	0.0%	16.4%
Sep	0.0%	11.6%
Oct	0.0%	1.8%
Nov	2.7%	5.4%
Dec	9.9%	16.8%

Source: Gary Fiske and Associates 2021.

² Demonstrated restrictive effects are defined as damage to the private well or pump caused by groundwater levels falling below the top of the well screens, or diminution of well yield, as further described in Section 4.8, Hydrology and Water Quality.

Therefore, as concluded in Section 4.8, the Proposed Project would not substantially alter the existing drainage patterns of the City's surface water sources such that potentially adverse water quality impacts would result.

Other changes anticipated with climate change, including air and water temperature increases and accelerated sea-level rise, could affect San Lorenzo River and North Coast stream lagoon conditions. As indicated in Section 7.1.1, Potential Effects of Climate Change, estuarine systems will be affected by accelerated sea-level rise, warming of water and air, ocean acidification, and changes in runoff. Some Central Coast marshes may drown or become shallow mudflats, leading to a loss of the ecosystem services that marshes provide, including carbon sequestration (CNRA 2018). While that is the case, the Proposed Project would not increase these risks, as residual flows and lagoon inflows would not be substantially altered, as described above. Overall, there are no climate change conditions that would modify the reported impact conclusions in Section 4.8 or required mitigation measures (MM HYD-1 through MM HYD-3).

7.2.9 Land Use, Agriculture and Forestry, and Mineral Resources

The less-than-significant or potentially significant impacts identified and evaluated in Section 4.9, Land Use, Agriculture and Forestry, and Mineral Resources, are due to construction of project and programmatic infrastructure components. Given that the same number and type of project and programmatic infrastructure components would be needed for the Proposed Project, the impacts would be the same or similar under climate change conditions, as reported in Section 4.9 (Impacts LU-1, LU-2, and LU-3).

As indicated in Section 7.1.1, Potential Effects of Climate Change, climate change outcomes for forests will depend largely on multiple abiotic drivers (increased air temperatures, altered fog patterns, changes in winter precipitation), and biotic factors (invasive species and insect and pest outbreaks) (CNRA 2018). While forests could be affected by climate change, the Proposed Project would not increase these effects. There are no climate change conditions that would modify the reported impact conclusions in Section 4.9 or the required mitigation measure (MM LU-1).

7.2.10 Noise

The less-than-significant or potentially significant impacts identified and evaluated in Section 4.10, Noise and Vibration, are due to construction of project and programmatic infrastructure components. Given that the same number and type of project and programmatic infrastructure components would be needed for the Proposed Project, the impacts would be the same under climate change conditions, as reported in Section 4.10 for Impacts NOI-1, NOI-2, and NOI-3. There are no climate change conditions that would modify the reported impact conclusions in Section 4.10 or required mitigation measures (MM NOI-1 through MM NOI-3).

7.2.11 Recreation

The less-than-significant and beneficial impacts identified and evaluated in Section 4.11, Recreation, are due to construction and operation of project and programmatic components. Given that the same project and programmatic components would be needed for the Proposed Project, the impacts would be the same or similar under climate change conditions, as reported in Section 4.11 (Impacts REC-1 through REC-3).

As indicated in Section 4.11, boats and related infrastructure can only operate safely throughout the full season when Loch Lomond Reservoir level is approximately 564 feet above mean sea level (amsl) or higher at the beginning of the recreational season (March 1 to mid-October). When the lake level is below approximately 564 feet amsl at the beginning of the season the City either, depending on actual lake levels, does not allow for boating at all that season or discontinues boating mid-season when boat launching is no longer possible.

