Chapter 6
Water Supply

This chapter describes potential changes to State Water Project (SWP) and Central Valley Project (CVP) water supply that could result from implementation of the Delta Conveyance Project (project). Changes to water supply, by themselves, are not considered an impact under CEQA and are not evaluated as impacts in this chapter. Potential changes to SWP and CVP water supply are described in this introductory chapter to provide a basis for understanding the impact assessments associated with other resource chapters in this document.

Many of the changes or impacts evaluated in this document are related to the potential changes to water supply described in this chapter. Chapter 5, *Surface Water*, is an introductory chapter to describe changes in surface waters of the Sacramento River and San Joaquin River Basins, including the Delta, that could be directly or indirectly affected by SWP and CVP operations. Chapter 7, *Flood Protection*, describes flood management such as regulated flow and storage, and flood protection facilities such as levees in the study area. Chapter 8, *Groundwater*, describes groundwater characteristics in the Sacramento and San Joaquin River Basins. Chapter 9, *Water Quality*, describes surface water quality in the Sacramento and San Joaquin River Basins. Chapter 12, *Fish and Aquatic Resources*, and Chapter 13, *Terrestrial Biological Resources*, discuss riparian corridor biological resources in the study area that are dependent on water supply and surface water flows. Chapter 29, *Environmental Justice*, describes the potential for disproportionately high and adverse effects on minority or low-income populations and draws upon the estimated water deliveries reported in this chapter to support portions of the impact assessment. Chapter 31, *Growth Inducement*, describes potential effects on urban areas caused by changes in SWP and CVP water supply deliveries.

Water supplies and approaches to water supply management vary significantly throughout California depending on supply sources and on various urban, agricultural, and environmental water needs. The study area for the SWP and CVP water supply analysis in this chapter includes the Delta region, areas upstream of the Delta (if modeling indicates a potential change as a result of the project alternatives), and the SWP and CVP south-of-Delta export service areas (i.e., areas that receive water from the Delta watershed that is delivered by the Harvey O. Banks Pumping Plant [Banks Pumping Plant] and C. W. "Bill" Jones Pumping Plant [Jones Pumping Plant]) and SWP's north-of-Delta export service areas (e.g., areas in Napa and Solano Counties delivered through the North Bay Aqueduct). The SWP and CVP are operated in a coordinated manner. Joint points of diversion allow the use of one project's diversion facility by the other under certain conditions. In part, both the SWP and CVP water delivery systems rely on runoff and reservoir releases in areas upstream of the Delta to deliver contracted water via the Sacramento and San Joaquin Rivers to Delta export pumps in the south Delta.

The Delta watershed includes the tributary rivers that flow directly into the Delta from the east and the Sacramento River and San Joaquin River Basins. In general, the Delta watershed is represented by the drainage of the Central Valley except for the Tulare Lake area. Areas outside of the Delta that receive water from the Delta watershed include Tulare Lake Basin, Solano County, Napa County, San Francisco Bay Area (Bay Area), Central Coast, and Southern California. Figure 1-2 in Chapter 1, *Introduction,* shows the major SWP and CVP water supply infrastructure. Figure 1-3 shows the SWP and CVP service areas.

6.0 Summary Comparison of Alternatives

Table 6-0 provides a summary comparison of modeled changes to SWP and CVP south of delta water supply by alternative. Some potential water supply changes are not included in the modeling, including the potential benefit associated with having a backup water supply to help prepare for earthquake risk.

Changes to water supply, by themselves, are not considered an impact under CEQA and are not evaluated as impacts in this chapter. Potential changes to SWP and CVP water supply are described in this introductory chapter to provide a basis for understanding the impact assessments associated with other resource chapters in this document. The project alternatives do not include any actions that would modify water deliveries to non-SWP and non-CVP water rights holders, including in-Delta water rights holders. Therefore, only changes to California Department of Water Resources (DWR), Bureau of Reclamation (Reclamation), and SWP water users and CVP water service contractors are included. No specific impact assessment results are presented in this chapter because the effects of these changes are not considered environmental impacts under CEQA.

Table 6-0. Water Supply for Existing Conditions and the Project Alternatives (thousand acre-feet)

Chapter 6 – Water Supply	Existing Conditions	Project Alternative								
		1	2a	2b	2c	3	4a	4b	4c	5
Total Annual SWP Deliveries Long-Term Average [a, d] (SWP Contract Year; January–December)	2,429	2,968	2,959	2,838	2,923	2,968	2,959	2,838	2,923	2,972
Total Annual SWP Deliveries, Average of Dry and Critical Water Years [b, d] (SWP Contract Year; January–December)	1,317	1,634	1,605	1,541	1,589	1,634	1,605	1,541	1,589	1,633
Total Annual South-of-Delta [c] CVP Deliveries, Long-Term Average [a] (CVP Contract Year; March–February)	1,587	1,634	1,678	1,610	1,629	1,634	1,678	1,610	1,629	1,633
Total Annual CVP South-of-Delta Deliveries, Average of Dry and Critical Water Years [b] (CVP Contract Year; March–February)	945	963	996	963	970	963	996	963	970	963

[a] Long-term average is the average annual for the period October 1921–September 2015 simulated in CalSim 3.

[b] Dry and critical is the average annual for the State Water Resources Control Board Water Right D-1641 40-30-30 dry and critical years for the period October 1921–September 2015 simulated in CalSim 3.

[C] Values do not include deliveries to exchange contractors.

[d] Values do not include deliveries to senior water right holders in the Feather River Service Area under various settlement agreements.

6.1 Overview of California Water Resources

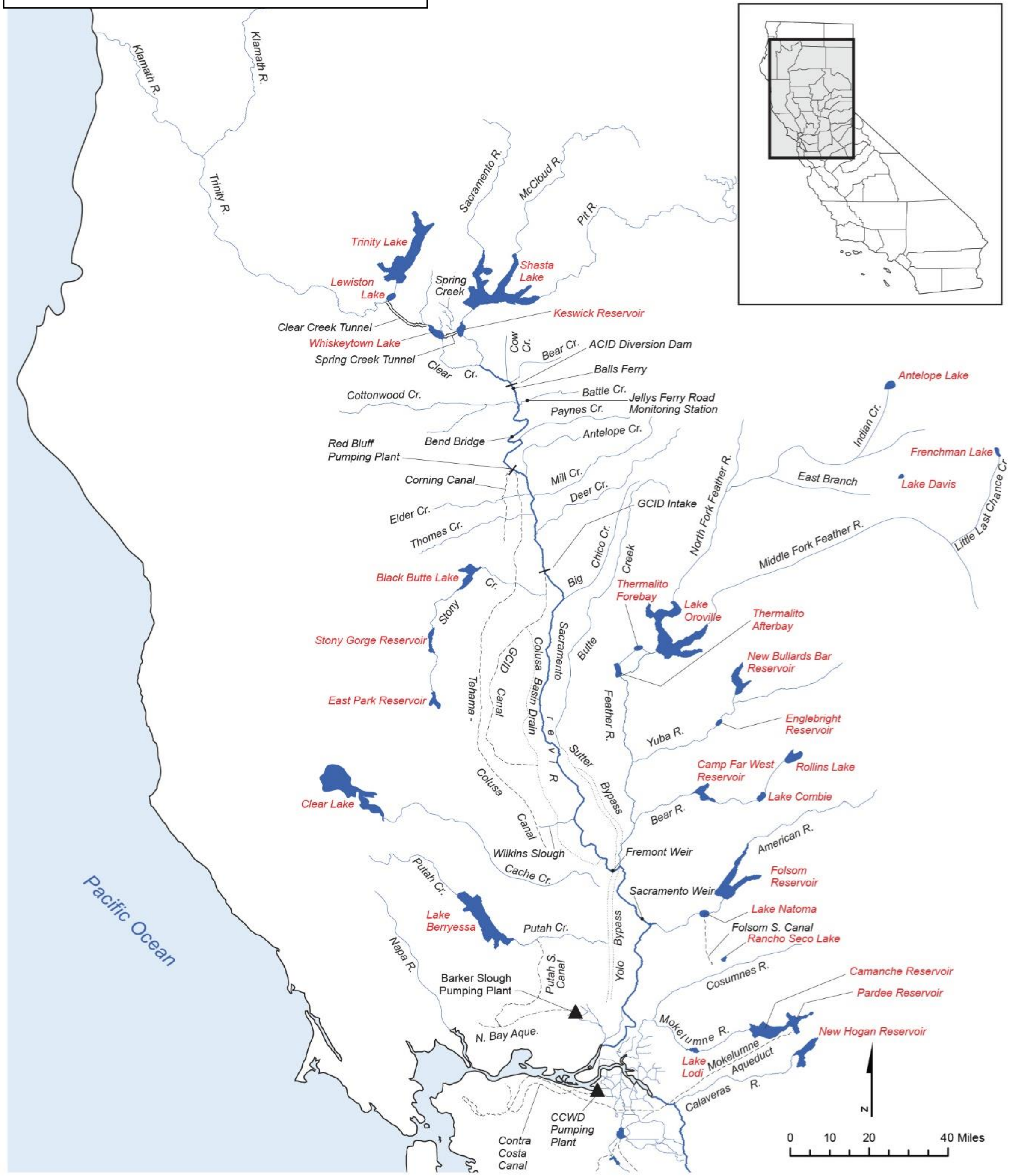
As described in Chapter 5, *Surface Water*, and Chapter 8, *Groundwater*, California's water resources vary dramatically geographically across the state because of extreme differences in precipitation conditions. Precipitation is a considerable source of California's water supply; however, it varies greatly from year to year, by season, and by where it falls geographically in the state. In winter and spring, precipitation and snowmelt are captured in surface water reservoirs to provide flood protection and water supply.

To cope with the state's hydrologic variability, state, federal, and local agencies have constructed a vast interconnected system of surface reservoirs, aqueducts, and water diversion facilities. This system helps California to store and convey water supplies from areas that have water available to areas that have water needs. In most regions of the state, these imported water supplies supplement local and regional water sources.

6.1.1 Developed Water Supplies

California has a long history of constructing large water infrastructure projects. The SWP, originally proposed in 1930, is a collection of canals, pipelines, reservoirs, and hydroelectric power facilities that delivers water to 27 million Californians, 750,000 acres of farmland, and businesses throughout the state. In addition to the SWP, other large water infrastructure projects include Hetch Hetchy Reservoir and Aqueduct, which supply water to the San Francisco Bay Area; Pardee Reservoir and the Mokelumne Aqueduct, which supply water to the East Bay in the San Francisco Bay Area; the federal CVP (including the Friant-Kern Canal), which supplies water to the Central Valley and Bay Area; the Colorado Aqueduct, which supplies water to Southern California; and the Los Angeles Aqueduct, comprising the Owens Valley Aqueduct and Second Los Angeles Aqueduct, which supplies water to the city of Los Angeles, as shown on Figures 6-1a, 6-1b, and 6-1c.

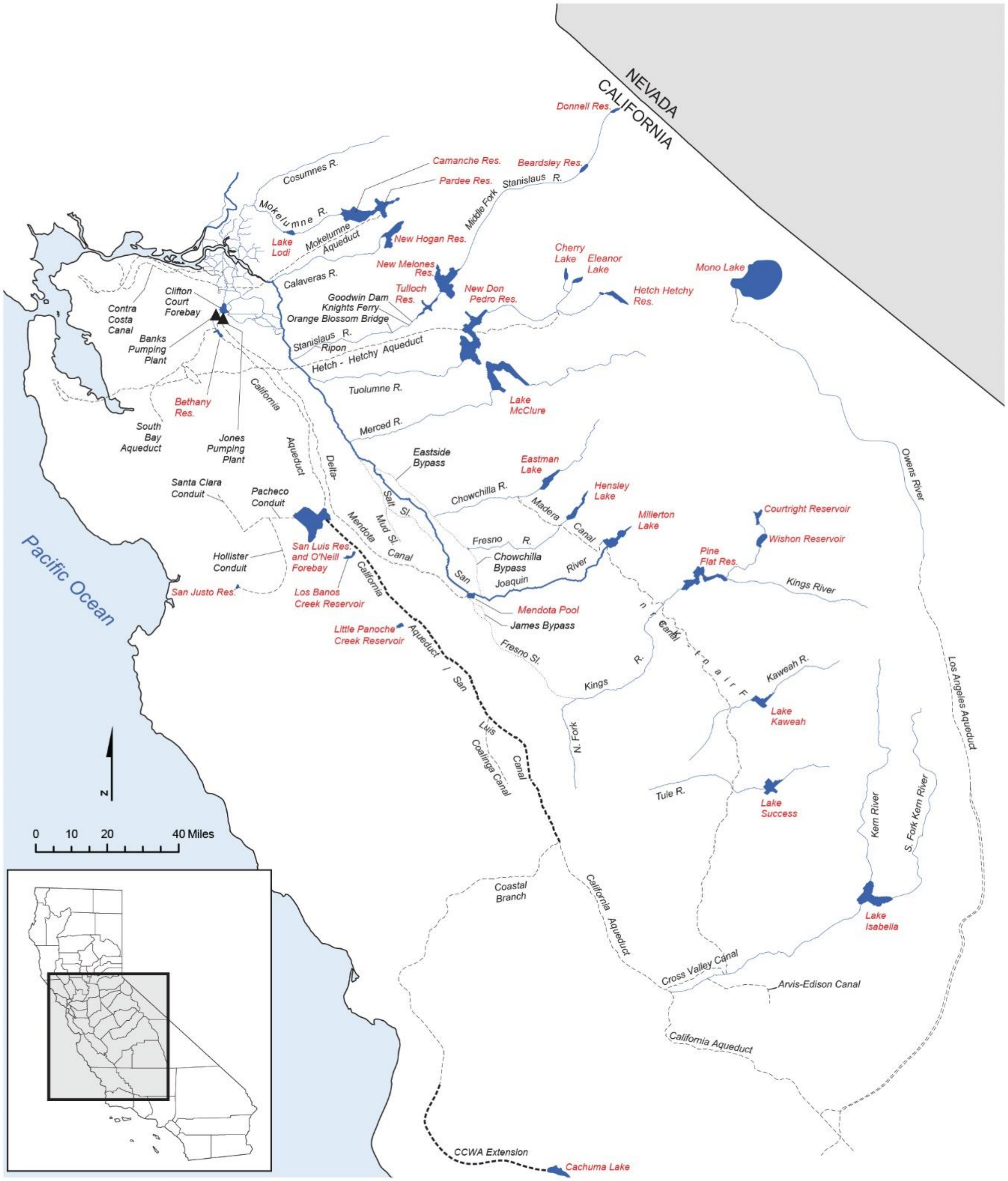
A text description of this figure is provided in Chapter 39, *Text Descriptions of Figures*



Source: US Bureau of Reclamation and Sites Project Authority 2017: 6-2

Figure 6-1a. Developed Water Supply Projects in Northern California

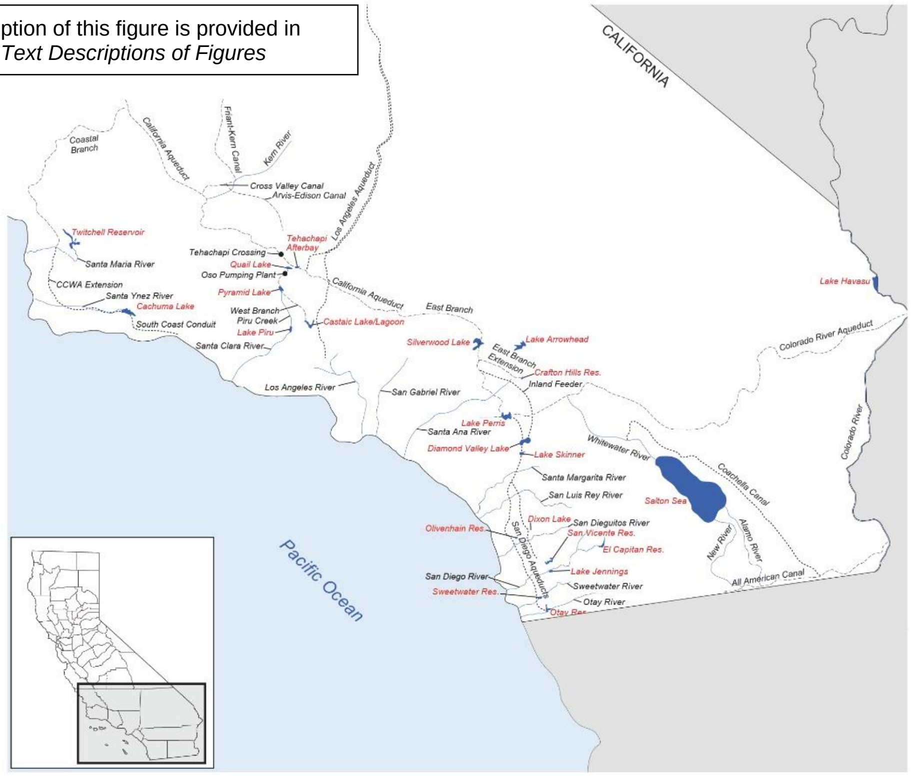
A text description of this figure is provided in Chapter 39, *Text Descriptions of Figures*



Source: US Bureau of Reclamation and Sites Project Authority 2017: 6-3

Figure 6-1b. Developed Water Supply Projects in San Francisco Bay Area, San Joaquin Valley, and Tulare Lake

A text description of this figure is provided in Chapter 39, *Text Descriptions of Figures*



Source: US Bureau of Reclamation and Sites Project Authority 2017: 6-4

Figure 6-1c. Developed Water Supply Projects in Central Coast and Southern California

6.1.2 Surface Water

This section provides a brief overview of California surface water resources related to water supply. Chapter 5 provides a detailed description of surface water resources in the study area.

