

Appendix 4A

Consideration of 2070 Conditions

4A.1 Introduction

The purpose of this appendix is to provide information regarding possible future hydrologic and regulatory conditions under a potential 2070 scenario, and potential future water management actions in 2070. The content of this appendix identifies whether the type and magnitude of impacts may change from those disclosed for 2040 under a possible 2070 scenario described herein. This appendix is not required by the California Environmental Quality Act (CEQA) and is not used to support the CEQA findings presented in Chapters 7 through 32 of this Final Environmental Impact Report (Final EIR).

Due to the inherent uncertainty regarding climate change and sea level rise, numerous assumptions were made to characterize possible future conditions in the 2070 timeframe. This set of assumptions represents just one possible future 2070 scenario. The 2070 scenario used in this appendix is not predictive and should not be construed as such. It is assumed that changes expected under No Project conditions in 2040, primarily climate change, would continue and increase in scale and scope by 2070. Climate is a primary influencing factor on water supplies. Changes in the amount of precipitation directly affect water supplies. In addition, changes in the seasonality of precipitation and the amount of precipitation falling as snow versus rain will affect the ability to store runoff in State Water Project (SWP)/Central Valley Project (CVP) reservoirs, which in turn will affect the water supply available to meet many competing needs. Increasing temperatures will result in earlier and faster snowmelt. Drier soil profiles in upper watersheds will absorb greater amounts of precipitation and reduce runoff. Increasing temperatures will increase reservoir evaporative losses. These conditions associated with climate change and sea level rise will make operating the SWP and CVP in 2070 more difficult.

Major uncertainties in defining future water supply and future water demand conditions include evolving socioeconomic conditions and a changing regulatory environment, both of which will continue to be affected by climate change in 2070. The effects of climate change on both natural vegetation and crop water demands are uncertain. While increasing temperature tends to increase evapotranspiration by vegetation, other climate changes such as increasing atmospheric carbon dioxide may reduce evapotranspiration, thereby, offsetting some of the effects of increasing temperature.

Socioeconomic conditions have a direct effect on water demands. As population increases, water demands for municipal, commercial, and industrial water supplies tend to increase. The nature of urban growth affects encroachment on agricultural lands. Irrigated land area is expected to decline during the twenty-first century. Climate, water reliability, and global commodity prices affect cropping patterns. Key areas of uncertainty related to water demand projections are as follows.

- Population growth and land encroachment
- Socioeconomic conditions
- Urban water conservation and recycling

- Agricultural cropping patterns and water use efficiency gains
- Changes in crop evapotranspiration
- In-stream and Delta flow requirements beyond existing regulatory requirements
- Water required to maintain Delta water quality and offset sea level rise
- The degree to which regions outside of the Central Valley depend on Central Valley water supplies
- Operational changes and adaptive measures such as increased artificial groundwater recharge

Because of the compounding uncertainties associated with climate change, system operations, water demands, and regulations associated with predicting future conditions, projections beyond 2070 were not conducted because they would be too speculative to provide any meaningful information.

The possible No Project 2070 conditions are described with and without the proposed project operations. As described in Section 4A.5, *Meeting Proposed Project Objectives under 2070 Conditions*, the proposed project would be able to capture inflow when it is available and would be expected to restore and protect the reliability of SWP water deliveries because overall SWP exports would be greater in 2070 than without the proposed project in 2070. The discussion in this appendix describes the potential environmental impacts of operating the proposed project under a possible 2070 condition and to determine if the impacts would be different in type or magnitude than expected in the 2040 timeframe. Several resource chapters of the Final EIR include appendices with analysis of the No Project Alternative at 2040 compared to the project alternatives at 2040. Similarly, in this appendix, Section 4A.4, *Potential Future Water Management*, provides a qualitative description of projected conditions for each environmental resource with the proposed project operating in 2070 compared to the without project scenario at 2070.

4A.2 Climate Change and Surface Water Conditions

Climate change is a global phenomenon, and its effects are expected to materialize at global, regional, and local scales. Despite international agreements to reduce greenhouse gas (GHG) emissions, effects of existing and ongoing emissions will continue to warm the climate for decades to come (Intergovernmental Panel on Climate Change 2021a). Climate change is already taking a toll on California water supplies in the form of more frequent and more severe droughts alternating with higher precipitation in wet years. In 2022, California finds itself in the second extreme drought in the past 10 years (California Drought Action 2022; State Water Resources Control Board 2022a). January and February of 2022 were the driest months on record (State Water Resources Control Board 2022b:1), while 2017 was the second wettest year on record for the eight-station precipitation index, which tracks conditions in the largest Central Valley watersheds important for water supplies (California Department of Water Resources 2017).

Furthermore, much of the western United States is currently in a megadrought (Williams et al. 2022). It is highly likely the 22-year long, turn-of-the-twenty-first-century drought in the western United States will continue through a 23rd year and match the duration of the shortest of the megadroughts identified in the past (Williams et al. 2022). This megadrought affects multiple watersheds across the west, including the Colorado River Basin, which is a major source of water supply for multiple states, including Southern California.

By 2070, climate change effects on precipitation, temperature, and sea level rise are expected to bring increased frequency and intensity of weather extremes such as heat waves, droughts, and floods. Warming temperatures expand the volume of sea water, while melting of glaciers and Arctic and Antarctic ice sheets further drive sea level rise around the globe. For the purposes of this appendix, one scenario (2070 Median Scenario) of climate change and sea level rise is considered as broadly representative of the water supply challenges that will confront the State of California. Specific assumptions of the 2070 Median Scenario are described in the subsections below.

4A.2.1 Precipitation

California's climate is highly variable, with large changes in precipitation from season to season and year to year. Climate change is expected to increase the frequency of both dry and wet extremes as well as the frequency of rapid transitions between them (Delta Stewardship Council 2021:3-17).

One-third to one-half of all precipitation in California occurs on only 5 to 10 days per year, on average (Dettinger et al. 2011:445, 461). Much of the precipitation in any given year can be attributed to only a few storms, generally atmospheric rivers, which contribute 30% to 45% of all precipitation in Central and Northern California (Dettinger et al. 2011:464). Therefore, a small change in the number of atmospheric river storms in a given year can make a significant difference in water supply. Recent studies of the 2012–2016 drought find that although the precipitation was not the lowest on record, low precipitation combined with higher temperatures resulted in conditions of extreme aridity. Other studies indicate that such conditions may be more likely in the future. For example, Swain et al. (2018) project in the future an increase in the frequency of both dry and wet extremes as well as an increase in the frequency of rapid transitions between dry and wet conditions, or “whiplash” events.

Levee maintenance and improvement activities over the last few decades in the Delta have focused on raising crest elevations to meet freeboard requirements, achieve modern standards of flood protection, and improve levee stability. Climate change is projected to result in the changes in hydrologic patterns, such as extreme storm events, and sea level rise (further described below) that will increase flood elevations within the Delta. These changes will reduce levee freeboard in the near to middle term and may result in levee overtopping or seepage and stability failures in the middle to long term (Delta Stewardship Council 2021). As such, extreme storm events will likely put additional strain on Delta levees and potentially increase the potential for failures.