Table 7-6 compares the percentage of days in each calendar month at the reservoir that fall below approximately 564 feet amsl under 2018 existing and Proposed Project conditions, based on an average for each of those months in all years in the climate change record (2020 to 2070). During the recreational use period from March 1 to mid-October, on average there are approximately 18.1% of days under 2018 existing conditions with climate change hydrology where a full season of boating and related operations would not occur because lake levels fall below approximately 564 feet amsl in March, at the beginning of the season. In comparison, under Proposed Project conditions with climate change, on average there would be approximately 14.5% of days where a full season of boating and related operations would not occur because lake levels fall below approximately 564 feet amsl in March, an improvement over existing conditions. Therefore, with climate change conditions, the Proposed Project would also have a beneficial effect on boating in Loch Lomond Reservoir, given that it would improve conditions for boating compared to existing conditions by increasing lake levels, which would allow for a full season of boating more frequently. Given this beneficial effect, the Proposed Project would not conflict with existing recreational uses at Loch Lomond Reservoir, as described in Section 4.11. There are no climate change conditions that would modify the reported impact conclusions in Section 4.11.

Table 7-6. Percentage of Days that Loch Lomond Reservoir Falls Below Approximately 564 Feet (amsl) under Climate Change Hydrology

Month	Climate Change Hydrology	
	2018 Existing Conditions	Proposed Project Conditions
Jan	30.9%	20.1%
Feb	18.1%	13.8%
Mar	18.1%	14.5%
Apr	20.3%	19.4%
May	22.3%	19.6%
Jun	27.4%	21.4%
Jul	31.6%	24.7%
Aug	41.1%	31.2%
Sep	46.9%	35.1%
Oct	47.1%	36.4%
Nov	47.4%	36.7%
Dec	47.8%	36.3%

Source: Gary Fiske and Associates 2021.

Note: amsl = above mean sea level.

7.2.12 Transportation

The less-than-significant impacts identified and evaluated in Section 4.12, Transportation, are due to construction of the project and programmatic infrastructure components. Given that the same number and type of project and programmatic infrastructure components would be needed for the Proposed Project, the impacts would be the same under climate change conditions, as reported in Section 4.12. There are no climate change conditions that would modify the reported impact conclusions in Section 4.12 for Impacts TRA-1 through TRA-5.

7.2.13 Utilities and Energy

The significant, less-than-significant and beneficial impacts identified and evaluated in Section 4.13, Utilities and Energy, are due to construction and operation of project and programmatic infrastructure components. Given that the same number and type of project and programmatic infrastructure components would be needed for the Proposed Project, most of the impacts would be the same or similar under climate change conditions, as reported in Section 4.13, Utilities and Energy (Impacts UTL-1 and Impacts UTL-3 through UTL-10).

However, as indicated in Section 7.1.4, Proposed Project Implementation with Climate Change, it is possible that ASR injection and extraction capacities needed to achieve the same water supply reliability goal for the Proposed Project under climate change conditions could be greater for injection capacity and less for extraction capacity (i.e., 6.0 mgd and 7.0 mgd, respectively), based on the results of the climate change modeling in Appendix D. If that were the case, electrical energy use would increase by approximately 2% over that estimated in Section 4.6, Greenhouse Gas Emissions, and Appendix E. This potential increase in energy use would not result in wasteful, inefficient, or unnecessary consumption of energy resources and would not result in conflicts with or otherwise obstruct a state or local plan for renewable energy or energy efficiency and the impacts would be less than significant, as described in Section 4.13 for Impacts UTL-6 and UTL-7.

Additionally, the Proposed Project, including all project and programmatic components, would provide adequate water supplies under climate change conditions to serve direct demand from new City staff associated with the Proposed Project and projected water demand in the areas served by the City during currently constrained dry periods. Specifically, the Proposed Project would meet the projected water demand of 3,200 million gallons per year that is forecasted in the City's 2015 Urban Water Management Plan and eliminate potential water shortfalls during dry and multiple-dry years. Therefore, the Proposed Project's impact related to water supply under climate change conditions would also be beneficial, as reported in Section 4.13 for Impact UTL-2. Overall, there are no climate change conditions that would modify the reported impact conclusions in Section 4.13 or required mitigation measures (MM BIO-1 through MM BIO-14; MM CUL-1 and MM CUL-2; MM GEO-1 and GEO-2; MM HAZ-1 and MM HAZ-2; MM HYD-1 through MM HYD-3; MM LU-1; and MM NOI-1 through MM NOI-3).

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