In California, winter precipitation and spring snowmelt are captured in surface water reservoirs to provide flood protection and water supply. The state's largest surface water "reservoir" is the Sierra Nevada snowpack, which is the primary source of water supply and natural groundwater recharge in California (California Department of Water Resources 2019a:1-14). The timing, quantity, and location of precipitation in California is distributed largely across the northern and mountainous regions of the state and generally occurs during the cool, winter months; however, agricultural and urban water uses are generally concentrated in the southern, coastal, and valley regions of the state and precipitation generally occurs during the warm summer and fall seasons.

To cope with the state's hydrologic variability, state, federal, and local agencies have constructed vast interconnected systems (i.e., the SWP and CVP) of surface reservoirs, aqueducts, and water diversion facilities. These systems help California store and convey water supplies from areas that have sufficient water to areas that are water deficient. In most regions of the state, these imported water supplies supplement local and regional water sources. California depends on these statewide water management systems to provide clean and reliable water supplies, protect lives and property from floods, endure drought, and sustain environmental values including the restoration and enhancement of terrestrial, wetland, and aquatic ecosystems.

6.1.3 Groundwater

Groundwater is water that exists underground in saturated zones beneath the land surface, and exists throughout California. This section provides a brief overview of California groundwater resources related to water supply. Chapter 8 provides a detailed description of groundwater resources in the study area.

The importance of groundwater as a resource varies regionally. For example, the Central Coast Hydrologic Region has the most reliance on groundwater to meet its local uses, with more than 90% of its water use supplied by groundwater in an average year. The Tulare Lake Hydrologic Region meets about 69% of its local uses with groundwater extraction. The rest of the Central Valley meets between 15% and 35% of local uses with groundwater. In Southern California, the use of groundwater varies between 15% and 37% of annual use (South Coast Hydrologic Region) and 40% of annual use (South Lahontan Hydrologic Region) (California Department of Water Resources 2021a:H-16). Within each of these regions, some local areas are 100% reliant on groundwater.

Groundwater resources will not be immune to climate change; in fact, historical patterns of groundwater recharge have changed considerably in recent years. During droughts, California has historically depended more heavily upon groundwater, and because droughts are expected to be exacerbated by climate change, efficient groundwater basin management is necessary to avoid additional overdraft and to take advantage of opportunities to store water underground and eliminate existing and future overdraft.

A new era for California's groundwater began in September 2014 with the passage of the Sustainable Groundwater Management Act (SGMA). SGMA established a path for the sustainable management of groundwater through the formation of locally organized groundwater sustainability agencies and locally developed groundwater sustainability plans. In response to the requirements of Section 12924 of the California Water Code and SGMA, in December 2016 DWR completed an interim update of Bulletin 118, addressing time-sensitive information important to implementation of the SGMA Program. The purpose of the interim update was to provide up-to-date information on groundwater basins subject to critical conditions of overdraft, groundwater basin boundaries, and basin prioritization (California Department of Water Resources 2016:11).

In January 2016, DWR released the final list of groundwater basins subject to critical conditions of overdraft. Bulletin 118, Update 1980 defines a groundwater basin subject to critical conditions of overdraft as follows: "[a] basin is subject to critical conditions of overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts" (California Department of Water Resources 1980:9). Several basins were identified as being in a critical condition of overdraft, most of which are in the Tulare Lake and San Joaquin River Basins.

In March 2021, DWR released the *Draft Groundwater Update 2020*, the first in what will be a series of 5-year updates required by SGMA. The 2020 update identifies 515 defined alluvial groundwater systems (basins) throughout the state (California Department of Water Resources 2021a:H-11). The majority of California's land area (about 60%) is outside of defined groundwater basins or subbasins, known as non-basin areas; yet groundwater extraction in these areas accounted for only about 5.7% of statewide groundwater production in 2014 (California Department of Water Resources 2021a:2-12). These basins, subbasins, and non-basins have various degrees of supply reliability, considering yield, storage capacity, and water quality.

6.1.4 Alternative Water Sources

Alternative sources of water, such as recycled water, desalinated water, and stormwater, are becoming more commonplace as part of California's water supply. Alternative water sources improve water supply reliability and the state's ability to withstand drought conditions.

California Water Code Section 13050 defines *recycled water* as "water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource." Recycled water is currently used for groundwater recharge; indirect potable reuse; repelling seawater intrusion; landscape irrigation; and industrial, agricultural, and environmental uses. The State Water Resources Control Board (State Water Board) is developing policy and regulations for direct potable reuse. The most recent survey of municipal water recycling, conducted jointly by DWR and the State Water Board, found that California used 714,000 acre-feet of municipal recycled water during 2015. This was an increase of 45,000 acre-feet since the previous survey in 2009 (California Department of Water Resources 2021b).

Water desalination is the removal of salts and dissolved solids from saline water (brackish water [including groundwater] or seawater), also known as desalting or desalinization. Desalination is receiving increased attention as a means for addressing the water supply challenges of California. In 2002, the California Legislature approved Assembly Bill 2717, which asked DWR to convene the California Water Desalination Task Force to look into potential opportunities and impediments for using seawater and brackish water desalination, and to examine what role, if any, the state should play in furthering the use of desalination technology. A primary finding of the task force is that economically and environmentally acceptable desalination should be considered as part of a balanced water portfolio to help meet California's existing and future water supply and environmental needs. Existing desalination facilities provide about 81,000 acre-feet annually to municipal water supplies. Seven seawater desalination plants are in various stages of planning and operation, with outputs ranging from about 2 acre-feet per year to over 50,000 acre-feet per year, and have the potential to contribute over 130,000 acre-feet annually. Several large-scale brackish groundwater desalination projects have been implemented in Alameda County, Ontario, Orange County, Perris, and Carson. Some facilities produce up to 14 million gallons a day of fresh water from brackish groundwater (CalDesal 2022).

Stormwater can be captured and stored in a variety of ways, including green roofs, infiltration basins, detention basins, and bioretention raingardens. Captured stormwater can be stored in underground tanks and reservoirs for use on-site or can be used to support groundwater recharge. Historically, stormwater was managed through flood control conveyance facilities to move urban stormwater to receiving waters as quickly as possible and prevent the collection of floodwaters on roads and in urban centers. Local and regional agencies, such as Fresno Metropolitan Flood Control District and Los Angeles County have implemented stormwater capture runoff projects to support groundwater recharge, improve water quality conditions, and attenuate flood flows. The capture and use of urban runoff, including gray water, as part of the water supply portfolio is an emerging consideration; however, barriers such as infrastructure needs, market pricing, and regulations still need to be overcome. The State Water Board has partnered with other state and local agencies to develop strategies to overcome barriers and increase stormwater capture and use to augment surface water supplies, recharge groundwater, and support ecosystems.

6.2 Overview of California Water Demand

Limitations on available surface water, groundwater, and the potential impacts of climate change pose significant challenges to meeting the state's water demands. Population growth is a major factor influencing current and future water uses. California's population is expected to increase from approximately 40.1 million in 2020 to approximately 41.2 million by the year 2025 and 44.8 million by 2050 (California Department of Finance 2021). A larger population requires more water, all other things being equal. However, significant progress in water conservation and water use efficiency has been made and has resulted in reduced per capita use and an overall slowing of the increase in water demand notwithstanding population growth. For example, major water reuse programs such as the Los Angeles County Sanitation District's Water Reuse Program and the City of San Diego's Recycled Water Program, as well as the Silicon Valley Advanced Water Purification Center in San Jose, reduce the demand for potable water that often depends on imported water from the SWP and other sources.

California is one of the most productive agricultural regions in the world. Agriculture is an important element of California's economy, with 77,100 farms and ranches receiving a total of $50.13 billion for their output in 2017, according to the California Department of Food and Agriculture (California Department of Food and Agriculture 2018:2). In an average year, California irrigates approximately 9.6 million acres of land with roughly 34 million acre-feet (MAF) of water (California Department of Water Resources 2021c).

Another important use of water is for environmental purposes. This includes water use for meeting flow and water quality standards established for various regions and waterbodies, including instream flow standards and regional plans such as the Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary and associated State Water Board's Water Right Decision 1641 (D-1641). Other applicable laws and regulations with specific water flow and quality requirements also contributed to the environmental water demand. These include the 2019 Biological Opinion (BiOp) issued by the U.S. Fish and Wildlife Service (USFWS) (U.S. Fish and Wildlife Service 2019) and another 2019 BiOp by the National Marine Fisheries Service (NMFS) (National Marine Fisheries Service 2019) for the coordinated long-term operations of the SWP and CVP, the Incidental Take Permit (ITP) by the California Department of Fish and Wildlife (CDFW) on long-term operations of the SWP (California Department of Fish and Wildlife 2020), and the Central Valley Project Improvement Act (CVPIA), which have all directly and indirectly resulted in the dedication of water to fish, wildlife, and habitat restoration. This dedication is accomplished by releasing water from upstream reservoirs for in-river and Delta outflow requirements and by reducing exports from the south Delta pumping plants during specific times, among other actions (California Department of Water Resources 2018).

The state's water resources are variable, and agricultural, urban, and environmental water uses all vary accordingly. In wetter water years with high levels of precipitation, agricultural and urban landscape (outdoor) water demands are lower because higher precipitation, especially in the early spring season, helps meet the needs of these water uses. As a result, applied water demands for urban and irrigated agriculture are usually highest during average to below-average water years.

Table 6-1 shows the precipitation and statewide water use in California from 2011 (a wet year) to 2015 (a critically dry year) compiled by DWR. Californians meet water demands primarily by using local surface water and groundwater supplies, as well as imported water through extensive regional and statewide networks of water storage and conveyance facilities (e.g., the SWP), and through continued improvement of water use efficiency. Additional emerging water supplies include recycled water and desalination in major urban and coastal areas, respectively, as previously mentioned.

Table 6-1. California Water—Precipitation and Applied Statewide Water Use, 2011–2015

Water Year	2011	2012	2013	2014	2015
Precipitation (millions of acre-feet)	248.1	138.9	142.0	102.6	143.3
Applied Water Use [a] (millions of acre-feet)					
Urban	7.7	8.3	8.3	8.1	7.0
Irrigated Agriculture	31.7	35.0	35.7	35.0	32.4
Environmental Water [b]	53.2	33.9	29.8	21.7	24.7

Source: California Department of Water Resources 2019b:3.

[a] *Applied water* refers to water delivered to a user, either indoors or outdoors, and typically occurs in an agricultural or urban setting.

[b] *Environmental water* refers to water allocated to: managed wetlands, minimum required Delta outflow, instream flow requirements, and wild and scenic rivers.

6.2.1 SWP and CVP Facilities and Operations

The Delta Conveyance Project is proposed as an SWP facility; however, the SWP operation is linked to that of the CVP through the Coordinated Operation Agreement (Section 6.2.1.3, *SWP/CVP Coordinated Operations*, *Coordinated Operation Agreement*) that was first established in 1986 and amended in 2018 (Bureau of Reclamation and California Department of Water Resources 1986, 2018). Thus, pertinent descriptions of CVP operation are also included in the discussions of Section 6.2.1.2, *CVP Facilities*, and Section 6.2.1.3.

DWR and Reclamation operate the SWP and the CVP, respectively, to divert, store, and convey water consistent with applicable laws and regulations, and contractual obligations for agricultural, urban, and environmental beneficial uses in the Sacramento River Basin, the Delta, and south of the Delta.[1] The SWP and CVP both include major reservoirs upstream of the Delta and transport water via natural watercourses and canal systems to areas south and west of the Delta. The CVP also includes facilities and operations on the Stanislaus and San Joaquin Rivers.

Operations of the SWP and CVP are highly regulated. The SWP and CVP must meet operational requirements in D-1641 to help meet Delta water quality objectives, as well as requirements in federal BiOps and state ITPs that are intended to protect certain fish and wildlife species. The state also regulates the SWP directly through the State Water Board under California's Porter-Cologne Water Quality Control Act and California's implementation of the federal Clean Water Act. DWR and Reclamation closely coordinate the SWP and CVP operations, respectively, to meet these conditions; however, these regulations can have significant effect on the amount of water the projects can deliver. For the federal, state, and local/regional laws, regulations, and programs that affect water supply operations, see Chapter 1, *Introduction.*

[1] The SWP and CVP will continue to be operated in accordance with D-1641 until a new water rights decision is adopted by the State Water Board.

6.2.1.1 SWP Facilities

The SWP is a multipurpose project with major facilities, including Lake Oroville and Dam, North Bay Aqueduct, Banks Pumping Plant, San Luis Reservoir, South Bay Aqueduct, and California Aqueduct. In addition to its water supply purpose, the SWP also provides functions for flood management, recreational, and environmental purposes. DWR holds contracts with 29 public water agencies for up to a maximum amount of 4.17 MAF in the Feather River Area, North Bay Area, South Bay Area, San Joaquin Valley, Central Coast, and Southern California for water supplies from the SWP. Water stored in the Oroville facilities provides water supply to the Feather River Service Area (FRSA) (i.e., Butte County, Yuba City, and Plumas County Flood Control and Water Conservation District) and is diverted through the Delta, along with available water in the Delta, for delivery to north-of-Delta contractors in Solano and Napa Counties and south-of-Delta SWP long-term water contractors (SWP water contractors) in the Bay Area, San Joaquin Valley, Central Coast, and Southern California. In addition to the 29 contractors, DWR also provides water to senior water right holders in the FRSA and the Delta based on its water right settlement agreements for construction and operation of the SWP. In the past decade, the SWP delivered on average 2.9 MAF of contracted water supplies annually (California Department of Water Resources 2021d:xxxvii). The following subsections provide additional descriptions of SWP facilities and operation.

Oroville Field Division

Lake Oroville has a storage capacity of approximately 3.5 MAF, and is fed by the North, Middle, and South forks of the Feather River. Average annual unimpaired runoff into the lake is about 4.5 MAF. Oroville Dam and related facilities comprise a multipurpose project. The reservoir stores winter and spring runoff, which is later released from storage into the Feather River to meet SWP demands and the project needs. It also provides on-peak and regular hydropower generation with the use of the Thermalito Afterbay and according to water release needs to meet all purposes. Lake Oroville also provides up to 750 thousand acre-feet (TAF) of flood control storage and significant recreation opportunities. It also provides freshwater releases for salinity control in the Delta and for fish and wildlife protection in the Feather River and downstream areas. The location of the Oroville facilities is shown in Figure 6-1a.

Approximately 4 miles downstream of Oroville Dam and Edward Hyatt Powerplant is the Thermalito Diversion Dam. Thermalito Diversion Dam consists of a 625-foot-long, concrete gravity section with a regulated ogee spillway that releases water to the Low Flow Channel of the Feather River. On the right abutment is the Thermalito Power Canal regulating headwork structure. The purpose of the diversion dam is to create a tailwater pool (called Thermalito Diversion Pool) for Edward Hyatt Powerplant and divert water into the 2-mile-long Thermalito Power Canal that conveys water in either direction. The Thermalito Diversion Pool acts as a forebay when Edward Hyatt Powerplant is pumping water back into Lake Oroville when needed. However, the feature was not used in recent years due to water temperature concerns. On the left abutment is the Thermalito Diversion Dam Powerplant with a capacity of 600 cubic feet per second (cfs), which releases water to the low-flow section of the Feather River.