Under the 2070 Median Scenario, all major watersheds in the Central Valley are projected to have greater annual precipitation with average precipitation increasing by 1.8% to 3.5% depending on the watershed.

4A.2.2 Temperature, Snowpack, and Unimpaired Runoff

GHG emissions resulting in higher global surface temperatures will continue to affect rainfall patterns, extreme weather events, and ocean temperature. Changes in surface temperatures are expected to affect snowpack and unimpaired runoff in California.

Compared to the reference period (centered on 1995), average temperature is projected to increase by at least 3.0° Celsius (5.4° Fahrenheit) in all major watersheds under future climate conditions. Average annual temperature increases are uniform across the state. Temperature increases are greatest in summer and fall, and smallest in winter and spring.

Historically, about 80% of the state's precipitation occurs in the form of snow that accumulates in the Sierra Nevada and is the primary water source for much of California. Sierra Nevada snowpack is an important factor in maintaining storage in SWP and CVP reservoirs. Heat waves and even moderate increases in average winter temperatures are expected to jeopardize snowpack, leading to early snow melting and increased flood risk. Significant seasonal changes in snowmelt runoff are expected to occur while total annual runoff volumes may not significantly change, as shown in Table 4A-1. Significant seasonal changes in runoff due to early snow melting are expected to affect the seasonal reservoir flood control operations and reduce the ability to refill reservoirs after the end of the flood season.

Table 4A-1 compares the Eight River Index for the 2070 Median Scenario to 2020 existing conditions.

Table 4A-1. Eight River Index for 2070 Median Climate Scenario Compared to Existing Conditions^a

Period	2020 (MAF)	2070 (MAF)	Percent Change (%)
Oct	0.53	0.45	-15%
Nov	0.92	0.93	1%
Dec	1.89	2.52	33%
Jan	2.53	4.14	64%
Feb	2.81	3.96	41%
Mar	3.23	3.88	20%
Apr	3.30	2.85	-14%
May	3.61	2.19	-39%
Jun	2.29	0.76	-67%
Jul	0.97	0.32	-67%
Aug	0.50	0.34	-33%
Sep	0.43	0.40	-6%
Oct-Mar	11.90	15.87	33%
Apr-Sep	11.11	6.87	-38%
Annual	23.01	22.75	-1%

^a The Eight River Index is defined in State Water Resources Control Board Water Right Decision 1641. It is the sum of the unimpaired runoff as published in the DWR Bulletin 120 for the following locations: Sacramento River flow at Bend Bridge, near Red Bluff; Feather River, total inflow to Oroville Reservoir; Yuba River flow at Smartville; American River, total inflow to Folsom Reservoir; Stanislaus River, total inflow to New Melones Reservoir; Tuolumne River, total inflow to Don Pedro Reservoir; Merced River, total inflow to Exchequer Reservoir; and San Joaquin River, total inflow to Millerton Lake.

Higher temperatures, when combined with moderate or low precipitation, would result in extreme aridity and drought. Higher temperatures may also increase evapotranspiration rates, which could increase water demand in some locations. Reduced soil moisture would also exacerbate the risk of catastrophic wildfire, bring longer fire seasons with more frequent wildfires, expand fire-prone areas, and heighten post-fire impacts and may also affect the amount of runoff available to place in storage. Healthy watersheds provide much of the state's water supply, protect water quality, and help reduce flood severity downstream, but wildfire can catastrophically damage watersheds along with human infrastructure (California Department of Water Resources 2018:1-14) and aquatic resources.

4A.2.3 Sea Level Rise

Warming air temperatures resulting from GHG emissions raise ocean temperature, resulting in higher sea level as sea water volume expands. Melting glaciers and ice sheets as a result of warming temperatures also contribute to global sea level rise. Climate change has already been observed to cause mass loss in the Greenland and Antarctic ice sheets and shrinking mountain glaciers (Intergovernmental Panel on Climate Change 2021b:SPM-6, SPM-9–SPM-10A). The resulting melting and runoff also contribute to sea level rise.

For the 2070 Median Scenario, sea level rise of 3.5 feet at San Francisco tide gage is assumed. This assumption is based on the California Ocean Protection Council's (OPC) guidance updated in 2018, the *State of California Sea-Level Rise Guidance* (California Natural Resources Agency and California Ocean Protection Council 2018). This guidance includes science-based methodology for state and local governments to analyze and assess the risks associated with sea level rise, and to incorporate sea level rise into their planning, permitting, and investment decisions. The OPC guidance incorporates probabilistic sea level rise projections, which associate a likelihood of occurrence (or probability) with sea level rise heights and rates and are directly tied to a range of emissions scenarios. DWR's use of the 3.5-foot scenario is a conservative assumption because it carries a mere 0.5% probability of occurring (i.e., a 1-in-200 chance of occurring) by 2070 under a high GHG emissions scenario, which OPC considers a medium-high risk scenario for planning purposes (California Natural Resources Agency and California Ocean Protection Council 2018). That amount of sea level rise is not expected to reach a 50% median probability or 66% likely range probability until after the year 2130 (California Natural Resources Agency and California Ocean Protection Council 2018).

The OPC guidance also includes an extreme scenario called the H++ scenario (resulting from loss of the West Antarctic ice sheet). But the probability of this scenario is currently unknown. Under the extreme H++ scenario, rapid ice sheet loss on Antarctica is assumed to drive rates of sea level rise in California above 50 millimeters per year (2 inches/year) by the end of the century, leading to potential sea level rise of 10.2 feet at 2100. This rate of sea level rise would be about 30 to 40 times faster than the sea level rise experienced over the last century. While DWR is not using the H++ sea level rise scenario for the year 2070, it has designed the project alternatives to withstand 10.2 feet of sea level rise plus a 200-year flood event, as explained in Appendix 5A, Section F, *Sea Level Rise and Delta Water Quality Modeling*.

The range of sea level rise projections at San Francisco are summarized in Table 4A-2.

Table 4A-2. Sea Level Rise Projections at San Francisco

Year	Emission Scenario	Probability Meets or Exceeds				
		Median (50%)	Likely Range (66%)	1-in-20 Chance (5%)	1-in-200 Chance (0.5%)	H++
2040	High emission scenario	0.6	0.5–0.8	1.0	1.3	1.8
2050	High emission scenario	0.9	0.6–1.1	1.4	1.9	2.7
2070	Low emission scenario	1.1	0.8–1.5	1.9	3.1	-
2070	High emission scenario	1.4	1.0–1.9	2.4	3.5	5.2
2100	Low emission scenario	1.6	1.0–2.4	3.2	5.7	-
2100	High emission scenario	2.5	1.6–3.4	4.4	6.9	10.2

Notes:

0.5% probability corresponds to the Medium-High Risk Aversion scenario in OPC's guidance.

H++ corresponds to OPC's extreme scenario resulting from loss of West Antarctic ice sheet.

