THE ECONOMY OF THE STATE WATER PROJECT

Clean, Reliable, and Affordable Water for California

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Executive Summary

The State Water Project (SWP) is among the world's most extensive water conveyance projects, featuring a 705-mile-long network of dams, reservoirs, hydroelectric facilities, pumping plants, and canals. The State Water Project plays a key role in the state's economy. It supplies over 27 million Californians, a majority of the state's population, along with commercial and industrial customers, including in the technology and manufacturing sectors, that account for a majority of the state's economic activity. Project deliveries also supply water to the agricultural sector, supporting the cultivation of fruits, vegetables, and nuts, particularly in the Central Valley, the nation's most productive agricultural region. This reliable water source not only ensures the livelihood of residents, businesses, and farmers but also contributes significantly to the state's economy through technology, manufacturing, and agricultural exports.

This report consolidates publicly available data from the California Department of Water Resources (DWR) and other agencies to provide policymakers with a comprehensive overview of the economy that is supported by the State Water Project. The aim is to present this information in a concise format to facilitate well-informed decision-making regarding the project. The information in this report covers patterns of water use in the State Water Project service area, the size of the urban and agricultural economies served by the State Water Project, the role of the State Water Project in serving underrepresented communities, and how the costs of State Water Project water deliveries compare to the costs of developing alternative water supplies.

Water from the State Water Project is delivered to twenty-nine contractors in six regions of California. These contractors are water agencies of varying sizes that fulfill diverse roles, including direct municipal water supply, wholesaling water to other local utilities and municipalities, and supplying water for irrigation and managing groundwater storage. Of the six regions supplied by the State Water Project, the two largest are Southern California, where 54% of State Water Project deliveries are used primarily in the urban sector, and the San Joaquin Valley, where 38% of State Water Project deliveries are used primarily in the agricultural sector. The remaining 8% of State Water Project deliveries are used in the Feather River Basin, the North and South Bay regions of the San Francisco Bay Area, and on the Central Coast in San Luis Obispo and Santa Barbara counties. Based on data on water use in California, 56.4% of total State Water Project deliveries are used by urban customers and 43.6% are used in agriculture. The State Water Project also delivers water for other beneficial uses, which are beyond the scope of this report.

Most State Water Project water deliveries are governed by contractual terms that set a maximum annual volume for each contractor, often referred to as Table A deliveries. During the year, the Department of Water Resources announces what percentage of contracted Table A volumes contractors can expect to receive. Allocations can shift significantly from one year to the next due to California's highly variable climate and hydrology. Over the past 20 years, contractors have received an average of 63% of their contracted Table A volumes.[1] Besides Table A deliveries, contractors also receive two other types of deliveries; Carryover Water, which lets contractors store unused Table A allocations for later use, and Article 21 Water, which is additional water that is made available to contractors when export capacity exceeds both current demands and regulatory obligations.

The State Water Project service area is the largest economy supported by a major water conveyance system anywhere in the United States, and the second largest anywhere in the world. The service area of the State Water Project is home to over twenty-seven million individuals, over two-thirds of the state's population, and supports an economy with a Gross Domestic Product (GDP) surpassing $2.25 trillion. Based on GDP, the State Water Project service area would rank as the world's eighth-largest economy if it were an independent nation. This economy supports the full-time employment of over 8.7 million individuals with jobs that pay a median income 23% higher than the national average.[2]

The regions served by the State Water Project have experienced significant income and population growth since the project was approved by voters in 1960. Since that time, populations in the six regions served by the State Water Project have at least doubled and in some cases tripled. Today, property in the State Water Project service area is valued at a total of over $4.26 trillion.[3]

In Southern California, the State Water Project constitutes more than 28% of its urban water supply, surpassing the volume of water supplied by the regions other two major urban water conveyance systems: the Colorado Aqueduct at 23% and the Los Angeles Aqueduct at 14%.[4]

In Kern County, the State Water Project provides 24% of all water used in agriculture.[5] State Water Project supplies have been crucial to driving the county's growth in almond and pistachio production, which has led the real value of agricultural production in the county to more than double since the early 2000s to an annual value of $8.2 billion. The State Water Project water will play an increasingly vital role in Kern county's agricultural water supply as the region takes actions to comply with the Sustainable Groundwater Management Act (SGMA).