Local agricultural districts, referred to as Settlement Contractors, divert water directly from the afterbay. These diversion points are in lieu of the traditional river diversion exercised by the local districts whose water rights are senior to the SWP.

Current operations of the Oroville facilities are governed, in part, by water temperature requirements at two locations: the Feather River Fish Hatchery and in the Low Flow Channel at Robinson Riffle. The existing Feather River flow requirements below Oroville Dam are based on an August 1983 Agreement between the DWR and CDFW (then California Department of Fish and Game [CDFG]). The 1983 Agreement established criteria and objectives for flow and temperatures in the Low Flow Channel, Feather River Fish Hatchery, and the High Flow Channel.

Until the Federal Energy Regulatory Commission (FERC) issues the new license for the Oroville facilities, including all hydropower facilities in the complex, DWR will comply with the terms and conditions of the existing FERC license. The pending license does not include specifications outside of the complex, and thus it is assumed that downstream of Thermalito Afterbay Outlet, the flows under a new FERC license are not likely to be different than under the existing license.

Delta Field Division

SWP facilities in the southern Delta include Clifton Court Forebay, John E. Skinner Fish Protective Facility (Skinner Fish Facility), and the Banks Pumping Plant. SWP operates these facilities under a variety of permits and agreements, including the Coordinated Operation Agreement, which is further described in Section 6.2.1.3.

Clifton Court Forebay is a reservoir with a capacity of 31,000 acre-feet at the southwestern edge of the Delta, about 10 miles northwest of Tracy. Clifton Court Forebay provides storage for off-peak pumping, moderates the effect of the pumps on the fluctuation of flow and stage in adjacent Delta channels, and collects sediment before it enters the California Aqueduct. Diversions from Old River into Clifton Court Forebay are regulated by five radial gates.

The Skinner Fish Facility is west of Clifton Court Forebay, 2 miles upstream of the Banks Pumping Plant. The Skinner Fish Facility screens fish away from the pumps that lift water into the California Aqueduct. Large fish and debris are prevented from entering the facility by a 388-foot-long trash boom. Smaller fish are diverted from the intake channel into bypasses by a series of metal louvers, while the main flow of water continues through the louvers toward the pumps. These fish pass through a secondary system of screens and pipes into seven holding tanks, where a subsample is counted and recorded. The salvaged fish are then returned to the Delta in oxygenated tank trucks. Very small fish typically remain in the main flow of water, and are transported to the pumps and exported from the Delta.

The Banks Pumping Plant is in the south Delta, about 8 miles northwest of Tracy; it marks the beginning of the California Aqueduct. The plant discharges into five pipelines that convey water into a roughly 1-mile-long canal, which in turn conveys water to the Bethany Reservoir. By means of 11 pumps, including 2 rated at 375 cfs capacity, 5 at 1,130 cfs capacity, and 4 at 1,067 cfs capacity, the plant provides the initial lift of water 244 feet into the California Aqueduct. The nominal capacity of the Banks Pumping Plant is 10,300 cfs. The maximum daily pumping rate at the Banks Pumping Plant is controlled by a combination of D-1641, adaptive management, and permits issued by the U.S. Army Corps of Engineers (USACE) that regulate the rate of diversion of water into Clifton Court Forebay for pumping at the Banks Pumping Plant. The diversion rate is normally restricted to 6,680 cfs as a 3-day average inflow and 6,993 cfs as a 1-day average inflow to Clifton Court Forebay in accordance with the existing USACE Section 10 permit issued pursuant to the Rivers and Harbors Act (State Water Resources Control Board 2017:2-69).

The Banks Pumping Plant lifts water into the California Aqueduct, which then flows to Bethany Reservoir. From Bethany Reservoir, the South Bay Pumping Plant lifts water into the South Bay Aqueduct to supply portions of Alameda and Santa Clara Counties. South Bay Aqueduct facilities include Lake Del Valle and Patterson Reservoir. Also from Bethany Reservoir, the 444-mile-long California Aqueduct conveys water to the primarily cultivated lands of the San Joaquin Valley and the mainly urban regions of Southern California and the Central Coast.

The Barker Slough Pumping Plant diverts water from Barker Slough into the North Bay Aqueduct for delivery in Napa and Solano Counties. Maximum pumping capacity is 175 cfs (pipeline capacity). During the past few years, daily pumping rates have ranged between 0 cfs and 140 cfs. The current maximum pumping rate is 140 cfs because an additional pump is required to be installed to reach 175 cfs. In addition, growth of biofilm in a portion of the pipeline is also limiting the North Bay Aqueduct's ability to reach its full capacity.

The North Bay Aqueduct intake is approximately 10 miles from the mainstem Sacramento River at the end of Barker Slough. Per CDFW fish screening criteria, each of the 10 North Bay Aqueduct pump bays is individually screened with a positive barrier fish screen consisting of a series of flat, stainless steel, wedge-wire panels with a slot width of 3/32 inch. This configuration is designed to exclude fish approximately 1 inch or larger from being entrained.

San Luis Field Division

The California Aqueduct transports water to O'Neill Forebay. Water in the forebay can be released to the San Luis Canal or pumped into San Luis Reservoir by the William R. Gianelli Pumping-Generating Plant (Gianelli Pumping-Generating Plant); these facilities are jointly used with Reclamation for CVP operations. DWR generally pumps water through the Gianelli Pumping-Generating Plant into San Luis Reservoir during late fall through early spring for temporary storage until water is released to meet late-spring and summer peak demands of SWP water contractors.

The San Luis Reservoir is an offstream storage facility along the California Aqueduct downstream of the Jones and Banks Pumping Plants. The CVP and SWP share San Luis Reservoir storage roughly 50/50 (SWP has 1,062 TAF of storage, and CVP has 966 TAF of storage). San Luis Reservoir is used to meet deliveries to the CVP and SWP contractors during periods when Delta pumping is insufficient to meet demands.

The San Luis Reservoir operates as a regulator accepting any water pumped from the Jones and Banks Pumping Plants that exceeds contractor demands, then releasing that water back to the aqueduct system when the pumping at the Jones and Banks Pumping Plants is insufficient to meet demands. The reservoir allows the SWP to meet peak-season demands that are seldom balanced by Jones and Banks pumping.

As the San Luis Reservoir is drawn down to meet contractor demands, it usually reaches its low point in late August or early September. From September through early October, demand for deliveries declines until it is less than the rate of diversions from the Delta at the Jones and Banks Pumping Plants.

SWP water pumped directly from the Delta and water eventually released from San Luis Reservoir continues to flow south in the San Luis Canal, a portion of the California Aqueduct jointly used by the SWP and CVP. The joint use ends near Kettleman City, and the SWP portion of the California Aqueduct continues.

San Joaquin Field Division

The San Joaquin Field Division, in Bakersfield, serves Kern, Kings, San Luis Obispo, and Santa Barbara Counties. The field division is responsible for the operation and maintenance of 123 miles of the California Aqueduct, as well as the Coastal Branch Aqueduct. Four pumping plants known as the Valley String move water over the Tehachapi Mountains and into Southern California. The Buena Vista Pumping Plant, the first in the Valley String, is on the California Aqueduct about 24 miles southwest of Bakersfield in Kern County. The plant operates in a series of sequential lifts in southern San Joaquin Valley to convey California Aqueduct water to and across the Tehachapi Mountains. The Buena Vista Pumping Plant provides the first lift from an elevation of 295.4 to 500.6 feet. The John R. Teerink Wheeler Ridge (Teerink) Pumping Plant is on the California Aqueduct about 27 miles downstream from the Buena Vista Pumping Plant. The Teerink Pumping Plant provides the second lift from an elevation of 492 to 724.5 feet and furnishes water for a turnout in the reach of the aqueduct that leads to the Ira J. Chrisman Wind Gap (Chrisman) Pumping Plant. An in-line plant, the Chrisman Pumping Plant is situated on the California Aqueduct about 1.6 miles downstream from the Teerink Pumping Plant. It lifts SWP water 518 feet for its journey to the A. D. Edmonston Pumping Plant, which is the final plant in the Valley String and the largest of the 21 SWP pumping plants. The Edmonston Pumping Plant's two main discharge lines stair-step 8,400 feet up the mountainside to a 62-foot-high, 50-foot-diameter surge tank.

The field division also maintains and operates the Coastal Branch Aqueduct, which extends 14.8 miles, and includes nearly 100 miles of buried pipelines and five pumping plants. In the San Joaquin Valley near Kettleman City, Phase I of the Coastal Branch Aqueduct includes the Las Perillas Pumping Plant and the Badger Hill Pumping Plant and serves agricultural areas west of the California Aqueduct. The Las Perillas Pumping Plant, about 1 mile from the California Aqueduct, provides the first lift for delivery of SWP water from the aqueduct through the first 15 miles of the Coastal Branch Aqueduct. The Badger Hill Pumping Plant is 3 miles downstream from the Las Perillas Pumping Plant and provides the second lift for delivery through the first 15 miles of the aqueduct.

The Coastal Branch's Phase II extended the conveyance facility to serve municipal and industrial (M&I) water users in San Luis Obispo and Santa Barbara Counties. Phase II consists of three pumping plants that lift water 1,500 feet and convey it through buried 57-inch-diameter pipelines to the summit of Polonio Pass in the Temblor Mountain Range: the Devil's Den Pumping Plant, Bluestone Pumping Plant, and Polonio Pass Pumping Plant.

Southern Field Division

The remaining water conveyed by the California Aqueduct is delivered to Southern California, home to about one-half of California's total population. Before this water can be delivered, the water must first cross the Tehachapi Mountains. Pumps at the Edmonston Pumping Plant, situated at the foot of the mountains, raise the water 1,926 feet—the highest single lift of any pumping plant in the world. From there, the water enters about 8 miles of tunnels and siphons as it flows into Antelope Valley, where the California Aqueduct divides into two branches: the East Branch and the West Branch.

The East Branch carries water through the Tehachapi East Afterbay, Alamo Powerplant, Pearblossom Pumping Plant, and Mojave Siphon Powerplant into Silverwood Lake in the San Bernardino Mountains, which stores 73,000 acre-feet of water. From Silverwood Lake, water flows through the San Bernardino Tunnel into Devil Canyon Powerplant. Water continues down the East

Branch to Lake Perris, the terminus of the East Branch. Lake Perris lies just east of Riverside, has a capacity of 131,500 acre-feet, and serves as a regulatory and emergency water supply facility for the East Branch.

Phase I of the East Branch Extension of the California Aqueduct provides conveyance facilities to deliver SWP water to San Gorgonio Pass Water Agency and to the eastern portion of the San Bernardino Valley Municipal Water District, which delivers water to areas such as Yucaipa, Calimesa, Beaumont, Banning, and other communities. The East Branch Extension is composed of a combination of existing San Bernardino Valley Municipal Water District facilities and newly constructed SWP facilities. While the new pipelines were designed for the ultimate conveyance capacity, the installed Phase I pumping capacity was less than one-half the ultimate capacity—enough to meet the immediate foreseeable demand for SWP water. Phase II brought the extension to its ultimate storage and conveyance capacity with the new Citrus Reservoir and Pump Station, enlargement of the Crafton Hills Dam, and additional pipelines (California Department of Water Resources 2018).

At the bifurcation of the California Aqueduct in Antelope Valley, the West Branch carries water through the Oso Pumping Plant, Quail Lake, Lower Quail Canal, and William E. Warne Powerplant into Pyramid Lake in Los Angeles County. From there, water flows through the Angeles Tunnel, Castaic Powerplant, Elderberry Forebay, and Castaic Lake, the terminus of the West Branch. Castaic Lake is north of Santa Clarita, has a capacity of 324,000 acre-feet, and is a regulatory and emergency water supply facility for the West Branch. Castaic Powerplant is owned and operated by the Los Angeles Department of Water and Power.

6.2.1.2 CVP Facilities

Reclamation is the largest wholesale water supplier in the United States, and the nation's second largest producer of hydroelectric power. Its facilities also provide substantial flood management, recreation, and fish and wildlife benefits. Reclamation operates the CVP. Reclamation coordinates operation of CVP in the Delta with the SWP in accordance with the water rights permits issued by the State Water Board and the Coordinated Operation Agreement (Section 6.2.1.3).

The CVP consists of 20 dams and reservoirs that together can store nearly 12 MAF of water. Reclamation holds over 270 contracts and agreements for water supplies that depend upon CVP operations. Through operation of the CVP, Reclamation delivers water in 29 of California's 58 counties in the following approximate amounts: 5 MAF of water for farms, 600 TAF of water for M&I uses (i.e., enough water to supply about 2.5 million people for a year), and an average of 355 TAF of Level 2 CVP water supply for wildlife refuges (plus additional Level 2 and Incremental Level 4 supplies delivered from various sources). Reclamation operates the CVP under water rights granted by the State of California, including those intended to protect agricultural and fish and wildlife beneficial uses in the Delta. The following subsections provide a description of the major CVP facilities by operating division.

Trinity River Division

The Trinity River Division includes Trinity Lake, Lewiston Reservoir, the area along the Trinity River from Trinity Lake to the confluence with the Klamath River, and the lower Klamath River from the confluence with the Trinity River.

Trinity Lake is a CVP reservoir on the Trinity River with a capacity of 2.4 MAF. Trinity Lake storage varies according to upstream hydrology, downstream water demands, and instream flow requirements. Reclamation maintains at least 600 TAF in Trinity Reservoir, except during the years when Shasta Lake is at low levels (i.e., about 10% to 15% of years).

Lewiston Reservoir is a CVP facility on the Trinity River and is 7 miles downstream of Trinity Dam. Lewiston Reservoir is used as a regulating reservoir for downstream releases to the Trinity River and to Whiskeytown Lake. The Lewiston Reservoir water storage volume is more consistent throughout the year because this reservoir is used to regulate flow releases to the powerplant and other downstream uses and not to provide long-term water storage. The mean annual inflow to Trinity Lake is 1.26 MAF per year (water years 2001–2017). From water years 1965–1980, an average of 80% of inflow was diverted to the Sacramento River Basin. An average of 61% of inflow was diverted for water years 1981–2000. Under the Trinity River Record of Decision (U.S. Fish and Wildlife Service et al. 2000), an average of 51% of inflows has since been diverted (water years 2001–2017). Water is diverted from the lower outlets in Trinity Lake to Lewiston Reservoir to provide cold water to the Trinity River.

Trinity River exports are first conveyed through Carr Powerplant, which flows directly into Whiskeytown Lake. The average seasonal timing of Trinity River exports varies in an effort to conserve coldwater pools and meet temperature objectives on the upper Sacramento and Trinity Rivers and manage economics of power production. Periodically, increased water releases are made from Trinity Dam consistent with Reclamation Safety of Dams criteria intended to prevent dam overtopping. Although flood control is not an authorized purpose of the Trinity River Division, flood control benefits are provided through normal operations.

Diversion of Trinity water to the Sacramento Basin provides supplemental water supply and hydroelectric power generation for the CVP and assists in water temperature management in the upper Sacramento River.

Shasta/Trinity River Division

The CVP's Shasta Division includes facilities that conserve water in the Sacramento River for (1) flood control, (2) navigation maintenance, (3) agricultural water supplies, (4) M&I water supplies, (5) hydroelectric power generation, (6) conservation of fish in the Sacramento River, and (7) protection of the Delta from intrusion of saline ocean water. The Shasta Division includes Shasta Dam, Shasta Lake, and Shasta Powerplant; Keswick Dam, Keswick Reservoir, and Keswick Powerplant; and the Shasta Temperature Control Device.

Shasta Lake has a maximum storage capacity of 4.552 MAF. Shasta Dam is on the Sacramento River just below the confluence of the Sacramento, McCloud, and Pit Rivers. The dam regulates the flow from a drainage area of approximately 6,649 square miles. Water in Shasta Lake is released through or around the Shasta Powerplant to the Sacramento River, where it is further regulated downstream by Keswick Dam.

Historical water storage volumes for Shasta Lake range from 1.1 MAF to over 4.5 MAF, depending on upstream hydrology, downstream water demands, and instream flow and water temperature requirements.

Keswick Reservoir has a capacity of approximately 23,800 acre-feet and serves as an afterbay for releases from Shasta Dam and for discharges from the Spring Creek Powerplant. All releases from

Keswick Reservoir are made to the Sacramento River at Keswick Dam. The dam has a fish-trapping facility that operates in conjunction with the Coleman National Fish Hatchery on Battle Creek.