Sea level rise could cause saltwater to intrude farther into the Delta, if additional freshwater is not released to repel it, affecting water quality for agricultural diversions and Delta tidal wetland habitat. Assuming the current State Water Resources Control Board (State Water Board) salinity requirements in the Delta are not modified, the incremental water cost of meeting salinity requirements becomes increasingly severe with each increment of sea level rise, with the largest increase in the spring months when historically the Delta water is fresher. Details of the effects of sea level rise on Delta operations are presented in Appendix 5A, *Modeling Technical Appendix*, Section F, *Sea Level Rise and Delta Water Quality Modeling*. During April to August, the Emmaton agricultural standard in the western Delta (closer to the Pacific Ocean) is likely to become the controlling objective (i.e., releases of water from SWP/CVP reservoirs would be needed to meet this standard) over a broader range of conditions as sea level increases.

The ability to maintain the existing Delta levee system is threatened by a combination of land subsidence, sea level rise, storm events, and earthquakes. Sea level rise is also expected to put additional pressure on levees and increase the frequency and duration of extreme high-water events. This increased duration of high water against the levees would significantly increase the likelihood of future failures (Public Policy Institute of California 2008:8). Levee failure could result in the inundation of islands and sea water intrusion into the interior Delta. Sea water intrusion into the interior Delta would negatively affect Delta water quality and could jeopardize operations of the SWP and CVP. Delta levee failure could also jeopardize an extensive network of public utilities (e.g., pipelines, highways, rail lines), farmland, and recreational opportunities in the Delta.

Levee failures may lead to large bodies of open water in the Delta, affecting circulation patterns, Delta salinity, and wildlife habitat with major implications for the conveyance of SWP/CVP water supplies across the Delta to the projects' export facilities in the south Delta.

4A.3 Potential Changes to Water Demands

Hydrologic conditions are expected to change as a result of climate change as discussed in Section 4A.2.1, *Precipitation*. Shifts in urban and agricultural water demand may also occur in the assumed 2070 scenario compared to 2020 and assumed 2040 conditions for a variety of reasons, including shifts to accommodate climate change. This section discusses the potential shifts in water demand that could occur; however, as demonstrated in this section, identifying and quantifying potential changes in water demand in 2070, decades from now, is speculative.

Urban water demands include residential, commercial, industrial, and institutional uses, with residential use accounting for about two-thirds of urban water use statewide. Urban per capita water use has fallen since 1990, even as population has grown, due to pricing incentives, water-saving technologies such as low-flow fixtures and appliances, and incentives and requirements to reduce landscape watering (Public Policy Institute of California 2019a:2). Future residential water use depends on both population growth and per capita water use. Per capita water use has been decreasing since the mid-1990s (Public Policy Institute of California 2018). Future per capita water use for the residential sector may decline faster than population growth. Outdoor watering accounts for approximately half of statewide urban water use; however, changes in landscaping may make

1 urban water use less affected by climate change. Current urban water management plans only
2 contain projections of urban water demands through 2045; therefore, it is speculative to quantify
3 changes in urban water use that might occur by 2070.

4 Agriculture represents about 80% of water use in California (California Department of Water
5 Resources 2022). Irrigated lands that depend largely on surface water are vulnerable to changes in
6 temperature and the amount and timing of precipitation. As described in Section 4A.2, *Climate*
7 *Change and Surface Water Conditions*, the frequency and intensity of climate extremes are expected
8 to increase, which may affect cropping patterns, the mix of annual and permanent crops in
9 California, and ultimately lead to a potential reduction in cropped area. Groundwater supplements
10 surface water or is the primary source of water in many parts of California. In recent droughts
11 (2012–2016), when surface water supplies were limited, groundwater pumping increased
12 significantly and accelerated groundwater depletion and overdraft in many areas of the state,
13 particularly the Central Valley (California Department of Water Resources 2018:2-1). Future
14 groundwater use will be managed under the requirements of the Sustainable Groundwater
15 Management Act (SGMA), which requires the development and implementation of plans to bring
16 basins into long-term balance. A 2019 study of water and the future of the San Joaquin Valley by the
17 Public Policy Institute of California (PPIC) found that groundwater agencies in overdrafted basins
18 will need to augment supplies, reduce demands, or some combination of those (Public Policy
19 Institute of California 2019b:3). Some amount of reduced groundwater pumping is expected in
20 overdrafted basins to achieve SGMA compliance. Farmers could reduce irrigated acreage or switch
21 to crops that use less water, which could result in a decrease in agricultural demand. The study
22 assumed that groundwater sustainability agencies (GSAs) implement SGMA using a glide path
23 approach that entails progressively ramping down pumping rather than ending overdraft right
24 away. This way, farmers needing to reduce acreage of perennial crops can plan this over time, so
25 they do not suffer long-term investment losses from removing productive orchards. The study
26 assumed that farmers would make cropping changes to minimize the loss in profits from water
27 shortages. Despite the assumption that farmers would shift cropping patterns to address reduced
28 groundwater pumping, the study found that even with ambitious investments in new supplies, to
29 end overdraft the irrigated footprint of the valley may need to shrink by more than 500,000 acres by
30 the early 2040s (Public Policy Institute of California 2019b:57). If climate change and availability of
31 groundwater affects agricultural areas such that the irrigated footprint shrinks over time, then the
32 agricultural water demand would also be expected to decrease.

33 In addition to the factors described above, urban encroachment, growth, and socioeconomics may
34 also lead to a reduction in agricultural lands in California. For the California Water Plan, Update
35 2013, the California Department of Water Resources (DWR) considered nine socioeconomic futures,
36 including current trends, slow growth, and expansive growth. For the California Water Plan, Update
37 2018, DWR projects a steady decrease in agricultural acreage from 2020 through 2100, in both the
38 Sacramento and San Joaquin Valleys (California Department of Water Resources 2018). Other
39 socioeconomic factors such as the cost of labor could also contribute to declining agricultural
40 acreage. If urban encroachment, growth, and socioeconomics affect agricultural areas such that the
41 irrigated footprint shrinks over time, then the agricultural water demand would also be expected to
42 decrease. Given the number of factors that could contribute to changes in agricultural water
43 demands, however, it is speculative to quantify the changes in agricultural demand that might occur
44 by 2070.

4A.4 Potential Future Water Management

Given the potential changes described in the preceding sections, with or without the project, surface water supply conditions are expected to experience the compounding effects of changes in precipitation, temperature, and sea level rise. Extreme rainstorms may cause flooding, extended dry periods, and changes in seasonal precipitation patterns would reduce reservoir storage; more Delta outflow would be required to meet Delta water quality objectives. Historically, Southern California has relied on both SWP and Colorado River supplies to meet much of its municipal and agricultural demand (Metropolitan Water District of Southern California 2020:1-21-23). However, climate change, along with projected future demand, is expected to result in challenges for Colorado River Basin supplies (Bureau of Reclamation 2012:18). These challenges are identified by the recent agreement between California, Arizona, and Nevada to take less water out of Lake Mead and by the recent testimony of the U.S. Bureau of Reclamation (Reclamation) commissioner for water users of this basin to conserve 2 million to 4 million acre feet of water in 2022 (Goodland 2022). A reduction in reservoir storage and decreased river flow are likely to trigger management or regulatory actions to balance water supply needs for multiple uses in the Colorado River Basin (Bureau of Reclamation 2012:4-10).