California Assembly Bill 685 (2012) recognizes the human right to water which guarantees the right to safe, clean, affordable, and accessible water for all Californians. However, many communities still face challenges accessing a safe water supply today due to social, economic, health, and environmental considerations. State Water Project deliveries uphold the right to water for a significant number of underrepresented people and communities. The term disadvantaged community (DAC) has differing definitions in state legislation, often

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[1] See Section II.
[2] See Section III.
[3] See Section III.
[4] See Section III. Note that the All-American Canal conveys a larger volume of water to Southern California than the State Water Project, but this primarily serves the agricultural Imperial Valley.
[5] See Section IV.

relating to median household income (MHI) or health and environmental quality measures. Depending on the definition used, 6.6 to 8.2 million individuals reside in disadvantaged communities served by State Water Project water. This is between 65% and 75% of all disadvantaged communities in California and between 17% and 21% of the state's total population. Most of these residents live in Southern California, between 6.1 to 7.1 million, depending on the definition used. Disadvantaged communities served by the State Water Project in Southern California constitute between 56 and 70% of the state's total population of disadvantaged communities.[6] In the San Joaquin Valley, residents of DACs are disproportionately likely to be employed in farm jobs served with water from the State Water Project.

The cost of water deliveries to State Water Project contractors is determined by a water charge that covers capital and operational costs of facilities that collect water north of and within the Delta, as well as the Project's share of costs of the California Aqueduct, and San Luis Reservoir. Contractors also pay a transportation charge that covers the capital and operational costs of facilities that pump and convey water from the delta to the contractors. The capital costs are amortized over varying time periods, with the requirement that the Project's initial facilities be recovered by the end of 2035.

The average cost of delivering State Water Project water ranges between $250 per acre-foot in the San Joaquin Valley, to $600 per acre-foot in Southern California and as high as $1,440 per acre-foot on the Central Coast. However, costs per acre-foot vary significantly from year-to-year depending on whether hydrologic conditions are wet or dry.

The long-term average costs of State Water Project water are competitive when compared to alternatives such as stormwater conservation programs ($600 to $5,000 per acre-foot, with a median of $2,100) and water conservation efforts such as turf (lawn) removal rebate programs ($420 to $1,500 per acre-foot, with a median of $1,100). Other common water conservation programs such as replacing toilets and clothes washers with high efficiency models, installing weather-based controllers and rotating nozzles for irrigation, and rain barrels can have lower costs comparable to State Water Project water deliveries, however these programs are not scalable and could not replace a significant volume of Project water deliveries.

State Water Project water has a notably lower cost than water recycling programs, which can exceed $2,200 per acre-foot, and seawater desalination facilities, which can cost upwards of $2,800 per acre-foot.[7] In addition to cost considerations, permitting and building desalination facilities in Southern California have proven to be challenging. Currently, desalination accounts for less than one percent of Southern California's water supply. Additionally, alternatives like recycling, stormwater management, and conservation programs are often limited in scale, often producing less than 10,000 acre-feet of water per year.

[6] See Section V.
[7] See Section VI.

California's largest desalination plant, located in Carlsbad, has an annual capacity of 56,000 acre-feet. To replace the volume of water currently provided by the State Water Project to Southern California, twenty-five additional desalination plants of the same size as the Carlsbad facility would need to be permitted and constructed. This highlights the significant challenges in ensuring water supply reliability and underscores the crucial role the State Water Project will continue to play in California's future water security.

I. Introduction

Despite the key role the State Water Project plays in California's water supply, there is a lack of recent publications that review the available data on the scope of the economy it serves. This report addresses this gap by summarizing publicly available data on State Water Project water distribution, the scale of the urban and agricultural economies it supports, the extent to which underrepresented populations are served, and the costs associated with developing alternative water supplies. The primary objective of this report is to inform policymakers about the State Water Project's operations and the economy that is served by the State Water Project.

The report is not a comprehensive valuation of the benefits of the State Water Project and does not attempt to document the benefits or costs of the State Water Project's non-water supply related impacts and amenities such as power generation, flood control, or any recreational and environmental values. These other benefits are significant, but beyond the scope of this report.