Reclamation operates the Shasta, Sacramento River, and Trinity River divisions of the CVP to meet (to the extent possible) the provisions of State Water Board Water Right Order 90-05 (Order 90-05). An April 5, 1960, memorandum of understanding between Reclamation and CDFW (then CDFG) originally established flow objectives in the Sacramento River for the protection and preservation of fish and wildlife resources. The agreement provided for minimum releases into the natural channel of the Sacramento River at Keswick Dam for normal and critical years. Since October 1981, Keswick Dam has operated based on a minimum release of 3,250 cfs for normal years from September 1 through the end of February, in accordance with an agreement between Reclamation and CDFW. This release schedule was included in Order 90-05, which maintains a minimum release of 3,250 cfs at Keswick Dam and Red Bluff Diversion Dam from September through the end of February in all water years, except critical years.

The CVP is operated to meet the navigation flow requirement of 5,000 cfs to Wilkins Slough (a gauging station on the Sacramento River), under all but the most critical water supply conditions, to facilitate pumping and use of screened diversions. At flows below 5,000 cfs at Wilkins Slough, diverters have reported increased pump cavitation as well as greater pumping head requirements. Diverters can operate for extended periods at flows as low as 4,000 cfs at Wilkins Slough, but pumping operations become severely affected and some pumps become inoperable at flows lower than this. Flows may drop as low as 3,500 cfs for short periods while changes are made in Keswick releases to reach target levels at Wilkins Slough, but using the 3,500 cfs rate as a target level for an extended period would have major impacts on diverters.

American River Division

Reclamation's Folsom Reservoir, the largest reservoir in the American River watershed, has a capacity of 967 TAF. The mean annual inflow to Folsom Lake is about 2.7 MAF per year. Folsom Dam, on the American River approximately 30 miles upstream from the confluence with the Sacramento River, is operated as a major component of the CVP. The American River Division includes facilities that provide conservation of water on the American River for flood management, fish and wildlife protection, recreation, meeting Delta flow and water quality requirements, irrigation and M&I water supplies, and hydroelectric power generation. Initially authorized features of the American River Division included Folsom Dam, Folsom Lake, and Folsom Powerplant; Nimbus Dam and Nimbus Powerplant; and Lake Natoma.

Nimbus Dam creates Lake Natoma, a forebay built to re-regulate flows of the American River and to direct water into the CVP Folsom South Canal. Releases from Nimbus Dam to the American River pass through the Nimbus Powerplant when releases are less than 5,000 cfs or through the spillway gates for higher flows. The American River flows 23 miles between Nimbus Dam and the confluence with the Sacramento River. Annual maximum water storage volumes for Folsom Lake for water years 2001–2021 vary between about 136 TAF and over 950 TAF, and for Lake Natoma between 6,800 acre-feet and over 8,600 acre-feet for the same period (California Department of Water Resources 2021e, 2021f).

Delta and West San Joaquin Divisions

The CVP's Delta Division includes the Delta Cross Channel, the Contra Costa Canal and Pumping Plants, Contra Loma Dam, Martinez Dam, the Jones Pumping Plant (formerly called Tracy Pumping

Plant), the Tracy Fish Collection Facility, and the Delta-Mendota Canal. The Delta Cross Channel is a gated diversion channel in the Sacramento River near Walnut Grove and Snodgrass Slough. The Contra Costa Water District (CCWD) diversion facilities use CVP water resources and water rights to serve district customers directly and to convey portions of the water into CCWD's Los Vaqueros Project. The Jones Pumping Plant diverts water from the Delta to the head of the Delta-Mendota Canal.

Flows into the Delta Cross Channel from the Sacramento River are controlled by two 60-foot by 30-foot radial gates. When the gates are open, water flows from the Sacramento River through the Delta Cross Channel to channels of the lower Mokelumne and San Joaquin Rivers toward the interior Delta. The Delta Cross Channel operation improves water quality in the interior Delta by improving circulation patterns of good quality water from the Sacramento River toward Delta diversion facilities. Between October 1 and May 20, the gates are operated to reduce juvenile salmonid entrainment risk.

The CVP uses the Sacramento River, San Joaquin River, and Delta channels to transport water to the export pumping plant in the south Delta: the Jones Pumping Plant, about 5 miles north of Tracy, which has six available pumps. The Jones Pumping Plant has a physical capacity of approximately 5,200 cfs. Because of limited capacity in the Delta-Mendota Canal, the plant is operated at a rate of approximately 4,600 cfs or below, unless Reclamation accesses the Delta-Mendota Canal/California Aqueduct Intertie to operate at the full physical capacity.

The Delta-Mendota Canal is operated and maintained by the San Luis and Delta-Mendota Water Authority under contract with Reclamation. The Delta-Mendota Canal begins at the Jones Pumping Plant and runs 117 miles south along the western edge of the San Joaquin Valley. Water may be pumped from the canal into O'Neill Forebay, and then pumped into San Luis Reservoir by the Gianelli Pumping-Generating Plant. The Delta-Mendota Canal ends at Mendota Pool, on the San Joaquin River near the town of Mendota. The Delta-Mendota Canal has an initial capacity of 4,600 cfs that decreases to about 3,200 cfs at its terminus.

Water demands for the Delta-Mendota Canal of the Delta Division and San Luis Unit of the West San Joaquin Division are primarily of three separate types: San Joaquin River Exchange Contractors, CVP water service contractors, and wildlife refuge contractors. A considerably different contractual relationship exists between Reclamation and contractors within each of these three groups. San Joaquin River Exchange Contractors agreed not to exercise their senior rights to water in the San Joaquin River for a CVP water supply from the Delta. Reclamation thus provided the San Joaquin River Exchange Contractors CVP water supply of 840 TAF per year, with a maximum reduction under the Shasta critical year criteria to an annual water supply of 650 TAF. CVP water service contractors that receive their CVP water supply from the Delta are subject to the availability of CVP water supplies that can be developed, and reductions in contractual supply can occur. Wildlife refuge contractors receive CVP water supplies for specific managed lands for wildlife purposes, and the CVP contract water supply can be reduced under Shasta critical year criteria up to 25%.

To achieve the best operation of the CVP, it is necessary to combine the contractual demands of these three types of contractors to achieve an overall pattern of requests for water. In most years sufficient supplies are not available to meet all water contractor demands because of statutory, regulatory, and water rights requirements. In some dry or critical years, water deliveries are limited because there is insufficient storage in northern CVP reservoirs to meet all statutory, regulatory, and water rights requirements including water temperatures, and to make additional water deliveries via the Jones Pumping Plant. The scheduling of water demands, together with the scheduling of the releases of water supplies from the northern CVP reservoirs and CVP San Luis Reservoir to meet those demands, is a CVP operational objective that is intertwined with the Trinity, Sacramento, and American River operations.

Stanislaus River Region

The Stanislaus River originates in the western slopes of the Sierra Nevada and drains a watershed of approximately 900 square miles. The average unimpaired runoff in the basin is approximately 1.2 MAF per year; the median historical unimpaired runoff is 1.1 MAF per year. Snowmelt contributes the largest portion of the flows in the Stanislaus River, with the highest runoff occurring in the months of April, May, and June. The flow in the lower Stanislaus River is primarily controlled by New Melones Reservoir, which has a storage capacity of about 2.4 MAF. New Melones Reservoir is approximately 60 miles upstream from the confluence of the Stanislaus River and the San Joaquin River and is operated by Reclamation.

New Melones Reservoir is operated primarily for purposes of water supply, flood management, power generation, fishery enhancement, and water quality improvement in the lower San Joaquin River. The reservoir and river also provide recreation benefits. Flood management operations are conducted in conformance with USACE's operational guidelines.

The operating criteria for New Melones Reservoir are affected by (1) water rights, (2) instream fish and wildlife flow requirements, (3) applicable D-1641 water quality and flow requirements, (4) dissolved oxygen requirements on the Stanislaus River, (5) CVP contracts, and (6) flood management considerations. Water released from New Melones Dam and Powerplant is re-regulated at Tulloch Reservoir and is either diverted at Goodwin Dam primarily for irrigation purposes or released from Goodwin Dam to the lower Stanislaus River.

D-1641 sets flow requirements on the San Joaquin River at Vernalis from February to June. These flows are commonly known as the Vernalis Bay-Delta flow requirements. Since D-1641 has been in place, the Vernalis Bay-Delta flow requirements have, at times, been an additional demand on the New Melones water supply beyond that provided for in the Interim Plan of Operation, which is the current operating plan for New Melones Reservoir.

San Felipe Division

The San Felipe Division provides a supplemental water supply in the Santa Clara Valley in Santa Clara County and the north portion of San Benito County. In addition to meeting demands in the San Joaquin Valley, the San Luis Reservoir is operated to supply water to the CVP San Felipe Division in San Benito and Santa Clara Counties. The San Felipe Division delivers both irrigation and M&I water supplies. Water is delivered within the service areas not only by direct diversion from distribution systems, but also through instream and offstream groundwater recharge operations being carried out by local interests. A primary purpose of the San Felipe Division in Santa Clara County is to provide supplemental water to help prevent land surface subsidence in the Santa Clara Valley caused by groundwater pumping. Santa Clara Valley Water District is the nonfederal operating entity for all the San Felipe Division facilities except for the Hollister Conduit and San Justo Reservoir.

Friant Division

Friant Dam is on the San Joaquin River, 25 miles northeast of Fresno where the San Joaquin River exits the Sierra Nevada foothills and enters the valley. The drainage basin is 1,676 square miles with an average annual runoff of 1.77 MAF.

The dam provides flood management on the San Joaquin River, provides downstream releases to meet senior water rights requirements above Mendota Pool, and provides conservation storage as well as diversion into Madera and Friant-Kern Canals. Water is delivered to a million acres of cultivated land in Fresno, Kern, Madera, and Tulare Counties in the San Joaquin Valley via the Friant-Kern Canal south into Tulare Lake Basin and via the Madera Canal north to Madera Irrigation District and Chowchilla Water District. A minimum of 5 cfs is required to pass the last water right holding about 40 miles downstream near Gravelly Ford. The reservoir, Millerton Lake, has a total capacity of 520,528 acre-feet.

6.2.1.3 SWP/CVP Coordinated Operations

DWR and Reclamation coordinate operations of water delivery facilities in the Central Valley. The water rights for the SWP and CVP are conditioned by the State Water Board to protect the beneficial uses of water in the Sacramento Valley. The SWP and CVP coordinate and operate to meet the jointly assigned water right requirements in the Delta.

Coordinated Operation Agreement

The *Agreement between the United States of America and the State of California for Coordinated Operation of the Central Valley Project and the State Water Project* (COA), signed in 1986, and subsequently amended in 2018, sets forth procedures for coordination of operations, identifies formulas for sharing joint responsibilities for meeting Delta standards and other legal uses of water, identifies how unstored flow will be shared, sets up a framework for exchange of water and services between the projects, and provides for periodic review of the agreement.

Reclamation and DWR operate their respective facilities in accordance with the COA. Implementation of the COA principles has continuously evolved since 1986 as changes have occurred to SWP and CVP facilities, to operating criteria, and to the overall physical and regulatory environment. For example, since 1986, when the COA was originally executed, updated water quality and flow standards adopted by the State Water Board, CVPIA, and Endangered Species Act (ESA) responsibilities have affected both SWP and CVP operations. The 1986 COA incorporated State Water Board Water Right Decision 1485 provisions regarding Delta salinity, outflow, and export restrictions. It also envisioned and provided a methodology to incorporate future regulatory changes, like Delta salinity requirements, but did not explicitly address sharing of export restrictions.

In 2018, Reclamation and DWR modified four key elements of the COA to explicitly address changes since the COA was signed: (1) in-basin uses including updated regulatory requirements since 1986, (2) export restrictions, (3) CVP use of the Banks Pumping Plant up to 195,000 acre-feet per year, and (4) periodic review.

Suisun Marsh Preservation Agreement

Since the early 1970s, the California Legislature, State Water Board, Reclamation, CDFW, Suisun Resource Conservation District, DWR, and other agencies have worked to preserve beneficial uses in Suisun Marsh. Early on, salinity standards were set by the State Water Board to protect alkali bulrush production, a primary waterfowl plant food. The most recent standard under D-1641 acknowledges that multiple beneficial uses deserve protection.

A contractual agreement between DWR, Reclamation, CDFW, and Suisun Resource Conservation District contains provisions for DWR and Reclamation to mitigate the effects on Suisun Marsh channel water salinity from the SWP and CVP operations and other upstream diversions. The Suisun Marsh Preservation Agreement requires DWR and Reclamation to meet salinity standards, sets a timeline for implementing the Plan of Protection, and delineates monitoring and mitigation requirements. In addition to the contractual agreement, State Water Board Water Right Decision 1485 adopted salinity standards in 1978, which have been carried forward to D-1641.

There are two primary physical mechanisms for meeting salinity standards set forth in D-1641: (1) the implementation and operation of physical facilities in the Marsh, and (2) management of Delta outflow (i.e., facility operations are driven largely by salinity levels upstream of Montezuma Slough and salinity levels are highly sensitive to Delta outflow). Physical facilities (described below) have been operating since the early 1980s and have proven to be a highly reliable method for meeting standards.

Suisun Marsh Salinity Control Gates

The Suisun Marsh Salinity Control Gates (SMSCG) are located on Montezuma Slough about 2 miles (3.22 kilometers) downstream from the confluence of the Sacramento and San Joaquin Rivers, near Collinsville. The objective of SMSCG operation is to decrease the salinity of the water in Montezuma Slough. The gates control salinity by restricting the flow of higher salinity water from Grizzly Bay into Montezuma Slough during incoming tides and retaining lower-salinity Sacramento River water from the previous ebb tide. Operation of the gates in this fashion lowers salinity in Suisun Marsh channels and results in a net movement of water from east to west through Suisun Marsh.

The SMSCG are operated during the salinity control season, which is October to May. Operational frequency is affected by salinity at D-1641 compliance stations, hydrologic conditions, weather, Delta outflow, tide, fishery considerations, and other factors. The boat lock portion of the gate is held partially open during SMSCG operation to allow an opportunity for continuous salmon passage. The boat lock gates may be closed temporarily, however, to stabilize flows to facilitate safe passage of watercraft through the facility.

Roaring River Distribution System

The Roaring River Distribution System was constructed as part of the Initial Facilities in the Plan of Protection for the Suisun Marsh. The system was constructed to provide lower-salinity water to 5,000 acres of private and 3,000 acres of CDFW-managed wetlands on Simmons, Hammond, Van Sickle, Wheeler, and Grizzly Islands.

Water is diverted through a bank of eight 60-inch-diameter culverts equipped with fish screens into the Roaring River intake pond on high tides to raise the water surface elevation in the distribution system above the adjacent managed wetlands. Managed wetlands north and south of the system receive water, as needed, through publicly and privately owned turnouts on the system.

Morrow Island Distribution System

The Morrow Island Distribution System was constructed in the southwestern Suisun Marsh as part of the Initial Facilities in the Plan of Protection for the Suisun Marsh. The contractual requirement for Reclamation and DWR is to provide water to the ownerships so that lands may be managed according to approved local management plans. The system was constructed primarily to channel drainage water from the adjacent managed wetlands for discharge into Suisun Slough and Grizzly Bay. This approach increases circulation and reduces salinity in Goodyear Slough.

The distribution system is used year-round, but most intensively from September through June. When managed wetlands are filling and circulating, water is tidally diverted from Goodyear Slough just south of Pierce Harbor through three 48-inch culverts.

South Delta Temporary Barriers Project

The South Delta Temporary Barriers Project was initiated by DWR in 1991. The project consists of four rock barriers across south Delta channels. The Temporary Barriers Project has been shown to improve water levels and water circulation in the south Delta and improves migration conditions for San Joaquin River salmon (California Department of Water Resources 2022). These rock barriers are designed to act as flow control structures, trapping tidal waters behind them after a high tide.

The Temporary Barriers Project will continue to be planned and permitted. Computer model simulations; real-time monitoring; and coordination with local, state, federal agencies, and interested parties will help determine if the temporary rock barriers operations need to be modified.