Local water agencies are expected to continue to adapt to a changing climate with conservation and resiliency programs such as local storage, recycling, groundwater recharge, and water quality management. These actions would be similar to those discussed for the No Project Alternative. To address these changes, water managers are likely to invest in a wide range of projects to protect water quality, water deliveries, and fish and wildlife and their habitats. By 2070, it is expected that state and local government programs, projects, plans, and policies would be modified to adapt to changing conditions. Local actions might include expansion of water conservation programs, water recycling projects, stormwater capture and treatment, desalination, and groundwater recovery and management, but it is impossible to know how widespread or effective these programs and projects would be by 2070. It is expected that local water supply projects would continue to rely on state and regional surface water supplies to supplement and blend with local supplies. Resource agencies may also enact regulations and permit conditions in response to changing environmental conditions. While there is uncertainty about how these environmental and regulatory conditions may change, all of these factors would directly and indirectly affect how water supply projects balance competing demands. While significant investments in projects such as surface and groundwater storage, stormwater capture and treatment, and water recycling would be anticipated, it would be too speculative to identify what projects would be completed by 2070 beyond what is already discussed in the appendices that evaluate 2040 conditions. Any project identified by a local water agency would be outside the purview of DWR and, if it met the definition of a project under CEQA, would require separate and independent compliance under CEQA.

Regulatory agencies could modify regulatory requirements to address challenging water supply conditions driven by climate change. Water managers could also modify operations to meet potential changes in regulatory requirements. The next sections consider potential regulatory and operational actions that could occur by 2070 in response to climate change and sea level rise. The discussion is limited to general trends based on recent observations of operations under drought conditions and informed by detailed simulations that were undertaken for existing conditions and for a 2040 level of development.

4A.4.1 Possible Future Regulatory Actions

By executive orders and statutes, state agencies are required to take actions in planning, design, construction, operation, and maintenance to both reduce GHG emissions and prepare for the inevitable effects of climate change. In March 2022, the State Water Board issued early warnings to water right holders of drought impacts, action recommendations, and the possibility of emergency regulations curtailing water diversions (State Water Resources Control Board 2022b). With extremely low storage in SWP and CVP reservoirs in December 2021, DWR and Reclamation submitted temporary urgency change petitions requesting modifications to water right requirements included in State Water Board Water Right Decision 1641 (D-1641) to allow management of reservoir releases on a pattern that conserves upstream storage for fish and wildlife protection and Delta salinity control while providing critical water supply needs. Such actions could become more frequent in the future. The following specific regulatory actions might occur or become more frequent.

- **Habitat protection outflow (spring X2):** From February to June, relaxed standards and/or imposed limits on reservoir storage withdrawals to support X2.
- **Western Delta agriculture, Emmaton water quality objective:** Relocation of compliance point from Emmaton further upstream to Threemile Slough.
- **San Joaquin River at Airport Way Bridge, Vernalis:** Reduction in releases from New Melones Reservoir.
- **Delta outflow, fish and wildlife objective:** Reduction in critical year requirements for North Delta Outflow Index.
- **Sacramento River at Rio Vista, fish and wildlife objective:** Reduction in critical year September through December flow objectives.

Future regulatory changes such as those described above would be primarily outside the purview of DWR and, if it met the definition of a project under CEQA, would require separate and independent compliance under CEQA.

Installation of an 800-foot-wide barrier on the West False River in the Delta, such as the one that was used in 2015 and 2021/2022, would help slow the movement of saltwater into the central Delta and the associated degradation of water supplies for Delta agriculture and for SWP and CVP exports. Additionally, the drought barrier would reduce the need for summer reservoir releases to repel salinity intrusion into the Delta. Unless a more permanent barrier solution is found, installation of the emergency barrier by DWR may become more frequent. Limiting exports to health and safety needs at times when Delta standards are not met is another potential future regulatory action.

4A.4.2 Possible Operations

Over the course of the next five decades, climate change and sea level rise pose a challenge to the SWP and CVP and are expected to make meeting river flow, water quality, outflow, and Delta regulations, such as D-1641, more difficult. As discussed in Section 4A.2.3, sea level rise could cause saltwater to intrude farther into the Delta. To meet existing water quality objectives, it is expected that water managers would need to release more water from upstream reservoirs to repel seawater. At the same time, as temperatures warm and precipitation patterns change and become more

1 volatile, water managers may need to increase reservoir carryover targets to protect coldwater pool
2 supplies, protect fish and wildlife, and meet obligations to senior water rights holders.

3 For the purposes of this appendix, DWR and Reclamation would continue to operate the SWP and
4 CVP to divert, store, and convey water consistent with existing applicable laws and contractual
5 obligations. However, changes to precipitation and the seasonal pattern of runoff may affect the
6 SWP's and CVP's ability to store sufficient water to meet all summer and fall water demands and
7 obligations. As an example, changes in runoff patterns may affect the ability of the SWP and CVP to
8 divert water from the Delta to place in storage in San Luis Reservoir, adversely affecting water
9 deliveries made from the reservoir during summer months.

10 Potential future strategies for coordinated long-term operations of the SWP and CVP could include
11 the following.

- 12 • Flow-related actions, habitat restoration, and intervention measures (such as adult fish rescue
13 or juvenile trap and haul) to maintain water deliveries and protect fish and wildlife.
- 14 • Continued SWP and CVP operations in compliance with D-1641 without additional releases for
15 fish and wildlife, for example, voluntary agreements.
- 16 • Management of reservoir storage primarily to protect the coldwater pool and making releases to
17 benefit fish (Bureau of Reclamation 2019:1-2-1-3).

18 Other operational changes that may occur by 2070 include modifying the current flood control
19 operations of major reservoirs to reflect advanced weather forecasting, which would allow
20 operators to take better advantage of changes in precipitation patterns that result in more runoff
21 early in the season and less runoff in April through June. Modification of flood control operations
22 would allow reservoirs to capture and store more runoff in the January through March timeframe,
23 rather than the historical operation of releasing water to maintain required flood control storage
24 space during the winter and spring months.

25 Water supplies and water demands in California nearly half-a-century into the future are highly
26 uncertain and would be affected by changes in both climate and demand (Sections 4A.2 and 4A.3), as
27 well as future regulatory actions (Section 4A.4.1, *Possible Future Regulatory Actions*). Water
28 managers would likely need to rebalance water demands by urban, agricultural, and environmental
29 uses in response to increasingly variable water supplies. Effective adaptation may require
30 fundamental changes to both water infrastructure and the regulatory environment such that the
31 needs for species protection, water quality, human health and safety, and economic uses are
32 rebalanced. However, actual changes to operations that could occur by 2070 are speculative.

33 **4A.5 Meeting Proposed Project Objectives under** 34 **2070 Conditions**

35 As previously described, the challenge of balancing many competing water demands is expected to
36 increase in the future as temperatures rise, precipitation becomes more variable, sea level rises,
37 snowpack diminishes, and human population grows.