This report relies on publicly available data from multiple sources. One extensively used source is the Department of Water Resources' Bulletin 132; this publication aggregates data on various aspects of the State Water Project, including water supply planning, construction, finance, management, and operations.[8] Also extensively relied on is Department of Water Resources' Water Balance Dataset, a program that calculates applied, net, and depletion water balances for California.[9] Additional economic and demographic data were sourced from various public outlets such as the California Employment Development Department, the US Census Bureau, and the Bureau of Economic Analysis.[10] Agricultural production figures were taken from annual crop reports produced by county agricultural commissioners.[11] Data on the classification of disadvantaged communities were sourced either from Department of Water Resources data or from the

[8] "Bulletin 132 Management of the California State Water Project," California Department of Water Resources.
Hereinafter referred to as "Bulletin 132."
[9] Water Plan Water Balance Data," California Natural Resources Agency.
Hereinafter referred to as "Water Balance Data."
Water balance data available annually from 2002 to 2019, except 2017. Department of Water Resources did not produce water balance estimates in 2017.
[10] "Employment by Industry Data," Employment Development Department.
"Population and Housing Unit Estimates," U.S. Census Bureau.
"Gross Domestic Product," Bureau of Economic Analysis.
[11] "California Agricultural Production Statistics," California Department of Food and Agriculture.

Office of Environmental Health Hazard Assessment's (OEHHA) CalEnviroScreen tool.[12] Other studies, described in further detail in Section VI, were consulted to assess the costs of alternative water supplies in Southern California.

The Department of Water Resources was created in 1956 with a mandate to create a comprehensive statewide water management system. During this period, the State Water Project was conceived to complement the existing federal Central Valley Project (CVP), which was primarily focused on agriculture in the Central Valley. The State Water Project addresses the geographical mismatch between the supply of water, which is concentrated in the snowpacks of Northern California, and the demand for water, which is concentrated in the cities and urban regions in Central and Southern California. In 1960, voters approved the California Water Resources Development Bond Act, which authorized the financing for the State Water Project's construction and ongoing management. One of the project's primary objectives is to provide a reliable water supply to urban and agricultural customers.

The core of the State Water Project's infrastructure includes thirty dams forming storage reservoirs, 705 miles of aqueducts, and thirty pumping and generating plants. Water is initially collected in Northern California's Feather River Basin. From there, water travels through the Feather and Sacramento rivers into the San Francisco Bay Delta. The San Francisco Bay Delta plays a pivotal role in this conveyance system, serving as a natural hub where water from the north meets the aqueducts leading to the south. At the Clifton Court Forebay water is lifted into the California Aqueduct, a 444-mile-long channel that conveys water to the south end of the San Joaquin Valley. Water is then pumped over the Tehachapi Mountains at the Edmonston Pumping Plant and into Southern California. Here the aqueduct splits into east and west branches, with terminal reservoirs that serve various parts of Southern California. Additional branch aqueducts serve specific communities in the North Bay and South Bay regions of the San Francisco Bay Area and on the Central Coast.

Oroville and the San Luis Reservoir, located near Los Banos, are key storage facilities that enhance the State Water Project's ability to provide reliable water supply. Lake Oroville has a capacity of 3.5 million acre-feet, while the San Luis Reservoir, a joint federal-state facility shared with the Central Valley Project, holds about two million acre-feet, of which the SWP's share is slightly over one million acre-feet.

In the face of climate change, California is expected to experience heightened water supply challenges. With rising temperatures and unpredictable weather patterns, managing the already complex water system will become increasingly demanding. Specifically, the impacts of climate change are anticipated to pose new challenges for the San Francisco Bay Delta, a crucial nexus in California's water supply chain.

[12] "DAC Mapping Tool," Department of Water Resources.
"Cal EnviroScreen 4.0," California Office of Environmental Health Hazard Assessment.

To adapt to these changes, the Department of Water Resources is currently pursuing the proposed Delta Conveyance Project and collaborating with agencies on other water storage projects, among other management plans and future projects. These plans are one part of the state's strategy to manage future water supply reliability.