San Luis Joint-Use Complex

Water in the main stem of the California Aqueduct flows south by gravity into the San Luis Joint-Use Complex, which was designed and constructed by the federal government and is operated and maintained by DWR. This section of the California Aqueduct serves both the SWP and the CVP. San Luis Reservoir, the nation's largest offstream reservoir, is impounded by Sisk Dam and lies at the base of the foothills on the west side of the San Joaquin Valley in Merced County, about 2 miles west of O'Neill Forebay. The reservoir provides offstream storage for excess winter and spring flows diverted from the Delta. It is sized to provide seasonal carryover storage. The reservoir can hold about 2.03 MAF, of which 1.06 MAF (approximately 52%) is DWR's share, and 965 TAF (approximately 48%) is Reclamation's share. Construction began in 1963 and was completed in 1967. Filled in 1969, the reservoir also provides a variety of recreational activities as well as fish and wildlife benefits.

In addition to the Sisk Dam, San Luis Reservoir, and O'Neill Dam and Forebay, the San Luis Complex consists of the following.

- O'Neill Pumping-Generating Plant (federal facility).
- William R. Gianelli Pumping-Generating Plant (joint federal–state facilities).
- San Luis Canal (joint federal–state facilities).
- Dos Amigos Pumping Plant (joint federal–state facilities).
- Coalinga Canal (federal facility).

- Pleasant Valley Pumping Plant (federal facility).
- Los Banos and Little Panoche Detention Dams and Reservoirs (joint federal–state facilities).

The O’Neill Pumping-Generating Plant pumps water from the Delta-Mendota Canal to O’Neill Forebay, where it mixes with water from the California Aqueduct. From O’Neill Forebay, the water can either be pumped up into San Luis Reservoir via the Gianelli Pumping-Generating Plant or leave via the San Luis Canal. The Dos Amigos Pumping Plant is on the San Luis Canal and 18 miles southeast of Sisk Dam. It lifts water 113 feet from the aqueduct as it flows south from O’Neill Forebay.

Water is redirected into San Luis Reservoir during the fall, winter, and spring months when the two pumping plants usually can divert more water from the Delta than is needed for scheduled demands. Because the amount of water that can be diverted from the Delta is limited by available water supply, regulatory constraints, and the capacities of the two pumping plants, the fill and drawdown cycle of San Luis Reservoir is an extremely important element of project operations.

In April and May, export pumping from the Delta is limited during the D-1641 San Joaquin River pulse period standards as well as by the 2019 BiOps and 2020 ITP. During this same time, SWP/CVP irrigation demands are increasing. Consequently, by April and May, the San Luis Reservoir has begun the annual drawdown cycle. In some exceptionally wet conditions, when excess water supplies from the San Joaquin River or Tulare Lake Basin occur in the spring, the San Luis Reservoir may not begin its drawdown cycle until late in the spring.

In July and August, the Jones Pumping Plant diversion is at the maximum capability, and some CVP water may be exported using excess Banks Pumping Plant capacity as part of a Joint Point of Diversion (JPOD) operation. Irrigation demands are greatest during this period, and San Luis Reservoir continues to decrease in storage capacity until it starts to be refilled with local inflow and Delta diversion, and the cycle begins anew.

The operation of the San Luis Unit requires coordination between the SWP and CVP because some of its facilities are entirely owned by the State of California and others are joint-use state and federal facilities. San Luis Unit annual water supply is contingent on coordination with SWP and CVP needs and capabilities. When the SWP excess export capacity is used to support additional pumping for the CVP under the JPOD allowance, it may be of little consequence to SWP operations but extremely critical to CVP operations. The availability of excess SWP export capacity for the CVP is contingent, in part, on the ability of the SWP to meet its SWP water contractors’ water supply commitments. Generally, the CVP will utilize excess SWP export capacity; however, there are times when the SWP may need to utilize excess CVP export capacity. Additionally, close coordination by SWP and CVP is required during this type of operation to ensure that water pumped into O’Neill Forebay does not exceed the CVP’s capability to pump into San Luis Reservoir or into the San Luis Canal at the Dos Amigos Pumping Plant. Although secondary to water management concerns, power scheduling at the joint facilities also requires close coordination. Because of time-of-use power cost differences, both entities will likely want to schedule pumping and generation simultaneously. When facility capabilities of the two projects are limited, equitable solutions are achieved between the operators of the SWP and the CVP.

With the existing facility configuration, the operation of the San Luis Reservoir could affect the water quality and reliability of water deliveries to the San Felipe Division if San Luis Reservoir is drawn down too low. Reclamation addresses this condition through coordination with the San Felipe

Division contractors and may solicit cooperation from DWR, as long as changes in SWP operations to assist with providing additional water in San Luis Reservoir (beyond what is needed for SWP deliveries and the SWP share of San Luis Reservoir minimum storage) does not affect SWP allocations or deliveries. If the CVP is not able to maintain sufficient storage in San Luis Reservoir, there could be potential impacts on resources in Santa Clara and San Benito Counties. During summer months, algae blooms of up to 35 feet thick often develop in the reservoir. When reservoir storage levels drop below 300,000 acre-feet, algae blooms may enter the Pacheco Pumping Plant Lower Intake and affect drinking water treatment plant deliveries within Santa Clara County. Deliveries to Santa Clara and San Benito may be severely or completely interrupted when storage levels are drawn down such that there is insufficient hydraulic head to effectively operate the Pacheco Pumping Plant. Deliveries to other SWP and CVP contractors are made through the Gianelli Intake, which is about 40 feet lower than the Lower Pacheco Intake and is generally unaffected by the water quality and supply interruption issues that affect the San Felipe Division.

6.2.1.4 SWP and CVP Water Supplies and Deliveries

SWP Water Contracts

In the 1960s, DWR began entering into long-term water supply contracts (i.e., SWP water contracts) with 32 water districts or agencies to provide water from the SWP. Over the years, a few of these water agencies have been restructured, and today DWR has contracts with 29 public entities. These 29 SWP water contractors supply water to urban and agricultural water users in Northern California, the Bay Area, the San Joaquin Valley, the Central Coast, and Southern California. Of the contracted water supply, approximately three-quarters goes to M&I users, and one-quarter goes to agricultural users. Through these SWP water contracts, the SWP provides water to over 27 million people in California and 750,000 acres of farmland throughout the state (State Water Contractors 2021). The foundation of allocating water to each contractor is based on their respective "Table A" amount, which is the maximum amount of water that is allocated and delivered to them by the SWP on an annual basis. Under statewide contracts, DWR allocates Table A water as an annual supply made available for scheduled delivery throughout the year. Table A totals approximately 4.2 MAF, with more than 3 MAF for San Joaquin Valley and Southern California water users. Table A does not represent a guaranteed water supply but rather a maximum allocated amount. Although an SWP water contractor may request up to its full Table A amount of water each year, in practice the available water is allocated in proportion to Table A and is frequently less, sometimes much less, than the full Table A amount. The contracts have been amended numerous times. Most recently, DWR and the SWP water contractors negotiated a contract extension amendment, and a water management amendment. Both are described below. Additionally, DWR and the SWP contractors have negotiated a proposed amendment to the SWP water supply contracts to allocate the costs of a new Delta Conveyance facility, including the costs identified in Water Code Section 85089. See Chapter 1 for a description of the approval process.

On December 11, 2018, DWR approved the SWP Water Supply Contract Extension Project extending the term of each of the SWP water contracts to December 31, 2085, and amending certain financial and other provisions of the contracts. In early 2021, under the water management amendments, DWR implemented additional water management practices that allow SWP water contractors greater flexibility to move and store their allocated SWP supplies through transfers and exchanges among themselves. This allows contractors to better manage their water supplies and better utilize regional water supplies when necessary.

DWR uses a forecasting water supply allocation process that is updated monthly, incorporates known conditions in the Central Valley watershed to date, and forecasts future hydrologic conditions to estimate SWP Table A water supplies that can be delivered to SWP water contractors as the water year progresses.

The initial Table A allocation for SWP water contract deliveries is made by December 1 of each year with a conservative assumption of future precipitation to avoid over-allocating water before the hydrologic conditions are well defined for the year. As the water year unfolds, hydrology and water supply delivery estimates are updated using measured and known information and conservative forecasts of future hydrology.

Another water supply consideration is the contractual ability of SWP contractors to “carry over” allocated (but undelivered) Table A supplies from the previous year to the next if space is available in the San Luis Reservoir. The carryover storage is often used to supplement an individual contractor’s current year Table A allocations if conditions are dry. Carryover supplies left in San Luis Reservoir by SWP contractors can result in higher storage levels in San Luis Reservoir. As SWP pumping fills San Luis Reservoir, the contractors are notified to take, or lose, their carryover supplies. Carryover water not taken, after notice is given to remove it, then becomes water available for reallocation to all contractors in a given year.

Article 21 of the SWP water supply contracts provides an interruptible water supply made available only when certain conditions exist: (1) the SWP share of the San Luis Reservoir is physically full or is projected to be physically full; (2) other SWP reservoirs south of the Delta are at their storage targets, or the conveyance capacity to fill these reservoirs is maximized; (3) the Delta is in excess conditions; (4) current year Table A allocation, which may be far less than the 4,173 TAF maximum, is being fully met; and (5) the Banks Pumping Plant has export capacity beyond that which is needed to meet current year Table A allocation and other SWP operational demands.

Article 21 (beyond the current year Table A allocation) water, which is delivered early in the calendar year, may be reclassified as Table A water later in the year depending on final allocations, hydrology, and SWP water contractor requests. Reclassification does not affect the amount of water carried over in San Luis Reservoir, nor does it alter pumping volumes or schedules. Availability of SWP water supplies is also related to Article 56 of the SWP water contracts. Article 56 provides for storage by SWP water contractors of SWP and non-SWP water in SWP and non-SWP reservoirs and groundwater banks outside of their service areas, and programs to allow transfers and exchanges of SWP water between SWP water contractors.

CVP Water Contracts

As the divisions of the CVP became operational, Reclamation entered into long-term contracts with water districts, irrigation districts, and others for delivery of CVP water. Approximately 250 contracts provide for varying amounts of water. Most of these original contracts were for a term of 40 years. The nature of the contracts varies, as the CVP is operated to meet its obligations to deliver water to senior water right holders who diverted water prior to construction of the CVP, wildlife refuge areas identified in the CVPIA, and water service contractors. Some of the contracts, including the Sacramento River Settlement contracts, the San Joaquin Exchange Contracts, and certain refuge contracts, have defined minimum deliveries.

Reclamation renewed many of its settlement contracts and water service contracts in 2005 consistent with the requirements of the CVPIA following issuance of the 2004 NMFS and 2005

USFWS BiOps regarding the long-term operations of the SWP and CVP. For the contracts not reviewed, Reclamation executed interim water service contracts. Reclamation delivers water to the CVP contractors in accordance with contracts between Reclamation and the CVP contractors.

Reclamation allocates CVP water on an annual basis in accordance with contracts. Reclamation bases north-of-Delta allocations primarily on available water supply within the system north of the Delta along with expected controlling regulations throughout the year. For south-of-Delta allocations, Reclamation relies on upstream water supply, previously stored water south of the Delta (in San Luis Reservoir), and conveyance capability through the Delta. Flows on the San Joaquin River often limit conveyance, as these flows are a driver of the flow direction within the Delta and, through their influence on the Old and Middle River net reverse flow, can affect entrainment levels at the state and federal pumps.

The water allocation process for the CVP begins in the fall when Reclamation makes preliminary assessments of the next year's water supply possibilities, incorporating fall storage conditions combined with a range of forecasted hydrologic conditions. Reclamation refines these preliminary assessments as the water year progresses.

As the water year unfolds, Central Valley hydrology and water supply delivery estimates are updated using measured and known information and conservative forecasts of future hydrology.

Delta Water Exports

Delta exports and water deliveries to SWP and CVP contractors are subject to hydrologic, demand, and regulatory conditions that have changed significantly since the CVP provided initial water deliveries starting in the 1940s (Chapter 1, Section 1.2, *Background*). As described previously, California water demand has continued to increase as a consequence of population growth, expanded agricultural acreage in production, and the dedication of water supplies for environmental needs. The regulatory environment changed as new laws were enacted by Congress or the California State Legislature, and new regulatory requirements were imposed to reflect changed water management policy and practices to respond to major drought events and climate change. In-Delta water use has remained relatively constant over the past 100 years and averages about 4% (0.9 MAF) of inflows into the Delta (Delta Stewardship Council 2018:83). In recent decades, SWP and CVP Delta exports exhibit a relative plateau to decrease, in average, with increased variability and reduced reliability. Figure 6-2 shows the trend in annual Delta exports for the period 1970 through 2019 with a timeline of the major changes that have affected water supplies and demands, such as the construction of the San Felipe Unit, implementation of the CVPIA, the USFWS and NMFS BiOps, and the CDFW ITP. It is expected that the trend in exports will continue to decrease due to increasing regulatory and environmental needs, and changes in hydrologic conditions under climate change.

This page intentionally left blank

A text description of this figure is provided in Chapter 39, *Text Descriptions of Figures*

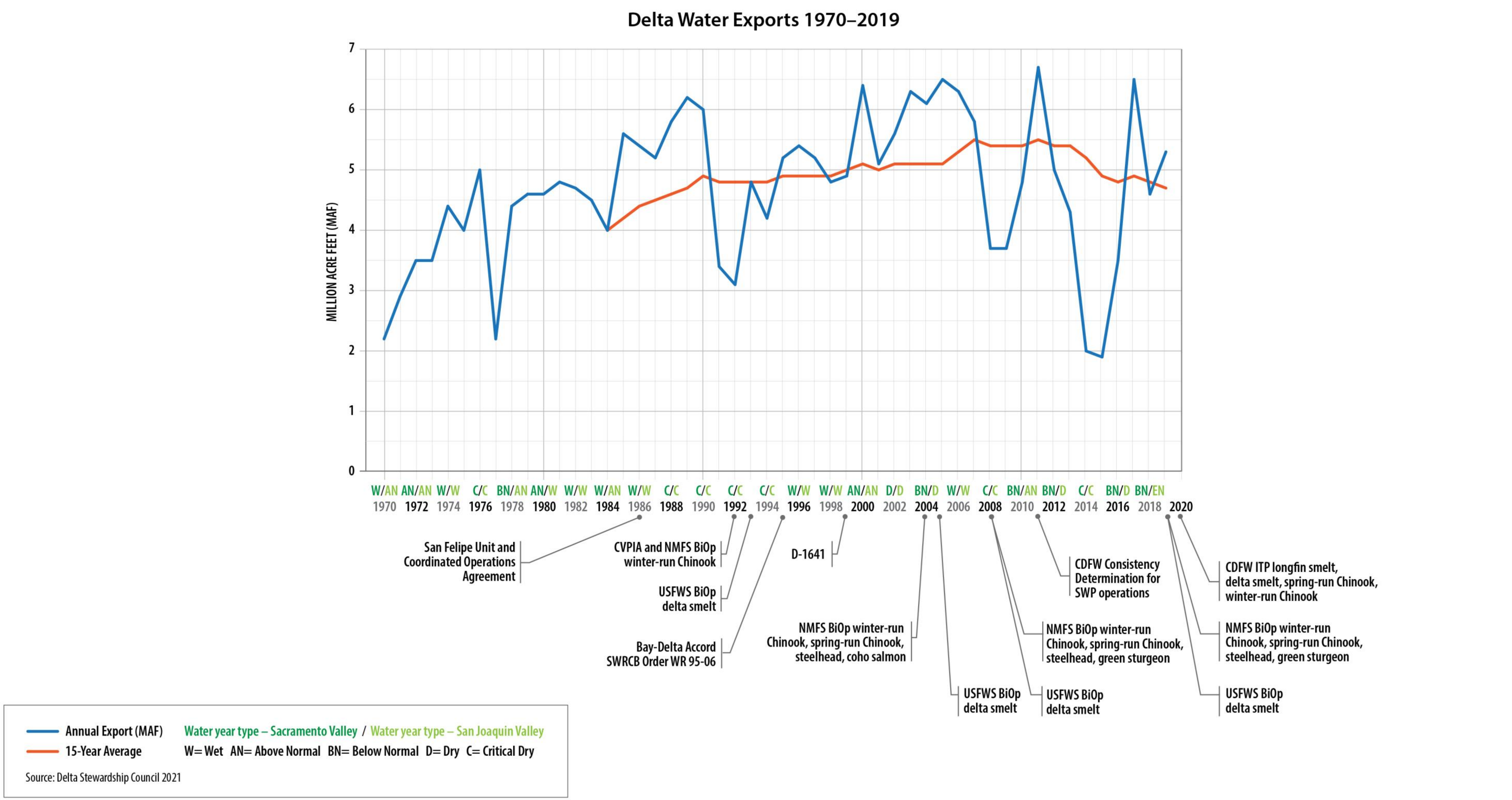


Figure 6-2. Delta Water Exports 1970–2019

This page intentionally left blank

6.2.1.5 Regional and Local Diversions from the Delta

There are over 2,200 diversions in the Delta area that are estimated to divert up to 5,000 cfs during peak summer months (California Department of Water Resources 2009:D-15). Most of the in-Delta diversions are related to agricultural operations. However, several communities divert surface water from the Delta, including the City of Antioch, City of Stockton, East Bay Municipal Utility District (EBMUD), Sacramento County, and CCWD. Numerous industries along the Contra Costa County shoreline from Martinez to Antioch, including powerplants and refineries, and industries in San Joaquin County near Stockton also divert surface water.