38 The proposed project is just one component of a suite of federal, state, regional, and local strategies
39 to protect and ensure a safe, adequate water supply under rising sea levels and a changing climate
40 well into the future. The proposed project is designed to increase resilience to seismic risks, sea

level rise, and other foreseeable consequences of climate change and extreme weather events. Consistent with the *California Water Resilience Portfolio*, it is intended to restore and protect the reliability of the SWP and, potentially, CVP water deliveries south of the Delta (Chapter 2, *Purpose and Project Objectives*).

In its *Climate Action Plan Phase III: Climate Change Adaptation Plan* (California Department of Water Resources 2020:29), DWR considers capture and conveyance in the Delta as important potential adaptations to mitigate system losses in other areas due to changing precipitation patterns and seasonal runoff. In addition, the project is expected to allow continued water deliveries and operational flexibility should catastrophic levee failure occur from seismic activity, extreme weather or pressure from sea level rise, or other disasters that may temporarily disrupt routing or quality of surface water supplies. As discussed in Appendix 5A, Section F, the proposed north Delta intake locations are not vulnerable to salinity intrusion from the sea level rise. Furthermore, the facilities are designed to withstand 200-year flood flows on top of water level elevations corresponding to 10.2-foot sea level rise.

As discussed in Section 4A.2, changes in temperature and precipitation are expected to significantly alter California's hydrology. Having alternative points of diversion in the north Delta would increase resiliency in managing combined effects of sea level rise and changes in upstream hydrology, including changes to timing and quantity of seasonal runoff patterns (Chapter 30, *Climate Change*, Section 30.2.3, *Climate Change Trends and Associated Impacts on the Study Area*).

Operation of the proposed project (Alternative 5) would be capable of capturing inflow when changing precipitation patterns are expected to generate higher inflow than the April through June timeframe, when reservoirs have historically captured runoff. By being able to capture inflow when it is available, overall exports would be expected to be greater than without the proposed project. Therefore, the proposed project is expected to restore and protect the reliability of SWP water deliveries and, potentially, CVP water deliveries south of the Delta, consistent with the *California Water Resilience Portfolio*, in a cost-effective manner.

4A.6 Potential Environmental Impacts under 2070 Conditions

The following sections qualitatively describe the possible condition of each resource in 2070 and the potential effects from proposed project operations. Each resource discussion is organized to first discuss likely changes to hydrologic conditions in 2070 due to climate change under the No Project Alternative as compared to 2040 conditions. Comparison of resource effects under conditions in 2040 as compared to existing conditions are provided in individual resource appendices throughout the Final EIR (e.g., Appendix 8C, *Groundwater 2040 Analysis*).

The discussion in this section is limited to general trends based on recent observations of operations under drought conditions and informed by detailed simulations that were undertaken for existing conditions and for a 2040 level of development. This discussion is also informed by the information discussed in Sections 4A.2 through 4A.4. As noted in those sections, many of the changes that could occur in 2070 represent a possible future scenario and are summarized as follows.

- Precipitation, temperature, snowpack, and sea level rise would occur as generally described in Sections 4A.2.1, *Precipitation*, through 4A.2.3, *Sea Level Rise*.

- 1 • Existing regulatory context includes D-1641 requirements; however, all of the actions as
2 described in Section 4A.4.1 would be expected to occur and potentially be more frequent to
3 protect reservoir storage as a result of the volatility of precipitation, temperature, snowpack,
4 and sea level rise changes.
- 5 • Some amount of land use change would result in reduced agricultural demand because of
6 changes to cropping and external economic factors, as described in Section 4A.3, *Potential*
7 *Change to Water Demands*.
- 8 • Future water supply projects, as described in Section 4A.4, would not occur.

9 Each resource section considers the potential effects on the resource from project operations under
10 the 2070 scenario. Construction impacts are not discussed as impacts associated with construction
11 would generally occur at the time of construction or relatively contiguous to construction and would
12 not occur in 2070. Resource effects are not discussed because it is assumed those resulting from
13 project maintenance would be identical to those previously discussed under the 2040 resource
14 analysis. In addition, resources that would not be affected or that would not result in additional or
15 different impacts from changes to water supply or hydrology under the proposed project in 2070
16 compared to the impacts discussed in the Final EIR are also not considered further. These resources
17 are not discussed further because the effects of the proposed project under 2070 conditions would
18 not be expected to be different in type or magnitude than those already disclosed in Chapters 7
19 through 32 of the Final EIR. These resources include Geology and Seismicity; Soils; Land Use;
20 Aesthetics and Visual Resources; Cultural Resources; Transportation, Public Services and Utilities;
21 Noise and Vibration; Hazards, Hazardous Materials, and Wildfire; Mineral Resources; and
22 Paleontological Resources.

23 **4A.6.1 Surface Water/Water Supply**

24 **4A.6.1.1 2070 Surface Water/Water Supply Conditions**

25 By 2070, surface water conditions are expected to change as a result of climate change and sea level
26 rise as described in detail in Section 4A.2. A warmer atmosphere would modify precipitation and
27 runoff patterns, which would alter both the timing and volume of flow and affect extreme hydrologic
28 events like floods and droughts. An increase in temperatures is expected to diminish snow
29 accumulation during the cool season (i.e., late autumn through early spring) and snowmelt
30 availability to sustain runoff during the warm season (i.e., late spring through early autumn).
31 Warming may also lead to more rainfall runoff during the cool season rather than snowpack
32 accumulation. Within the Delta, this would likely lead to increases in December through March river
33 inflows and decreases in April through July river inflows. It is also anticipated that droughts would
34 increase in severity and duration, resulting in periods of critical dryness, further reducing Delta
35 inflows between April and October during these dry periods. These changes may require changes in
36 in-Delta water use patterns and upstream reservoir management. Increasing runoff magnitude—
37 from more precipitation as rain and earlier snowmelt—would stress reservoirs more frequently
38 during wet years, requiring more frequent and larger reservoir releases. The potential for increased
39 flooding means that reservoirs may need to release more water to maintain flood storage capacity,
40 but this depleted storage may not be replenished by rainfall and snowmelt later in the water year,
41 particularly during droughts. This would exacerbate the potential for lower water availability and
42 storage in future years. Overall, SWP/CVP long-term average annual diversions are expected to
43 decrease compared to 2040 conditions.

4A.6.1.2 Proposed Project Operation Effects on Surface Water/Water Supply

Similar to the 2040 conditions described in Appendix 5B, *Surface Water 2040 Analysis*, operation of the proposed project would not have effects on SWP and CVP reservoir storage levels under 2070 conditions. Generally, storage at SWP and CVP north-of-Delta reservoirs averaged for all years and for dry/critical water years is expected to be similar to the No Project Alternative at 2070 for all time periods examined. Similar to 2040, operation of the proposed project at 2070 is not expected to affect upstream reservoir storage. By 2070, it is expected that there would be fewer opportunities to utilize the north Delta diversions based on changes to hydrologic conditions and increasing operational constraints caused by climate change. However, SWP and CVP diversions are projected to be greater in 2070 with the proposed project than without the north Delta intakes.

The effect of the proposed project operations on Sacramento Valley flows under 2070 conditions is expected to be generally similar to what is described in Appendix 5B. The project could have minor effects on north-of-Delta CVP allocations and deliveries to CVP water service contractors, both agricultural and M&I. Deliveries to CVP Sacramento Settlement Contractors and Level 2 deliveries to wildlife refuges are based on the inflow to Lake Shasta, are nondiscretionary, and would not be affected.