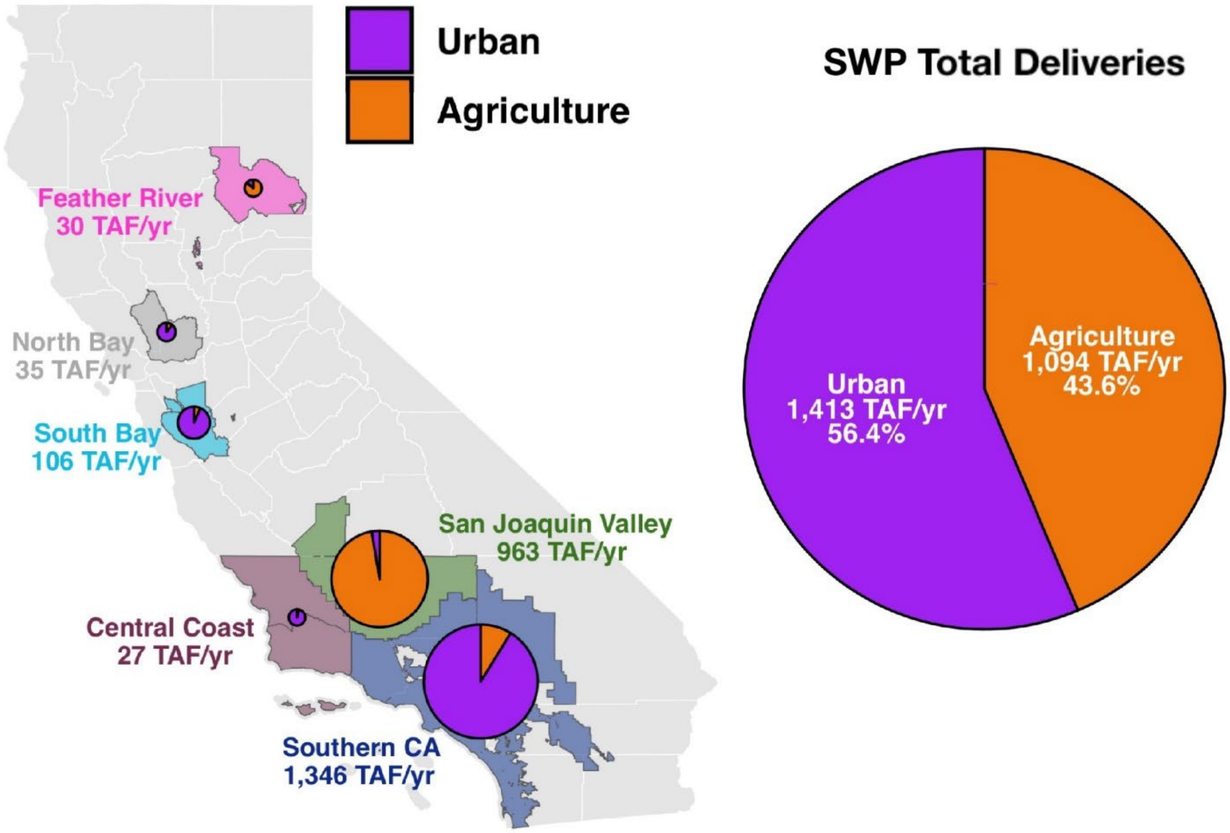
II. Water Use in the State Water Project Service Area

Figure 1 shows the six regions served by the State Water Project and how deliveries are used within the State Water Project service area. The text next to each region shows the average State Water Project deliveries over 18 years. The pie charts in Figure 1 illustrate the annual average breakdown of water use for each region and for the State Water Project service area as a whole. These figures are based on the Department of Water Resources' Water Balance Data. This dataset is based on simplified water budgets that compute applied, net, and depletion water balances for a water year, based on analyses of developed and dedicated water supplies, water uses by sector, water reuses, operational characteristics for an area, and inflows and outflows. These estimates are based on data from 2002 to 2019.[13]

On average, the State Water Project delivers over 2.5 million acre-feet of water annually. Around 1.4 million acre-feet of water, or 56.4% of total State Water Project deliveries, supply urban areas, including residential, commercial, and industrial customers and other urban water uses such as parks, landscaping, and urban fire suppression. Deliveries to the agricultural sector constitute around 1.1 million acre-feet per year, or around 43.6% of total State Water Project deliveries.