Surface water in the Delta also is influenced by consumptive use of groundwater by agricultural crops and by seepage from the surface water into the interior of the islands and tracts. A substantial portion of the water diverted from the Delta or that seeps into the islands and tracts is returned to the Delta surface water by agricultural and drainage flows and seepage that is pumped from the islands and tracts into the Delta.

Agencies and water districts that divert and use water from the Delta for M&I uses and agricultural irrigation are described below.

Freeport Regional Water Authority

The Freeport Regional Water Project (FRWP), completed in 2011, diverts up to a maximum of about 286 cfs from the Sacramento River near Freeport for Sacramento County and EBMUD. EBMUD diverts water pursuant to its amended contract with Reclamation. Sacramento County diverts using its water rights and its CVP contract supply. Reclamation delivers CVP water pursuant to its respective water supply contracts with the Sacramento County Water Agency (SCWA) and EBMUD through the FRWP to areas in central Sacramento County. SCWA is responsible for providing water supplies and facilities to areas in central Sacramento County, including the Laguna, Vineyard, Elk Grove, and Mather Field communities through a capital funding zone known as Zone 40.

North Delta Water Agency

The North Delta Water Agency (NDWA), which includes about 300,000 acres within the north Delta, was created in 1973 by an act of the California Legislature. NDWA's primary purpose is to assure and protect the water supply and water quality for landowners within agency boundaries. NDWA entered into a contract with DWR in 1981 to assure a dependable water supply of suitable quality. The contract requires DWR to ensure a certain quality of water and, under certain conditions, to financially compensate if the water quality conditions cannot be met. The contract also provides that DWR will furnish such water as may be required within NDWA to the extent not otherwise available under the individual water rights of the water users. The contract provides that water within the boundaries of NDWA will be of suitable quality through year-round criteria monitored at seven locations.

Central Delta Water Agency

The Central Delta Water Agency (CDWA) was formed to assist landowners to protect and assure a dependable supply of water of suitable quality sufficient to meet existing and future needs. The agency encompasses approximately 120,000 acres in San Joaquin County, all of which is within the Delta. The lands within the CDWA are primarily agricultural but also contain recreational and significant wildlife habitat areas. These lands are dependent on water supply from in-channel Delta diversions for irrigation and other beneficial uses. The in-channel water supply is currently dependent on the flow and quality of both the Sacramento and San Joaquin River systems.

Contra Costa Water District Diversion Facilities

CCWD diverts water from the Delta for irrigation and M&I uses under its CVP contract and under its own water right permits and license, issued by the State Water Board. The CCWD water system includes the Mallard Slough, Rock Slough, Old River, and Middle River (on Victoria Canal) intakes; the Contra Costa Canal and shortcut pipeline; and the Los Vaqueros Reservoir. The Rock Slough Intake facilities, the Contra Costa Canal, and the shortcut pipeline are owned by Reclamation but operated and maintained by CCWD under contract with Reclamation. Mallard Slough Intake, Old River Intake, Middle River Intake, and Los Vaqueros Reservoir are owned and operated by CCWD and are not part of the CVP.

City of Stockton

The City of Stockton began operation of a 30-million-gallon-per-day intake facility in 2012, as part of the Delta Water Supply Project (Phase 1) to divert water along the San Joaquin River at Empire Tract (City of Stockton 2021).

South Delta Water Agency

The principal purpose of the South Delta Water Agency is to protect the water supply of the lands within its boundaries against salinity intrusion and to assure a dependable supply of water of suitable quality to meet present and future needs. The area within the agency boundary (Middle Roberts, Upper Roberts, Union, Fabian Tract, and Stark Tract Islands) encompasses about 148,000 acres and is primarily agricultural with some municipal use. The primary source of water is in-channel water supply in the southern Delta from San Joaquin and Sacramento River flows that are diverted for irrigation and other beneficial uses via several small pumps and siphons.

City of Antioch

The City of Antioch has a water right to divert from the San Joaquin River and is a customer of the CCWD. Whenever the river salinity is at an acceptable level (i.e., chloride concentration less than 250 milligrams per liter), the appropriative water right is used (and water is diverted from the San Joaquin River near Antioch Bridge). Whenever the river salinity level is unacceptable, or when demand exceeds the existing pumping capacity, the City purchases substitute or additional water supplies directly from the CCWD. Currently, the City is implementing a brackish water desalination facility that will allow the use of their Delta water right year-round, even when river salinity is at unacceptable levels.

6.2.1.6 Water Transfers

California water law and the CVPIA promote water transfers as an important water resource management tool to address water shortages, provided that certain protections to source areas, users, and affected environmental resources are incorporated into the water transfer. Parties seeking water transfers generally acquire water from willing sellers who have surplus reservoir storage water, sellers who can pump groundwater instead of using surface water, or sellers who will fallow crops or substitute a crop that uses less water to reduce normal consumptive use of surface diversions.

Water transfers involving the SWP and CVP (facilities and contractors) occur when a water agency or a water right holder willingly undertakes actions to make project or non-project water available for transfer. These transfers may require export from the Delta through SWP and/or CVP facilities. In some cases, water transfers may be for in-Delta environmental uses.

There is a potential for other voluntary water market transactions that could be conveyed to the Delta for export or environmental purposes. These could include exchanges of non-project water, coordinated or integrated operations of projects other than the SWP or CVP, or sales of water rights that could be used to supplement project water supplies or for increasing instream flows. These other types of transactions would most likely come from some of the same sources and have similar constraints and in-Delta impacts.

The analysis in Appendix 3H, *Non-Project Water Transfer Analysis for Delta Conveyance*, concludes that there is more than sufficient available export capacity for water transfers in all water year types with the current facilities. Maximum historical water transfers in each water year type were less than the permitted annual volumes. In below normal years, when there is greater demand for water transfers, historical data shows there was still sufficient available export capacity even after water transfers were exported.

Therefore, though the project may add additional export capacity, it is unlikely to increase the amount of water transfers, because the current capacity is not even fully utilized. For this reason, potential direct or indirect impacts of water transfers is not further discussed in this chapter, as the project appears very unlikely to increase transfer activity.

6.3 Water Supply Changes

This section describes the changes, as well as the methods used to determine such changes, associated with water supply that would result from project construction, operation, and maintenance.

6.3.1 Methods for Analysis

6.3.1.1 Process and Methods of Review for Water Supply

Consistent with previous modeling analyses conducted by DWR and Reclamation for the SWP and CVP, including the 2019 *Reinitiation of Consultation on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project Final Biological Assessment* (Bureau of Reclamation 2019) and the 2020 *Incidental Take Permit for the Long-Term Operation of the State Water Project in the Sacramento–San Joaquin Delta 2081-2019-066-00* (California Department of Fish and Wildlife 2020), the modeling results presented in this section assumed that the SWP and CVP were solely responsible for providing any needed water for implementing the project alternatives. The project alternatives do not include any actions that would modify water deliveries to non-SWP and non-CVP water rights holders, including in-Delta water rights holders. Therefore, only changes to DWR, Reclamation, and SWP water users and CVP water service contractors are included in this chapter.

Basis for Quantification of SWP and CVP Exports and Deliveries

The analysis of changes in Delta exports and SWP/CVP water deliveries compares simulated water supply conditions (based upon CalSim 3 results) of the project alternatives to existing conditions, reflecting differences in SWP/CVP surface water supply availability resulting from SWP/CVP operations.

For each project alternative, changes in reservoir storage, annual deliveries, and Delta outflow are presented to provide a basis for understanding changes in SWP and CVP exports and deliveries. However, no specific impact assessment results are presented in this chapter because the effects of these changes are not considered environmental impacts under CEQA. Changes in Delta outflow and SWP/CVP upstream reservoir storage are relevant to water quality (Chapter 9, *Water Quality*), conditions for fisheries (Chapter 12, *Fish and Aquatic Resources*), recreation (Chapter 16, *Recreation*), public services and utilities (Chapter 21, *Public Services and Utilities*), and hydroelectric generation (Chapter 22, *Energy*). Specific impacts analysis and mitigation measures are provided in those chapters.

6.3.1.2 Evaluation of Operations

The water supply analysis was conducted using the CalSim 3 model. A full description of the modeling tools and outputs is included in Appendix 5A, *Modeling Technical Appendix*.

CalSim 3 is a reservoir-river basin planning model developed by DWR and Reclamation to simulate the operation of the SWP and CVP over a range of different hydrologic conditions. CalSim 3 allows for specification and achievement of a series of user-specified priorities and goals. It is the best available planning model for the SWP and CVP system operations. Earlier versions of CalSim, in particular CalSim II, have been used in previous system-wide evaluations of SWP and CVP operations. Inputs to CalSim 3 include water diversion requirements (demands), stream accretions and depletions, reservoir inflows, irrigation efficiencies, and parameters to calculate return flows, nonrecoverable losses, and groundwater hydrology. Sacramento and San Joaquin Valley and tributary rim basin hydrologic inputs are based on an adjusted historical sequence of monthly stream flows over a 94-year period (1922–2015), in order to represent a sequence of flows at a given level of development. Adjustments to historic hydrologic sequences are imposed based on current land use and meteorological and hydrologic conditions to develop an existing (2020) level of hydrology. Projected future land use, meteorological, and hydrologic conditions expected in 2040 are used to develop a future (2040) level of development. The resulting hydrology represents the simulated water supply available from Central Valley streams to the SWP and CVP at the given level of development for use in CalSim 3 simulations. For this document, the 2020 level hydrology was used for the existing conditions simulation and all project alternatives. The No Project Alternative uses the 2040 level hydrology in the CalSim 3 simulations.

CalSim 3 produces outputs for river flows and diversions, reservoir storage, Delta flows and exports, Delta inflow and outflow, deliveries to project and non-project users, and controls on project operations. Water rights deliveries to non-SWP and non-CVP water rights holders do not change in the CalSim 3 simulations of the project alternatives. As previously mentioned, CalSim 3 and its predecessor, CalSim II, have been adopted by DWR and Reclamation for the purpose of SWP/CVP system operations analysis in the context of long-term planning. Despite being recognized as the best available tool for this purpose and as the standard tool for project evaluation to support the environmental review process, CalSim 3 is subject to certain limitations. These include the use of assumptions for approximating the operations of various facilities and regulatory requirements, approximations of real-time daily or even hourly operational considerations in order to incorporate them into a monthly model, and additional uncertainty inherited from input data and the model development process (Appendix 5A, Section B, *Hydrology and Systems Operations Modeling*, for more detail). Therefore, inferences using CalSim 3 results from any single scenario may be appropriate for general, long-term trend assessment, but may not be adequate to support detailed reviews on an individual timestep basis or for selected periods. The following provides some examples for illustrative purposes.

Under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements, the SWP and CVP operators use a complicated decision process to decide on how to operate the projects to best meet the overall balance of requirements. This process is unique depending on the specific circumstances and operational requirements in place at the time. During these periods in a simulation, CalSim 3 utilizes a series of operating rules to reach a solution to allow the continuation of the simulation. These operating rules are a simplified version of the very complex decision processes that SWP and CVP operators would use in actual extreme conditions. Therefore, model results and potential changes under these extreme conditions should be recognized as an approximation of the actual operations that would occur under those conditions.

As an example, CalSim 3 results show very infrequent simulated occurrences of extremely low storage conditions at SWP and CVP reservoirs during critical drought periods when storage is at “dead pool” levels (below the elevation of the lowest river outlet). Simulated occurrences of reservoir storage conditions at dead pool levels may occur coincidentally with simulated potential impacts. These conditions can occur both with and without the project alternatives, though not necessarily in the same timestep. Dead pool conditions are never more frequent under the project alternatives and are often less frequent when compared to simulation results without the project alternatives. When reservoir storage is at dead pool levels, there may be instances in the simulation results in which flow conditions fall short of minimum flow criteria, salinity conditions may exceed salinity standards, diversion conditions fall short of allocated diversion amounts, and operating agreements are not met. During real-life operations, operators would use allowable real-time adjustments in operation to satisfy regulatory, legal, and contractual requirements given the current conditions and hydrologic constraints to the maximum extent possible. In some cases, certain voluntary extraordinary water conservation and changes in regulatory requirements for water rights or for flow and water quality requirements could be imposed to accommodate extreme conditions, such as during the drought emergency of 2012–2016. These potential, specific real-time actions are not simulated in CalSim 3 during these periods because these actions were implemented to address the specific circumstances under the emergency declaration and associated emergency regulations. These specific actions or level of implementation cannot be predicted a priori, nor could they be reasonably incorporated as regular operations. Therefore, the results of CalSim 3 reflect the assumption that these interventions are not imposed.

Recognizing the model limitations discussed here and in Appendix 5A, the applications of CalSim 3 (and its predecessors) are considered appropriate only when modeling results are used in a statistical comparative analysis, that is, with two scenarios that differ only in terms of operational and other assumptions that are needed to understand the effects of the project being analyzed. Under a comparative analysis, the potential influences of model limitations can be reduced. This application mode is compatible with the needs of the environmental review process and, thus, is used in the analysis presented in this chapter as described below.

Modeling results are presented with project alternatives paired based on their corresponding facility capacity and operation for better contrasting the differences. For example, CalSim 3 results for Alternative 1 (6,000 cfs) and Alternative 3 (6,000 cfs) are paired together, Alternative 2a (7,500 cfs) and Alternative 4a (7,500 cfs) are paired together, etc. CalSim 3 is a mass-balance model and, thus, its results are not influenced by conveyance alignment. However, despite having the same north Delta intake capacity and operation as Alternatives 1 and 3, Alternative 5 (i.e., Bethany Reservoir alternative) is presented separately from the other alternatives because export capacity assumptions are slightly different than in Alternatives 1 and 3. All project alternatives include assumptions about Banks Pumping Plant outages, which can reduce exports below physical or permit capacity. For project alternatives other than Alternative 5, this outage-based limit on exports is applied to the total pumping at the Banks Pumping Plant; for Alternative 5, this outage-based limit is only applied to the south-of-Delta exports at the Banks Pumping Plant. This is due to diversions from the proposed north Delta intakes under Alternative 5 going directly to Bethany Reservoir through facilities that are different from those associated with the other project alternatives (i.e., Southern Complex) and the Banks Pumping Plant. This distinction allows for slightly higher exports under Alternative 5 when compared to Alternatives 1 and 3, which can cause minor differences in the results of the surface water analyses between the two alignments.

Even with comparative analysis, model uncertainty and its influence on the model results that are presented cannot be completely avoided. Therefore, in addition to showing the effects of the project being analyzed, observed differences between two scenarios can sometimes include the effects of model uncertainty. While no exact quantification of model uncertainty is available, DWR believes that CalSim 3 results are subject to approximately a 5% uncertainty. These considerations and appropriate use of CalSim 3 and its modeling results are discussed in more detail in the Appendix 5A, Section B.

SWP and CVP Exports and Deliveries

SWP and CVP water supply availability is evaluated in this chapter as SWP/CVP exports into the export service areas and SWP/CVP deliveries throughout the system. Water deliveries downstream of San Luis Reservoir are not necessarily the same volume as Delta exports because portions of the exported water are stored in San Luis Reservoir and portions are lost during conveyance.

The model results for CVP Settlement, Refuge, and Exchange Contractors and SWP FRSA Contractors are complex. Deliveries to CVP Settlement, Refuge, and Exchange Contractors and SWP FRSA Contractors are only shown for average, dry, and critical water year types; dry and critical water year types are the only years in which allocations for these contractors may be less than 100%. Deliveries to these contractors may be reduced very infrequently in these years because of reservoirs reaching dead pool storage. In the modeling, some CVP water contractors receive their full contract amounts in water years that are classified as Shasta non-critical (based on the hydrologic Shasta Index). In Shasta critical water years (there are 12 occurrences in the 94 years simulated under current climate conditions), these contractors receive 75% of their full contract amounts. The model meets these deliveries unless that is not possible because storages are at dead pool. Hence, deliveries reported for these contractors will include 12 normally reduced-allocation years and may include very infrequent additional reductions (either in Shasta critical years or other years) because of the simulated dead pool storage conditions.