Proposed project operations would not be expected to have significant impacts on water management in the San Joaquin Valley because there are no onstream SWP facilities located on the San Joaquin River and its tributaries. The proposed project is likely to increase SWP deliveries to its long-term contractors in the San Joaquin Valley and San Joaquin River watershed compared to the No Project Alternative at 2070. The project could have minor effects on south-of-Delta CVP allocations and deliveries to CVP water service contractors, both agricultural and M&I, located on the west side of the San Joaquin Valley. Deliveries to CVP exchange contractors and Level 2 deliveries to wildlife refuges are based on inflows to Lake Shasta, are nondiscretionary, and would not be affected. Significant changes to reservoir storage or stream flows are not expected.

4A.6.2 Flood Protection

4A.6.2.1 2070 Flood Protection Conditions

Potential flood risk in the Delta is expected to increase under 2070 conditions compared to 2040 conditions for the No Project Alternative due to the change in surface water resources, including runoff pattern changes and sea level rise (Delta Stewardship Council 2020:10). A detailed discussion of flood protection under 2072 conditions for the No Project Alternative has been provided in Appendix 7A, *Flood Protection 2040/2072 Analysis*. The 2072 analysis was completed to be consistent with the State Plan of Flood Control for the Sacramento River per direction from the Central Valley Flood Protection Board. This plan includes flood protection measures such as levee setbacks and improvements. It is expected that 2070 conditions would result in greater runoff magnitude from more precipitation and earlier snowmelt, which would increase the potential for flooding. This increase in rain could potentially require reservoirs to release water to maintain flood storage capacity compared to 2040 conditions. In the Delta, levee freeboard would decrease and potentially be exceeded as peak water levels increase in response to higher inflows combined with rising sea levels due to climate change.

4A.6.2.2 Proposed Project Operation Effects on Flood Protection

Overall, project operation effects would be similar to those described under 2040 conditions in the Delta (Appendix 7A). Model analysis performed for 2072 shows there is no substantial change in river levels at the location of the intakes. For an in-depth discussion of proposed project operations effects at 2072, please see Appendix 7A.

4A.6.3 Groundwater

4A.6.3.1 2070 Groundwater Conditions

Under 2070 conditions, precipitation patterns are expected to change such that an increase in the frequency of both dry and wet extremes as well as the frequency of rapid transitions between these extremes would occur (Delta Stewardship Council 2021:3-17). Vertical recharge from irrigation is likely to decrease because of adoption of more efficient irrigation technology and improvements in surface water distribution systems. In some areas, groundwater pumping may increase to make up for diminished surface water availability; however, this action may be limited by SGMA. During droughts, the ability to meet future consumptive use demands from groundwater may depend on the expansion of artificial groundwater recharge programs. Maintaining groundwater levels may become increasingly challenging if prolonged droughts become more frequent with insufficient wet years to allow groundwater levels to recover after periods of prolonged extraction.

4A.6.3.2 Proposed Project Operation Effects on Groundwater

Under proposed project operations, it is expected that conditions would be similar to those under conditions in 2040 (Appendix 8C, *Groundwater 2040 Analysis*), including: changes in stream gains or losses in various interconnected stream reaches; changes in groundwater elevation; changes in groundwater levels affecting supply wells; changes to long-term groundwater storage; changes in groundwater elevations near project intake facilities affecting agriculture drainage; effects on major conveyance facilities resulting from land subsidence; and changes in groundwater quality from project operations.

Because operation of the proposed project at 2070 would allow for increased deliveries during certain years and times of the year—specifically during wet years—compared to the No Project Alternative, it is anticipated the proposed project would provide more reliable water supplies for blending with lower-quality groundwater and conjunctive use projects, resulting in a beneficial effect on groundwater levels in SWP, and potentially CVP, service areas.

4A.6.4 Water Quality

4A.6.4.1 2070 Water Quality Conditions

Under 2070 conditions for the No Project Alternative, warming air and water temperatures, sea level rise, and changes in hydrologic patterns due to climate change would affect water quality in the Delta and may require changes in in-Delta water use patterns and upstream reservoir management. The greatest likely effect on Delta water quality in the future is expected to be increased salinity constituent levels, particularly in the Delta. Seawater is a primary source of bromide, chloride, and higher electrical conductivity (EC) levels, and sea level rise may result in elevated levels of these constituents relative to existing or 2040 conditions. Climate change-driven effects on water

temperature and potentially lower inflows in the summer months may contribute to more frequent or more extensive cyanobacteria harmful algal blooms (CHABs) in the Delta than under existing or 2040 conditions. Finally, climate change and associated large-flow events could result in higher sediment loading to the Delta, potentially resulting in higher turbidity and total suspended solids in some years compared to existing or 2040 conditions.

4A.6.4.2 Proposed Project Operation Effects on Water Quality

Proposed project operations under DWR's conservative 2070 conditions in the Delta are expected to have similar or reduced effects for boron, bromide, chloride, EC, mercury, nutrients, organic carbon, selenium, turbidity, and total suspended solids, dissolved oxygen, pesticides, trace metals, and CHABs than reported under 2040 conditions because it is expected the north Delta diversion would be utilized less under the conservative 2070 assumptions than under the 2040 assumptions (Appendix 9L, *Water Quality 2040 Analysis*). However, the natural interannual variability in Delta outflows, sea level rise, and changing hydrological conditions would be larger drivers of changes in water quality in the Delta compared to project-related effects on water quality. In addition, water conveyance facilities are designed and would be constructed to accommodate the 200-year flood event on top of the H++ extreme scenario for 2100 of 10.2 feet of sea level rise, so they would not increase the risk of release of pollutants upon inundation under the assumed 2070 sea level rise of 3.5 feet. Finally, the north Delta intakes are located on the Sacramento River where they are less vulnerable to salinity intrusion from sea level rise (Appendix 5A, Section F).

4A.6.5 Fish and Aquatic Resources

4A.6.5.1 2070 Fish and Aquatic Resource Conditions

Under the assumed 2070 conditions for the No Project Alternative, climate change and sea level rise will remain key factors driving potential changes to conditions for fish and aquatic resources relative to existing conditions. Changes in winter runoff patterns due to increased rain-based precipitation would lead to changes in the timing and volume of Delta inflow/outflow, which could affect fish and aquatic resources. These changed seasonal flow patterns could result in mixed effects on fish and aquatic resources in the Delta. For example, increases in December through March runoff (Section 4A.6.1, *Surface Water/Water Supply*) would result in greater inflow to the Delta and greater Delta outflow. Existing statistical relationships suggest this could result in greater longfin smelt abundance indices (see illustration of climate change effects at 2040 based on comparison of No Project Alternative to existing conditions in Chapter 12, Impact AQUA-7). There is significant uncertainty in this relationship given that the existing statistical relationships are derived from historical conditions; changes in other factors such as temperature and associated ecosystem shifts may result in changes to statistical relationships between longfin smelt abundance indices and flow in the future.