[13] Note that these estimates exclude data from 2017. DWR did not produce data for this year.

Figure 1: Water Use in the State Water Project Service Area



Sources: Department of Water Resources, "Water Plan Balance Data."
Note: Units in thousands of acre-feet per year. Water use averaged over 2002-2019 (excluding 2017, for which data was not available).

Southern California receives about 1.35 million acre-feet of State Water Project water per year on average, or around 54% of all water deliveries. Around 90% of all State Water Project water use in Southern California is in the urban sector.[14] Within Southern California, the Metropolitan Water District of Southern California (MWD) is the single largest user of State Water Project water. Currently about 24% of total water needs come from State Water Project deliveries, according to MWD's Integrated Resource Plan.[15] The MWD serves a large area that includes parts of six counties: Los Angeles, Orange, San Diego, Riverside, San Bernardino, and Ventura. The district provides water to twenty-six member agencies, which in turn supply water to a total of approximately nineteen million people.

[14] Department of Water Resources, "Water Balance Data."
[15] "The Integrated Water Resource Plan," The Metropolitan Water District of Southern California.

The State Water Project delivers on average 963 thousand acre-feet per year to the San Joaquin Valley, around 90% of which is delivered to Kern County. Unlike Southern California, State Water Project water is primarily used for agricultural purposes in the San Joaquin Valley.

The South Bay counties of Santa Clara and Alameda receive around 106 thousand acre-feet of State Water Project water per year. Water in the South Bay is predominantly used in the urban sector. The North Bay aqueduct delivers on average thirty-five thousand acre-feet per year, primarily to urban customers in Napa and Solano Counties in the North Bay. The Central Coast aqueduct supplies on average twenty-seven thousand acre-feet per year of water to San Luis Obispo and Santa Barbara counties, again mostly to the urban sector. Finally, in the Feather River Basin, thirty-six thousand acre-feet per year of water is used for both agriculture and urban sectors.

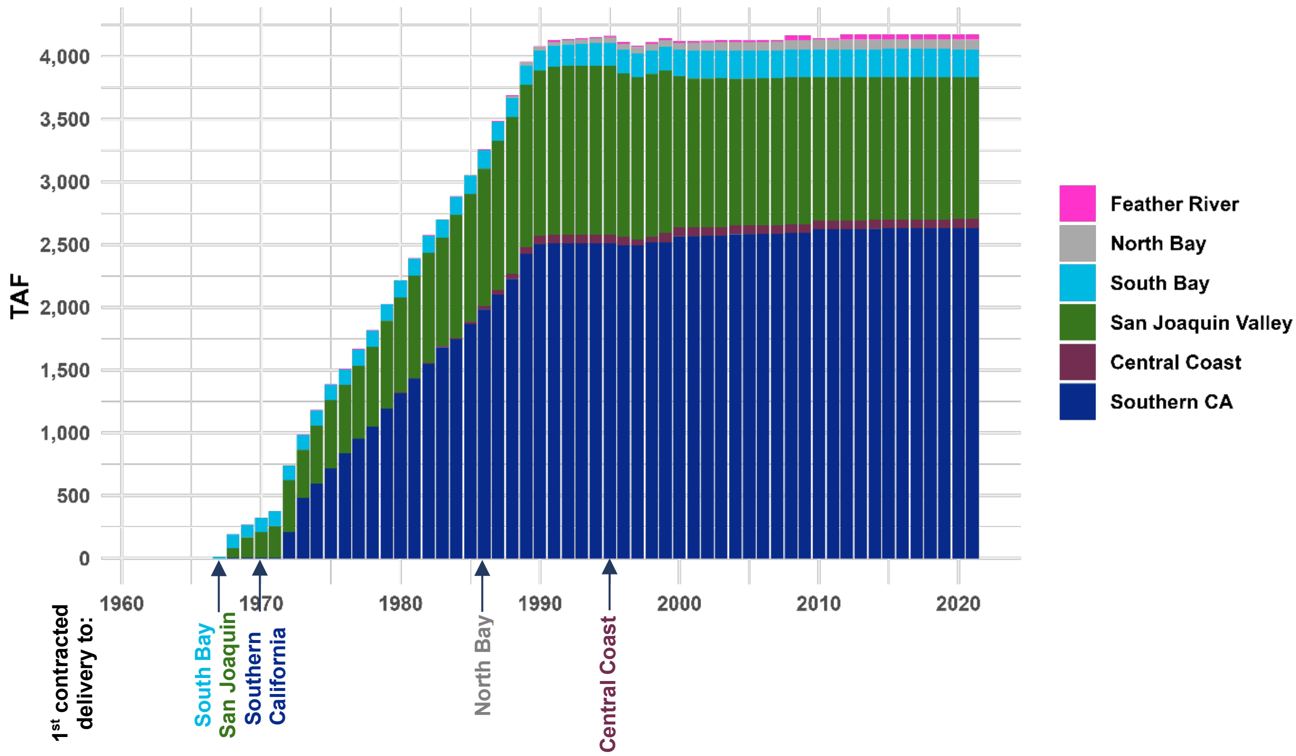
State Water Project deliveries are allocated among contractors in three ways: Table A deliveries, carryover storage, and Article 21 deliveries. Table A water serves as the cornerstone of the State Water Project's allocations, providing long-term stability for both urban and agricultural customers through providing contractors with a share of the available water each year. Carryover storage offers contractors the flexibility to store Table A allocations for future use, as part of a risk mitigation policy to protect against future dry periods. Article 21 water is available occasionally, providing short-term opportunities to access additional supplies when conditions permit.