Similarly, in the modeling, FRSA water contractors receive their full contract amounts in water years that are classified as Feather River non-critical (based on the hydrologic Feather River Index). In

Feather River critical water years (there are six occurrences in the 94 years simulated under current climate conditions) these contractors receive 50% of their full contract amounts per year, except if that would result in more than two 50% allocations in a 7-year period. This latter condition applies once under current climate conditions, so there is one Feather River critical water year which has a 100% allocation. The model meets these deliveries unless that is not possible because storages are at dead pool. Hence, deliveries reported for these contractors will include 5 normally reduced-allocation years and may include very infrequent additional reductions (either in Feather River critical years or other years) because of the simulated dead pool storage conditions.

When reporting changes in CVP Settlement, Refuge, and Exchange Contractors and SWP FRSA Contractors, average deliveries are provided for the combination of the D-1641 40-30-30 dry and critical years for the period of October 1921–September 2015. The computation of these year types with CalSim 3 hydrology can differ from the historical water year types used in the earlier CalSim II model, in particular in a few years previously designated as dry years that are designated as below normal years in CalSim 3. The methods for generating the forecast-based water year types used in CalSim 3 are described in Appendix 5A. Use of Sacramento Valley 40-30-30 year types as defined in D-1641 in the existing conditions model run provides a consistent set of years that covers all the Shasta critical and Feather River critical years under both current and future climate conditions; as well as providing a consistent reporting of results in dry and critical years for all SWP and CVP water contractors (as shown in Appendix 5A).

Despite these detailed model inputs and assumptions, the model may still very infrequently show dead pool conditions in very dry years that appear to prevent Reclamation and DWR from meeting their contractual obligations to their corresponding contractors. Such model results are considered anomalies that reflect the inability of the model to make real-time policy decisions under extreme circumstances, as the actual (human) operators must do. Thus, any reductions simulated due to reservoir storage conditions being at dead pool for these types of deliveries should only be considered as indicators of stressed water supply conditions under that project alternative and should not be understood to reflect literally what would occur in the future. In actual future operations, as has always been the case in the past, the project operators would work in real time to satisfy legal and contractual obligations given the current conditions and hydrologic constraints with or without the project.

6.3.2 Comparison of Project Alternatives with Existing Conditions

Changes in average annual water supplies based on model simulation results for the No Project Alternative (2040 hydrology) compared against existing conditions are shown in Table 6-2. The frequency of available Article 21 south-of-Delta water supplies over the 94-year simulation period for existing conditions and the No Project Alternative are shown in Table 6-3. Table 6-4 shows a summary of Delta outflow and exports for the No Project Alternative compared against existing conditions.

Changes in average annual water supplies based on model simulation results for the project alternatives under 2020 conditions compared against existing conditions are shown in Table 6-5. The frequency of available Article 21 south-of-Delta water supplies over the 94-year simulation period for existing conditions and the project alternatives is shown in Table 6-6. Table 6-7 shows a summary of Delta outflow and exports for the project alternatives compared against existing conditions. Modeled results do not estimate a water supply benefit associated with having an alternate water supply source as a backup for potential future supply interruptions caused by seismic events. Detailed results for monthly and annual changes are presented in Appendix 6A, *Water Supply 2040 Analysis*.

Table 6-2. Water Supply Summary, Changes to Water Supply by the No Project Alternative (2040 Hydrology), Geographic Area, and User, Shown in Thousand Acre-Feet and Resulting Percentages, as Compared to Existing Conditions (2020 Hydrology)

Parameter/Location	EC (TAF)	No Project (TAF)	No Project (%)
End of September Storage (Long-Term Average)			
Trinity Lake	1,438	1,321	-8%
Shasta Lake	2,827	2,715	-4%
Lake Oroville	1,964	1,673	-15%
Folsom Lake	546	484	-11%
San Luis Reservoir	619	558	-10%
CVP San Luis Reservoir	193	174	-10%
SWP San Luis Reservoir	426	385	-10%
Annual SWP Deliveries Long-Term Average [a] (SWP Contract Year; January–December)			
Total SWP Contractors Deliveries	3,509	3,273	-7%
SWP FRSA	1,081	1,056	-2%
SWP Table A	2,110	1,926	-9%
SWP A56	226	184	-19%
SWP A21	93	107	15%
Annual SWP Deliveries, Average of Dry and Critical Water Years [b] (SWP Contract Year; January–December)			
Total SWP Contractors Deliveries	2,375	2,135	-10%
SWP FRSA	1,059	1,019	-4%
SWP Table A	1,145	979	-14%
SWP A56	166	129	-23%
SWP A21	6	9	51%
Annual CVP Deliveries, Long-Term Average [a] (CVP Contract Year; March–February)			
Total CVP Deliveries	4,483	3,883	-13%
Total CVP Deliveries North-of-Delta	575	528	-8%
CVP North-of-Delta Agriculture	309	230	-26%
CVP North-of-Delta M&I	140	171	22%
CVP North-of-Delta Refuge Level 2	125	127	2%
Total CVP Deliveries South of the Delta	1,587	966	-39%
CVP South-of-Delta Agriculture	1,168	577	-51%
CVP South-of-Delta M&I	141	109	-23%
CVP South-of-Delta Refuge Level 2	278	280	1%

Parameter/Location	EC (TAF)	No Project (TAF)	No Project (%)
CVP Settlement Contractors	1,503	1,564	4%
CVP Exchange Contractors	818	825	1%
Annual CVP Deliveries, Average of Dry and Critical Water Years [b] (CVP Contract Year; March–February)			
Total CVP Deliveries	3,620	3,145	-13%
Total CVP Deliveries North of the Delta	411	361	-12%
CVP North-of-Delta Agriculture	131	66	-50%
CVP North-of-Delta M&I [c]	156	168	8%
CVP North-of-Delta Refuge Level 2	124	127	3%
Total CVP Deliveries South of the Delta	945	422	-55%
CVP South-of-Delta Agriculture	571	71	-88%
CVP South-of-Delta M&I	112	81	-28%
CVP South-of-Delta Refuge Level 2	261	270	3%
CVP Settlement Contractors	1,492	1,567	5%
CVP Exchange Contractors	772	795	3%

Alt = alternative; CVP = Central Valley Project; EC = existing conditions; FRSA = Feather River Service Area; M&I = municipal and industrial; SWP = State Water Project; TAF = thousand acre-feet.

[a] Long-term average is the average annual for the period October 1921–September 2015 simulated in CalSim 3.

[b] Dry and critical is the average annual for the State Water Resources Control Board Water Right D-1641 40-30-30 dry and critical years for the period October 1921–September 2015 simulated in CalSim 3.

[c] The CVP North-of-Delta M&I includes a number of individual diversions including East Bay Municipal Utility District (EBMUD) diversion at Freeport. The diversion is made in drought years when EBMUD's total system storage is forecast to be less than 450,000 acre-feet. This extra diversion during only dry/critical years and zero in other years causes the dry/critical average, which includes those diversion, to be higher than the long-term average, with zero diversion in the wetter years.

Table 6-3. Frequency of Years of Available Article 21 Deliveries South-of-Delta for the No Project Alternative (2040 Hydrology) as Compared to Existing Conditions (2020 Hydrology) over the Simulation Period

Article 21 Deliveries South-of-Delta	EC	No Project
Total Years of available Article 21 supplies Long-Term Average [a] (SWP Contract Year; January–December)	61	50
Percent of Years of available Article 21 supplies	65%	53%

EC = existing conditions; SWP = State Water Project.

[a] Long-term average is the average annual for the period October 1921–September 2015 simulated in CalSim 3.

Table 6-4. Summary of Annual Delta Outflow and Exports October–September under the No Project Alternative (2040 Hydrology) as Compared to Existing Conditions (2020 Hydrology)

Parameter/Location	EC (TAF)	No Project (TAF)	No Project (%)
Outflow	15,216	16,751	10%
Total Delta Export	4,939	4,133	-16%
SWP Delta Export Total [a]	2,401	2,186	-9%
SWP Delta Export at North Delta Diversion Intakes	0	0	N/A
SWP Delta Exports at South Delta Intakes	2,401	2,186	-9%
CVP Delta Export Total	2,538	1,947	-23%
CVP Delta Export at North Delta Diversion Intakes	0	0	N/A
CVP Delta Exports at South Delta Intakes	2,538	1,947	-23%

CVP = Central Valley Project; EC = existing conditions; N/A = not applicable; SWP = State Water Project; TAF = thousand acre-feet.

[a] Values do not include transfer water delivered as part of the lower Yuba River Accord.

Table 6-5. Water Supply Summary, Changes to Water Supply by the Project Alternatives, Geographic Area, and User, Shown in Thousand Acre-Feet and Resulting Percentages, as Compared to Existing Conditions (2020 Hydrology)

Parameter/Location	EC (TAF)	Alts 2b, 4b (TAF)	Alts 2b, 4b (%)	Alts 2c, 4c (TAF)	Alts 2c, 4c (%)	Alts 1, 3 (TAF)	Alts 1, 3 (%)	Alts 2a, 4a (TAF)	Alts 2a, 4a (%)	Alt 5 (TAF)	Alt 5 (%)
End of September Storage (Long-Term Average)											
Trinity Lake	1,438	1,443	0%	1,445	0%	1,443	0%	1,441	0%	1,443	0%
Shasta Lake	2,827	2,846	1%	2,844	1%	2,838	0%	2,841	1%	2,837	0%
Lake Oroville	1,964	1,979	1%	1,980	1%	1,981	1%	1,982	1%	1,983	1%
Folsom Lake	546	552	1%	552	1%	552	1%	551	1%	551	1%
San Luis Reservoir	619	695	12%	696	12%	699	13%	699	13%	700	13%
CVP San Luis Reservoir	193	192	0%	191	-1%	194	0%	194	0%	193	0%
SWP San Luis Reservoir	426	502	18%	504	18%	506	19%	505	18%	506	19%
Annual SWP Deliveries Long-Term Average [a] (SWP Contract Year; January–December)											
Total SWP Contractors Deliveries	3,509	3,918	12%	4,001	14%	4,046	15%	4,037	15%	4,050	15%
SWP FRSA	1,081	1,079	0%	1,079	0%	1,078	0%	1,078	0%	1,079	0%
SWP Table A	2,110	2,338	11%	2,372	12%	2,391	13%	2,380	13%	2,392	13%
SWP A56	226	260	15%	258	14%	252	11%	252	11%	252	11%
SWP A21	93	240	159%	293	216%	325	250%	327	252%	328	254%
Annual SWP Deliveries, Average of Dry and Critical Water Years [b] (SWP Contract Year; January–December)											
Total SWP Contractors Deliveries	2,375	2,594	9%	2,640	11%	2,686	13%	2,656	12%	2,686	13%
SWP FRSA	1,059	1,053	0%	1,052	-1%	1,052	-1%	1,051	-1%	1,053	-1%
SWP Table A	1,145	1,313	15%	1,364	19%	1,413	23%	1,381	21%	1,412	23%
SWP A56	166	222	34%	219	32%	215	29%	217	30%	215	29%
SWP A21	6	6	-6%	6	-8%	6	3%	7	21%	6	3%
Annual CVP Deliveries, Long-Term Average [a] (CVP Contract Year; March–February)											
Total CVP Deliveries	4,483	4,507	1%	4,525	1%	4,531	1%	4,578	2%	4,530	1%
Total CVP Deliveries North-of-Delta	575	577	0%	576	0%	576	0%	579	1%	576	0%
CVP North-of-Delta Agriculture	309	311	1%	310	0%	311	0%	313	1%	310	0%
CVP North-of-Delta M&I	140	141	0%	140	0%	140	0%	141	0%	140	0%
CVP North-of-Delta Refuge Level 2	125	125	0%	125	0%	125	0%	125	0%	125	0%

Parameter/Location	EC (TAF)	Alts 2b, 4b (TAF)	Alts 2b, 4b (%)	Alts 2c, 4c (TAF)	Alts 2c, 4c (%)	Alts 1, 3 (TAF)	Alts 1, 3 (%)	Alts 2a, 4a (TAF)	Alts 2a, 4a (%)	Alt 5 (TAF)	Alt 5 (%)
Total CVP Deliveries South of the Delta	1,587	1,610	2%	1,629	3%	1,634	3%	1,678	6%	1,633	3%
CVP South-of-Delta Agriculture	1,168	1,191	2%	1,209	3%	1,213	4%	1,256	8%	1,213	4%
CVP South-of-Delta M&I	141	141	0%	142	1%	143	1%	145	3%	143	1%
CVP South-of-Delta Refuge Level 2	278	278	0%	278	0%	278	0%	278	0%	278	0%
CVP Settlement Contractors	1,503	1,502	0%	1,502	0%	1,503	0%	1,503	0%	1,503	0%
CVP Exchange Contractors	818	818	0%	818	0%	818	0%	818	0%	818	0%
Annual CVP Deliveries, Average of Dry and Critical Water Years [b] (CVP Contract Year; March–February)											
Total CVP Deliveries	3,620	3,145	-13%	3,646	1%	3,650	1%	3,641	1%	3,678	2%
Total CVP Deliveries North of the Delta	411	420	2%	417	1%	415	1%	419	2%	415	1%
CVP North-of-Delta Agriculture	131	138	6%	136	4%	134	2%	138	6%	134	2%
CVP North-of-Delta M&I [c]	156	157	1%	157	1%	156	1%	157	1%	156	0%
CVP North-of-Delta Refuge Level 2	124	124	0%	124	0%	124	0%	124	0%	124	0%
Total CVP Deliveries South of the Delta	945	963	2%	970	3%	963	2%	996	5%	963	2%
CVP South-of-Delta Agriculture	571	589	3%	595	4%	589	3%	621	9%	588	3%
CVP South-of-Delta M&I	112	113	1%	113	1%	113	1%	115	2%	113	1%
CVP South-of-Delta Refuge Level 2	261	261	0%	261	0%	261	0%	261	0%	261	0%
CVP Settlement Contractors	1,492	1,491	0%	1,491	0%	1,491	0%	1,491	0%	1,491	0%
CVP Exchange Contractors	772	772	0%	772	0%	772	0%	772	0%	772	0%

Alt(s) = alternative(s); CVP = Central Valley Project; EC = existing conditions; FRSA = Feather River Service Area; M&I = municipal and industrial; SWP = State Water Project; TAF = thousand acre-feet.

[a] Long-term average is the average annual for the period October 1921–September 2015 simulated in CalSim 3.

[b] Dry and critical is the average annual for the State Water Resources Control Board Water Right D-1641 40-30-30 dry and critical years for the period October 1921–September 2015 simulated in CalSim 3.

[c] The CVP North-of-Delta M&I includes a number of individual diversions including East Bay Municipal Utility District (EBMUD) diversion at Freeport. The diversion is made in drought years when EBMUD's total system storage is forecast to be less than 450,000 acre-feet. This extra diversion during only dry/critical years and zero in other years causes the dry/critical average, which includes those diversion, to be higher than the long-term average, with zero diversion in the wetter years.

Table 6-6. Frequency of Years of Available Article 21 Deliveries South-of-Delta over the Simulation Period

Article 21 Deliveries South-of-Delta	EC	Alts 2b, 4b	Alts 2c, 4c	Alts 1, 3	Alts 2a, 4a	Alt 5
Total Years of available Article 21 supplies	61	67	66	71	73	74
Long-Term Average [a] (SWP Contract Year; January–December)						
Percent of Years of available Article 21 supplies	65%	71%	70%	76%	78%	79%

Alt(s) = alternative(s); EC = existing conditions.

[a] Long-term average is the average annual for the period October 1921–September 2015 simulated in CalSim 3.