Increased Delta inflow from large storm events is projected to result in increases in sediment loading relative to existing conditions. Based on an ensemble of climate change predictions, predictions for sediment loading at midcentury (2040–2069) are 33% greater than existing conditions, and predictions for the end of the century (2070–2099) are nearly 40% greater than existing conditions (Stern et al. 2020:9), although there is significant uncertainty and leveling off or declines in sediment loading are also plausible outcomes (Stern et al. 2020:13). Should increases in sediment loading occur, this may help bolster the resilience of marshes against sea level rise by

aiding in marsh accretion, thereby sustaining habitat of many native fish species (Stern et al. 2020:13). Other potential positive effects of greater sediment loading include greater turbidity, reducing risk of predation (Stern et al. 2020:13). Potential negative effects in the Delta include greater light attenuation and potential adverse effects on benthic and photosynthetic organisms (Stern et al. 2020:13).

Although there may be some positive effects from climate change as noted above, negative effects are also likely, particularly with respect to native fish and aquatic resources. Prime among the negative effects are potential direct and indirect effects of temperature increases. For example, the number of physiologically stressful days (mean daily water temperature $\geq 24^{\circ}\text{C}$) per year for juvenile delta smelt in west and north Delta habitats is projected to increase from approximately 0 to 40 days per year or less in 2010 through 2019 to approximately 20 to 100 days per year in 2070 through 2079, depending on the assumed climate change scenario and location (Brown et al. 2016:10). Indirect effects of increased temperature include the potential for greater prevalence of CHABs, which may degrade habitat quality for species such as delta smelt (Flow Alteration – Management Analysis and Synthesis Team 2022:36; see also Section 4A.6.4, *Water Quality*). As noted in Section 4A.6.4, depending on hydrologic conditions, sea level rise may result in higher EC (salinity) in the Delta, which in the context of fish and aquatic resources may change species distributions, including nonnative *Potamocorbula amurensis* clams that consume foodweb materials of native fish and expand upstream during lower flow/higher salinity conditions (Kimmerer et al. 2019:20–22).

4A.6.5.2 Proposed Project Operation Effects on Fish and Aquatic Resources

Impact mechanisms of the proposed project operations under 2070 conditions are expected to be the same as those discussed under conditions in 2040. The expected effects on fish and aquatic resources, in terms of the relative magnitude of difference compared to the No Project Alternative at 2070, would generally be similar to those discussed in Appendix 12C, *Fish and Aquatic Resources 2040 Analysis*. Based on flow-survival relationships (see discussion of *Through-Delta Survival* in Impact AQUA-2 analysis within Chapter 12), operations in 2070 generally would be expected to result in less difference between the proposed project operations and the No Project Alternative in through-Delta survival for migrating juvenile salmonids at 2070 than between the proposed project and the No Project Alternative at 2040 because of greater inflows to the Delta as a result of climate change-related changes in precipitation patterns (Section 4A.6.1.1, *2070 Surface Water/Water Supply Conditions*). As noted above, there is uncertainty in the extent to which statistical relationships based on historical observations over the past several decades (e.g., Polansky et al. 2021; Smith et al. 2021) may apply in future scenarios given the changes expected as a result of climate change beyond flow.

4A.6.6 Terrestrial Biological Resources

4A.6.6.1 2070 Terrestrial Biological Resource Conditions

Under conditions in 2070 for the No Project Alternative, the quantity or quality of available habitat for terrestrial species would be affected by climate change and sea level rise. Sea level rise, in combination with more extreme flooding, could cause increased inundation of various habitats. As described in Sections 4A.3 and 4A.6.1, changes in land use and diversion may occur in 2070, thus

reducing cultivated agricultural land, including crops that some wildlife have become dependent on, such as alfalfa for Swainson's hawk and corn for sandhill cranes. Reductions to the quantity and quality of water suitable for irrigation due to sea level rise and upstream hydrologic conditions may affect crop production on crop lands used by some special-status wildlife for foraging and nesting (e.g., tricolored blackbird, greater sandhill crane) (Delta Stewardship Council 2021:5-34, 5-35).

4A.6.6.2 Proposed Project Operation Effects on Terrestrial Biological Resources

Effects from proposed project operation under 2070 conditions would be the same as those discussed under conditions in 2040. Specifically, there would be no additional effects on or changes to riparian species or different riparian habitat conditions as a result of the proposed project operations in 2070 as compared to 2040 conditions. Additionally, proposed project operation effects would have no additional effects on or changes to tidal and nontidal aquatic communities, wetlands (all), vernal pools and plants, or grasslands. The proposed project would not conflict with conservation plans in the study area, and proposed project operations would not change the bed, channel, or bank of rivers, streams, and lakes or the deposition of materials into these resources subject to notification under California Fish and Game Code Section 1600 *et seq.*

4A.6.7 Agricultural Resources

4A.6.7.1 2070 Agricultural Resource Conditions

Conditions in 2070 under the No Project Alternative would be similar to those reported in Appendix 15C, *Agricultural Resources 2040 Analysis*. Specifically, it is expected that land designated as Important Farmland or farmland under a Williamson Act contract or within a Farmland Security Zone would decrease due to continued urban growth, salination of coastal aquifers from sea level rise, and flooding of farmland and increased drought due to climate change effects, changing hydrologic conditions, and changes in diversions (as described in Sections 4A.3 and 4A.6.1). In addition, reduced groundwater supplies may also increase long-term fallowing of farmland (remapping some Important Farmland to the non-Important category).

4A.6.7.2 Proposed Project Operation Effects on Agricultural Resources

Proposed project operations under 2070 conditions would be similar to those reported in Appendix 15C. Like 2040 conditions, project operations could indirectly affect agricultural production by altering the quality of agricultural irrigation water, especially in the western Delta. However, the natural interannual variability in Delta outflows, sea level rise, and changing hydrological conditions would be larger drivers of EC levels in the Delta compared to project-related effects on EC levels. Further, crops in these areas are typically salt-tolerant and harvested before the early fall, which is when irrigation water with increased levels of EC are more likely to be utilized. Given this, the effects from project operations on farmland would be similar to Impact AG-3 described in Appendix 15C.

4A.6.8 Recreation

4A.6.8.1 2070 Recreation Conditions

Under conditions in 2070 for the No Project Alternative, changes in upstream hydrologic conditions and sea level rise could have indirect effects on recreational facilities. Specifically, some shoreline recreation facilities could be affected by varying water levels. Changes to land or shoreline use under the No Project Alternative at 2070 could occur due to the inundation of Delta lands associated with sea level rise. Depending on their location, recreational facilities such as marinas, boat launches, and parks could be subject to disruption in the event of a levee failure and may not be economically viable to be placed back in use if a severe inundation event were to occur.