Figure 2 shows the history of maximum contractual Table A allocations by service area. Currently, almost 4.2 million acre-feet of water is contracted as Table A. Southern California accounts for 63% of the contracted maximum Table A volume, with Metropolitan Water District alone contracting 45%. Contractors in the San Joaquin Valley hold 27% of the maximum Table A volume. Contractors in the South Bay hold 5% of total allocations, whilst contractors in the Feather River Basin, North Bay, and Central Coast each hold 1 to 2%.

Figure 2 shows how the volumes of water contracted under Table A increased over time as new project facilities came online. The first contracted deliveries of project water to the South Bay and San Joaquin Valley began in 1968.[16] In 1971, the Edmonston Pumping Plant began operating, delivering the first water to Southern California. In 1987, the North Bay Aqueduct was completed, allowing the State Water Project to deliver the first contracted water to the North Bay.[17] The first deliveries to the Central Coast began in 1996, with the Central Coast Aqueduct completed and dedicated shortly after in 1997. The East Branch Extension (EBX) of the State Water Project, completed in two phases between 2003 and 2017, supplies project water to eastern San Bernardino County in Southern California[18].

[16] Between 1962-1968, the State Water Project supplied non-project water to contractors in the South Bay, as shown in Figure 3.
[17] Between 1968-1987, the State Water Project supplied non-project water to contractors in Napa Valley through an interim facility.
[18] "Projects and Facilities," San Gorgonio Pass Water Agency.

Figure 2: History of State Water Project Maximum Contractual Table A Allocations by Service Area (1962-2021)