Table 6-7. Summary of Annual Delta Outflow and Exports October–September under the Project Alternatives as Compared to Existing Conditions (2020 Hydrology)

Parameter/Location	EC (TAF)	Alts 2b, 4b (TAF)	Alts 2b, 4b (%)	Alts 2c, 4c (TAF)	Alts 2c, 4c (%)	Alts 1, 3 (TAF)	Alts 1, 3 (%)	Alts 2a, 4a (TAF)	Alts 2a, 4a (%)	Alt 5 (TAF)	Alt 5 (%)
Outflow	15,216	14,777	-3%	14,681	-4%	14,631	-4%	14,604	-4%	14,626	-4%
Total Delta Export	4,939	5,377	9%	5,478	11%	5,528	12%	5,563	13%	5,532	12%
SWP Delta Export Total [a]	2,401	2,811	17%	2,895	21%	2,940	22%	2,931	22%	2,944	23%
SWP Delta Export at North Delta Diversion Intakes	0	558	N/A	675	N/A	740	N/A	673	N/A	746	N/A
SWP Delta Exports at South Delta Intakes	2,401	2,252	-6%	2,220	-8%	2,200	-8%	2,258	-6%	2,198	-8%
CVP Delta Export Total	2,538	2,566	1%	2,583	2%	2,588	2%	2,631	4%	2,588	2%
CVP Delta Export at North Delta Diversion Intakes	0	0	N/A	0	N/A	0	N/A	100	N/A	0	N/A
CVP Delta Exports at South Delta Intakes	2,538	2,566	1%	2,583	2%	2,588	2%	2,532	0%	2,588	2%

Alt(s) = alternative(s); CVP = Central Valley Project; EC = existing conditions; N/A = not applicable; SWP = State Water Project; TAF = thousand acre-feet.

[a] Values do not include transfer water delivered as part of the lower Yuba River Accord.

6.3.2.1 No Project Alternative

The No Project Alternative represents the circumstances under which the project (or project alternative) does not proceed and considers predictable actions, such as projects, plans, and programs that would be predicted to occur in the foreseeable future if the Delta Conveyance Project was not constructed and operated. Under the No Project Alternative, no construction or modification to SWP or CVP facilities or operations would occur. Under the No Project Alternative, DWR would continue to operate the SWP to divert, store, and convey SWP water consistent with applicable laws and contractual obligations. Because of the interrelated operation of the SWP and CVP, the No Project Alternative would also assume the current operation of the CVP would continue. The No Project Alternative also discusses how other predictable actions by water suppliers that receive SWP supplies could affect the environment.

Future Water Supply Conditions

Under the No Project Alternative, DWR operation of the SWP and Reclamation operation of the CVP are assumed to remain subject to the current take prohibition for listed species and other ESA requirements required by the 2019 USFWS and NMFS BiOps (U.S. Fish and Wildlife Service 2019; National Marine Fisheries Service 2019) and the 2020 ITP (for SWP only) (California Department of Fish and Wildlife 2020). The No Project Alternative is intended to identify predictable or foreseeable conditions under a long-term scenario in which the Delta Conveyance Project is not approved or implemented. Such foreseeable actions include a continuing uncertainty of SWP/CVP south Delta exports, increasing vulnerability in the south Delta to long-term degradation in water quality due to sea level rise that could be expected to occur, and continuing vulnerability resulting from a major seismic or levee failure event that could cause salinity intrusion that would temporarily halt export operations (Appendix 3C, *Defining Existing Conditions, No Project Alternative, and Cumulative Impact Conditions*).

Climate Change and Sea Level Rise

Climate change is projected to change precipitation and runoff patterns in the future. While the specifics of future conditions are uncertain, most future projections indicate that climate change is likely to result in earlier spring runoff and increased severity of extreme dry and wet conditions. Under the No Project Alternative, the SWP and CVP would be limited in their ability to capture flashy winter storm events, which would decrease SWP and CVP water supply reliability into the future. Tables 6-2, 6-3, and 6-4 present modeling results that simulate changes in water supply conditions into the future under the No Project Alternative; the key drivers for these changes are the climate change and sea level rise assumptions incorporated into the modeling effort. Key water supply changes expected to occur under the No Project Alternative include the following.

- Total SWP deliveries: Average annual SWP deliveries would decrease under the No Project Alternative for the long-term average, dry water years, and critical water years (Table 6-2). Long-term average annual deliveries and dry and critical water year deliveries would decrease 7% and 10%, respectively.
- SWP Table A deliveries: Average annual SWP Table A deliveries are expected to decrease under the long-term average, dry water years, and critical years for the No Project Alternative (Table 6-2). Long-term average annual and dry and critical water year Table A deliveries would decrease 9% and 14%, respectively.

- SWP Article 56 and Article 21 deliveries: Average annual SWP Article 56 deliveries would decrease under the long-term average, dry water years, and critical water years compared to deliveries under existing conditions (Table 6-2). For both the long-term average and for dry and critical years, Article 56 deliveries would decrease 19% and 23%, respectively. Article 21 deliveries would increase on both the long-term average and during dry and critical years by 15% and 51%, respectively. While the increase in Article 21 delivery amounts may appear a substantive percentage, it is a smaller absolute increase (in dry and critical years, the Article 21 supply increases from 6 to 9 TAF). Additionally, as shown in Table 6-3 under the No Project Alternative, Article 21 deliveries would decrease in frequency but would increase in quantity when available because of the flashy storms that are projected to occur in the future.
- SWP Feather River Service Area: Annual deliveries to the SWP FRSA under the long-term average and dry and critical water years are expected to decrease when compared to existing conditions (Table 6-2). On a long-term average, deliveries are expected to decrease 2%, and during dry and critical water years, deliveries are expected to decrease 4%.
- CVP Deliveries: The long-term average annual total CVP deliveries for the No Project Alternative are expected to decrease 13%. During dry and critical years, decreases to total CVP deliveries of 13% are expected (Table 6-2). Modeling results indicated that the greatest decreases would occur for south-of-Delta agriculture, with decreases of 51% projected on the long-term average and 88% in dry and critical water years.

Generally, SWP and CVP deliveries would continue to decrease into the future beyond the 2040 horizon because of climate change and sea level rise. Trends in climate change and sea level rise are expected to continue, which would result in more extreme precipitation conditions coupled with higher sea level rise. These changes would likely continue to decrease SWP and CVP deliveries past the 2040 conditions modeled.

Earthquake Risk

As discussed in Chapter 1, Section 1.2.3.3, *Delta Levee Risks,* earthquakes pose a risk to Delta levees. When levees fail, water rushes into the lower-than-sea-level islands, pulling salt water from San Francisco Bay into the Delta. Depending on the location and timing of the levee failure, it may increase salinity in the area of the Banks and Jones Pumping Plants such that Delta diversions may need to halt for months (or even years). While the No Project Alternative does include continued efforts to improve Delta levees, some risk of failure would continue into the future. Prolonged periods of reduced or no pumping would result in the need to ration water supplies or release water from reservoirs south of the Delta due to intrusion of higher salinity seawater in the Delta. Delta inflows and outflows would be managed to provide flushing and restoration of water quality, which could result in exceedances of “normal” Delta outflow based on increased tidal flows into and out of the unrepaired levees and flooded islands. Management shifts could reduce the amount of water allocated for pumping by the SWP and CVP.

Additionally, because water supplies in the Delta are subject to regulatory and judicial requirements such as the ESA, reductions in consumptive withdrawals to protect species and associated habitat(s) in the Delta area could limit the ability to pump water for the SWP and CVP, especially under reduced water supply conditions related to a major earthquake event and levee failures.

Other Predictable Actions

The No Project Alternative also considers projects, plans, and programs that would be predicted to occur in the foreseeable future if the Delta Conveyance Project was not constructed and operated. A list and description of actions included as part of the No Project Alternative is provided in Chapter 3, *Description of the Proposed Project and Alternatives*, and in Appendix 3C. The No Project Alternative includes the possible actions of California water suppliers other than DWR under a long-term scenario in which the Delta Conveyance Project is not approved or implemented and therefore SWP water supply reliability is not improved.[2] In this scenario, SWP water supply reliability would be expected to continue to degrade, and water agencies that receive SWP supplies would need to take additional actions to address local shortages that likely go beyond those actions identified in long-term planning documents. These actions could include pursuing additional water conservation programs, water recycling projects, groundwater recovery projects, desalination of seawater or brackish groundwater, surface water storage, groundwater management, or water transfers and exchanges.[3]

Public water agencies participating in the Delta Conveyance Project have been grouped into four geographic regions. The water agencies within each geographic region would foreseeably pursue a similar suite of water supply projects under the No Project Alternative (Appendix 3C). Table 6-8 shows the options available for each region and the potential to address water supply shortfalls in the No Project Alternative. Table 6-8 also includes the estimated range of forgone water supplies that DCP would have provided if constructed and operated. The estimated range reflects a low and high range of water provided by the project alternative and is based on the SWP delivery information summarized in Table 6-7 above. Additional information on the geographic grouping of SWP contractors participating in DCP is provided in Appendix 3C, Section 3C.3.2.5.

Table 6-8. Other Predictable Actions in the No Project Alternative

Region	Estimated Range of Forgone Water Supplies if DCP not Constructed (from Existing Conditions in 2020 to No Project Alternative in 2040)	Available Alternate Supply Types	Net Effects on Water Supply
Northern Coastal	20,500 AF – 27,200	Increased/accelerated desalination, water recycling, groundwater management (recovery, brackish water desalination), water use efficiency improvements	Alternate water supplies would foreseeably compensate for the supply decrease associated with climate change and sea level rise, but an extended outage associated with earthquake risk would pose challenges.
Northern Inland	10,200 AF – 13,600 AF	Water recycling, groundwater recovery	While alternate water supply options in this region are limited,

[2] CVP contractors would also likely consider other actions to address water supply shortages, but they are not discussed as part of the No Action/No Project because the project only includes improving water supply reliability for SWP contractors.

[3] It is acknowledged that water agencies are already exploring these types of actions as outlined in their water management plans. However, the No Project Alternative focuses on the added level of these actions that would be needed in order to replace any water reliability that would be gained through the Delta Conveyance Project.

Region	Estimated Range of Forgone Water Supplies if DCP not Constructed (from Existing Conditions in 2020 to No Project Alternative in 2040)	Available Alternate Supply Types	Net Effects on Water Supply
		(brackish water desalination), water use efficiency improvements	the decrease in supply would be smaller than in other regions. Alternate water supplies would foreseeably compensate for the supply decrease associated with climate change and sea level rise, but an extended outage associated with earthquake risk would pose challenges.
Southern Coastal	126,800 – 168,300 AF	Increased/accelerated desalination, water recycling, groundwater recovery (brackish water desalination), groundwater management, water use efficiency improvements	Alternate water supplies would foreseeably compensate for the supply decrease associated with climate change and sea level rise, but an extended outage associated with earthquake risk would pose challenges.
Southern Inland	251,500 AF – 333,900 AF	Water recycling, groundwater recovery (brackish water desalination), water use efficiency improvements	This region (including Kern County and inland areas south of the Tehachapi Mountains) has geographic and physical limitations on alternate water supplies. Parts of the Metropolitan Water District within this region would have access to water from a portfolio of supplies that span multiple regions and supply sources. For other entities, limited groundwater and desalination options would result in few options to address supply shortages from the SWP. Supply shortages associated with climate change, sea level rise, and earthquake risk would persist in the No Project Alternative.

AF = acre-feet; SWP = State Water Project.

The low range of water supplied reflects Alternatives 2b and 4b and the high range reflects Alternative 5.

Without the Delta Conveyance Project, public water agencies would be faced with declining water supply reliability from the SWP, which would have a compounding effect on existing production from groundwater and recycling that is dependent on SWP water quality. The Northern Coastal, Northern Inland, and Southern Coastal regions have the potential to address the supply shortfalls through alternate supplies, but those alternate supplies may be insufficient if there is an extended outage at the Delta diversion facilities in the case of an earthquake and levee failure. The Southern Inland region would have a substantial shortfall from the SWP and has limited options for alternate supplies. In addition, this area is going to have other supply limitations imposed from the SGMA (discussed in more detail in Chapter 8, *Groundwater*). SGMA may limit groundwater pumping in some areas to promote sustainable groundwater management, which would increase pressure on surface water supplies. Under the No Project Alternative, declining surface water supply reliability, paired with decreasing groundwater, may result in water supplies that are not able to meet demand in some areas.

6.3.2.2 Project Alternatives

Total SWP Deliveries

Average annual SWP deliveries would increase from existing conditions under all project alternatives for the long-term average, dry water years, and critical water years (Table 6-5). Modeled long-term average annual increases would be 12% for Alternatives 2b and 4b; 14% for Alternatives 2c and 4c; and 15% for Alternatives 1, 2a, 3, 4a, and 5. Increases to SWP deliveries are also expected during dry and critical water years, with models indicating a range between 9% for Alternatives 2b and 4b; 11% for Alternatives 2c and 4c; 12% for Alternatives 2a and 4a; and 13% for Alternatives 1, 3, and 5. The project alternatives would also provide a water supply reliability benefit associated with earthquake risk that is not captured in the modeling. In the event that a seismic event causes a levee failure, saltwater intrusion into the Delta could reduce or temporarily stop diversions in the south Delta. The project alternatives would have an additional diversion in a different location, which would improve reliability in the case of these events.

SWP Feather River Service Area

No changes to annual deliveries to the SWP FRSA under the long-term average is expected when compared to existing conditions (Table 6-5). During dry and critical water years, deliveries are expected to remain similar to existing conditions and for Alternatives 1, 2b, 3, 4b, and 5.

SWP Table A Deliveries

Average annual SWP Table A deliveries are expected to increase under the long-term average, dry water years, and critical years for all project alternatives (Table 6-5). On a long-term average, Table A deliveries are expected to be 11% for Alternatives 2b and 4b; 12% for Alternatives 2c and 4c; and 13% for Alternatives 1, 3, 2a, 4a, and 5. During dry and critical years, increases of Table A deliveries are expected to be 15% for Alternatives 2b and 4b; 19% for Alternatives 2c and 4c; 21% for Alternatives 2a and 4a; and 23% for Alternatives 1, 3, and 5.

SWP Article 56 and Article 21 Deliveries

Average annual SWP Article 56 deliveries would increase under the long-term average and dry and critical water years compared to deliveries under existing conditions (Table 6-5). On a long-term average Article 56 deliveries would increase between 11% for Alternatives 1, 2a, 3, 4a, and 5; 14% for Alternatives 2c and 4c; and 15% for Alternatives 2b and 4b over existing conditions. During dry and critical years, Article 56 deliveries would increase 29% for Alternatives 1, 3, and 5; 30% for Alternatives 2a and 4a; 32% for Alternatives 2c and 4c; and 34% for Alternatives 2b and 4b.

Average annual SWP Article 21 deliveries would also increase under the long-term average and, depending on the project alternative, would decrease or increase under dry and critical water years compared to deliveries under existing conditions (Table 6-5). On a long-term average Article 21 deliveries would increase 159% for Alternatives 2b and 4b; 216% for Alternatives 2c and 4c; 250% for Alternatives 1 and 3; 252% for Alternatives 2a and 4a; and 254% for Alternative 5 over existing conditions. During dry and critical years, Article 21 deliveries would decrease 6% under Alternatives 2b and 4b and 8% under Alternatives 2c and 4c; however, they would remain essentially the same for Alternatives 1, 3, and 5; and increase 21% under Alternative 2a and 4a.

Article 21 deliveries typically include a small amount for north-of-Delta SWP water contractors that could occur every year, and occasional but more significant deliveries for south-of-Delta contractors. The project alternatives are not likely to affect the frequency of north-of-Delta Article 21 deliveries but could influence, and likely increase, those for south-of-Delta deliveries. Table 6-6 shows the changes in frequency of south-of-Delta Article 21 deliveries. As shown, the frequency of available Article 21 water would increase over existing conditions for all project alternatives. Under existing conditions, about 61 years of the 94-year simulation period (about 65%) has some amount of available Article 21 supplies. Available Article 21 supplies would increase to about 67 years (71%) of the simulation period under Alternatives 2b and 4b, and to 74 years (about 79%) of the simulation period under Alternative 5.

CVP Deliveries

The long-term average annual total CVP deliveries for all of the project alternatives are expected to remain essentially the same (Table 6-5). Alternatives 2a and 4a would result in the highest increase for south-of-Delta agriculture deliveries, with an average annual increase of 8%.

During dry and critical years, most project alternatives would result in increases in deliveries (Table 6-5). Alternatives 2a and 4a would result in the greatest increase: 9% for south-of-Delta agriculture deliveries. Similar to SWP deliveries, Alternatives 2a and 4a could provide a benefit of increased resilience to seismic events in the Delta.

CVP Settlement and Exchange Contractors do not show any change in average annual deliveries and under dry and critical dry water years as those deliveries are under water rights that are unaffected by the operations of the north Delta intakes.