4A.6.8.2 Proposed Project Operation Effects on Recreation

Compared to 2040 conditions, changes in flow patterns in Delta waterways under 2070 conditions could result in shifts to flows at parks or other recreation facilities near waterways, depending on flows in dry or wet years during project operations. However, these changes are expected to be within the range of variability Delta boaters experience currently and would not affect recreationists' boating enjoyment. In addition, total suspended solids or turbidity are expected to be similar to operation effects under 2040 conditions, within threshold standards, and not noticeable to recreational users in the Delta or adjoining waterways. Erosion and deposition processes—driven by tidal flow velocity changes—would also be similar to operation effects under 2040 conditions; thus, boating channels and the forces that change and shape them would be expected to be similar to existing conditions (refer to Chapter 16 for further details). No additional construction or expansion of recreation facilities is expected as a result of long-term project operation in 2070.

4A.6.9 Socioeconomics

4A.6.9.1 2070 Socioeconomic Conditions

Under conditions in 2070 for the No Project Alternative, increased drought frequency and magnitude as a result of climate change is likely to reduce the reliability of annual SWP or CVP water deliveries. New limits on groundwater extraction and use due to implementation of SGMA are likely to lead to decreases in water availability for agricultural, environmental, and urban uses. Some housing and populations could be affected by this reduction in water availability. Reductions in agricultural output would also be expected due to decreased water availability under the No Project Alternative at 2070.

4A.6.9.2 Proposed Project Operation Effects on Socioeconomics

The reliability of annual water deliveries to the SWP, and potentially CVP, under the proposed project operation may decrease under 2070 conditions compared to 2040 conditions. However, the proposed project would continue to deliver water for agricultural and urban uses in SWP, and potentially CVP, service areas. With changed hydrologic conditions, proposed project operations under the 2070 scenario would provide more water for agricultural use than under the No Project Alternative in 2070, which may reduce land fallowing. Proposed project operation in 2070 would also improve urban water supply compared to under the No Project Alternative in 2070.

4A.6.10 Energy

4A.6.10.1 2070 Energy Conditions

Under conditions in 2070 for the No Project Alternative, indirect impacts on energy may occur as a result of changes in hydrologic conditions and sea level rise that could result in a risk to infrastructure from inundation. Given hydrologic changes discussed in Section 4A.2, *Climate Change and Surface Water Conditions*, and potential changes in water management discussed in Section 4A.4, *Potential Future Water Management*, hydropower production may experience year to year volatility depending on precipitation and snowpack by 2070 compared to 2040 conditions. SWP and CVP electricity consumption throughout California is expected to be similar to 2040 conditions.

4A.6.10.2 Proposed Project Operation Effects on Energy

Impacts of the proposed project operation on energy consumption under 2070 conditions are expected to be the same or less, on average, when compared to energy consumption expected under proposed project operations in 2040 because long-term average exports are expected to be similar to or decrease compared to 2040. Because the proposed project is not expected to affect upstream reservoir operations, the proposed project would not affect hydropower production.

4A.6.11 Air Quality and Greenhouse Gases

4A.6.11.1 2070 Air Quality and Greenhouse Gas Conditions

Emissions for equipment and vehicles are expected to be lower in 2070 compared to 2040 because of expected continued improvements in engine technology and existing regulations to reduce combustion emissions across the entire SWP and CVP system.

4A.6.11.2 Proposed Project Operation Effects on Air Quality and Greenhouse Gases

During proposed project operations in 2070, there would be no difference in operating emissions intensity of equipment and vehicles compared to the 2040 analysis presented in Appendix 23F, *Air Quality and Greenhouse Gases 2040 Analysis*. Since technological improvements and regulatory drivers are expected to result in lower magnitude of emissions, it is therefore expected that impacts on air quality from proposed project operations would be lower in 2070 compared to 2040. Since the impact mechanism from proposed project operations would be the same as those discussed in Chapter 23, *Air Quality and Greenhouse Gases*, it is expected that effects on air quality would generally be similar to those described in Chapter 23 compared to the No Project Alternative at 2070. Similarly, it is expected that effects on GHGs would generally be less than those described in Chapter 23 compared to the No Project Alternative based on Senate Bill 100, which requires that zero-carbon resources comprise 100% of electric retail sales to end-use customers by 2045.

4A.6.12 Public Health

4A.6.12.1 2070 Public Health Conditions

Under conditions in 2070 for the No Project Alternative, impacts on water quality due to climate change effects could result in formation of disinfection byproducts in drinking water due to changes in bromide concentrations in the Delta due to increased salinity in the Delta from sea level rise. In addition, conditions in 2070 could result in an increase in mosquito populations from higher temperatures, increasing vector-borne diseases. Finally, it is expected that 2070 conditions would result in increased CHABs from higher water temperatures and longer hydraulic residence times in the Delta during certain years.

4A.6.12.2 Proposed Project Operation Effects on Public Health

Proposed project operation under conditions in 2070 would not result in different effects or impacts for increases in vector-borne diseases; exceedance(s) of water quality criteria for constituents of concern (e.g., CHABs) such that drinking water quality may be affected; or substantial mobilization of or increase in constituents known to bioaccumulate than those under 2040 conditions discussed in Appendix 26A, *Public Health 2040 Analysis*.

4A.6.13 Environmental Justice

4A.6.13.1 2070 Environmental Justice Conditions

Under conditions in 2070 for the No Project Alternative, impacts on environmental justice communities within the Delta may occur as the result of changes in upstream hydrologic conditions, sea level rise, and rising temperatures, since minority and low-income communities are generally more vulnerable to harm from adverse environmental events than the general population (American Rivers 2022). These changes could also result in increased risk of flooding in minority and low-income communities.

4A.6.13.2 Project Operation Effects on Environment Justice

As discussed in Section 4A.6.1, although water delivery to SWP, and potentially CVP, service areas is likely to be reduced compared to existing or 2040 conditions under the No Project Alternative, proposed project operation in 2070 is still expected to provide beneficial effects on water supply conditions in minority and low-income communities within the SWP export service areas, supplement or reduce groundwater use, and increase economic security for those industries that rely on water compared to the No Project Alternative under 2070 conditions.

4A.6.14 Tribal Cultural Resources

4A.6.14.1 2070 Tribal Cultural Resource Conditions

Chapter 32, *Tribal Cultural Resources*, identified the Delta as a Tribal Cultural Landscape (TCL) and a Tribal cultural resource, and analyzed effects on the character-defining features that contribute to the significance of the Delta TCL. Many of the character-defining features of the Delta TCL are water-related resources, including water quality, water supply, surface water, and aquatic resources.

Under 2070 conditions, flow-related changes could affect the water-related, character-defining features as described in previous sections (e.g., Section 4A.6.1, *Surface Water/Water Supply*; Section 4A.6.4, *Water Quality*; and Section 4A.6.5, *Fish and Aquatic Resources*).

4A.6.14.2 Proposed Project Operation Effects on Tribal Cultural Resources

The effect of operations of Alternative 5 under the 2070 scenario would be similar to the effects analyzed in Chapter 32. As described in Section 4A.6.1, *Surface Water/Water Supply*; Section 4A.6.3, *Groundwater*; 4A.6.4, *Water Quality*; and Section 4A.6.5, *Fish and Aquatic Resources*, the flows in the Delta under Alternative 5 under the 2070 scenario are not likely to substantially differ from those described in Chapter 32 for Alternative 5, and therefore the effects on water-related, character-defining features for the Delta TCL is expected to be relatively similar.

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