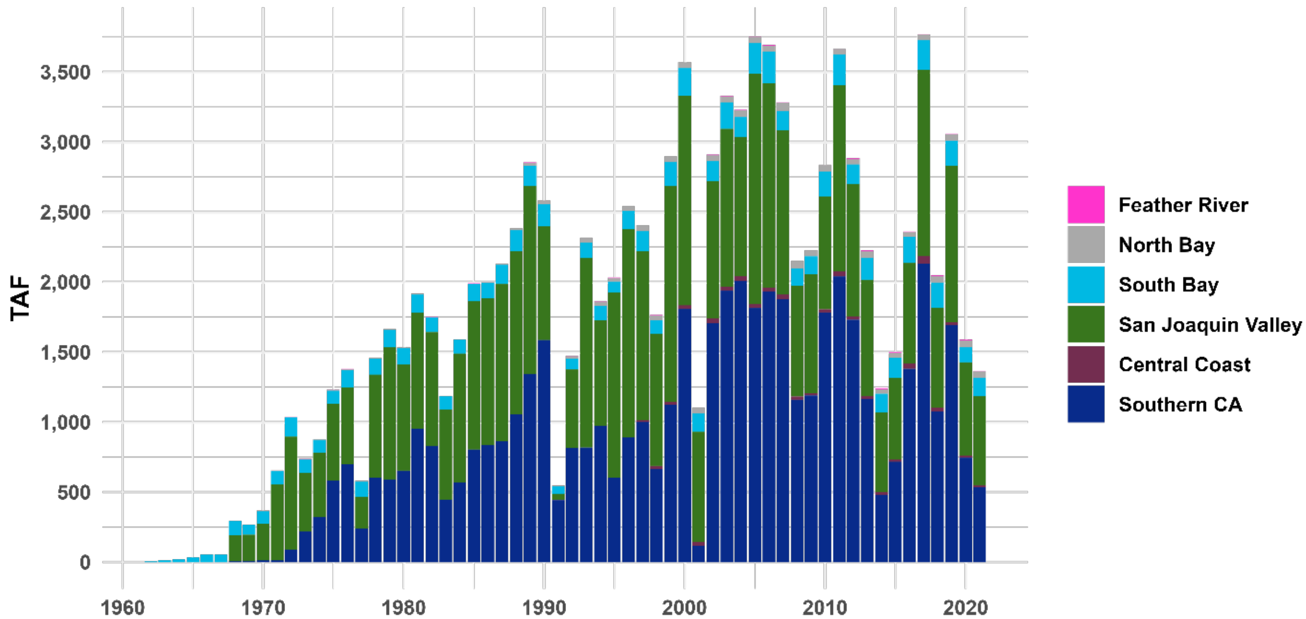


Source: California Department of Water Resources, "Bulletin 132-22, Table B-4."

Table A allocations provide the basis for extended planning, however actual deliveries vary considerably based on year-to-year water availability and operational considerations. Figure 3 shows the full history of actual deliveries to each region in the State Water Project service area. These data include both Table A allocations, as well as carryover water and Article 21 water. Over the past 20 years, State Water Project contractors have received on average 63% of their Table A allocation.[19] Figure 3 highlights the variable nature of water supply; California's climate is characterized by patterns of alternating dry and wet periods, often resulting in challenges for water resource management.

[19] California Department of Water Resources, "Bulletin 132-22, Appendix Tables B-4 and B-5B."

Figure 3: History of State Water Project Deliveries by Service Area (1962-2021)



Source: California Department of Water Resources, "Bulletin 132-22, Table B-5B."

III. The Urban Economy of the State Water Project

The State Water Project contractors supply water to urban customers in all six State Water Project service regions. These regions are home to over two-thirds of California's population, including six of the state's ten largest cities.[20] Urban water customers include residential, commercial, and industrial customers, as well as municipal uses of water such as public parks. A reliable water supply is essential for these customers; it plays a critical role in public health and sanitation, attracting and retaining the residential and business customers that drive economic growth, and contributing to the overall quality of life.

Within this service area, the State Water Project provides 20% of all water for urban consumption, making it a critical part of the area's water supply portfolio. Table 1 below presents summary statistics describing the size of the economy in each of the six service regions. In total, the State Water Project service area contains twenty-seven million residents and serves an area with a GDP of about $2.3 trillion and a median household income of $85,460. This median income is about 23% higher than the average for the United States.[21] The

[20] The six cities supplied by the State Water Project are Los Angeles, San Diego, San Jose, Long Beach, Bakersfield, and Anaheim. Of the remaining four largest cities, three are supplied by other large water conveyance projects: San Francisco is supplied by San Francisco Public Utility Commission's Hetch Hetchy Aqueduct, Fresno by the Central Valley Project's Friant Division, and Oakland by East Bay Municipal Utility District's Mokelumne Aqueduct. Sacramento draws water directly from the Sacramento River.

21 Based on a 2021 American Community Survey estimate of national median household income of $69,717 in 2021 dollars. Gloria Guzman, "Household Income 2021, American Community Survey Briefs," US Census Bureau, October 2022.

State Water Project service area also contains 800,000 businesses that employ more than seven million workers.[22] These urban customers include many underrepresented communities who depend on the State Water Project for a low-cost and reliable water supply. The economic and demographic characteristics of these communities are further discussed in Section V.

Customers in Southern California account for the majority of State Water Project deliveries to urban customers, on average around 1.4 million acre-feet of water per year, or 86% of all urban State Water Project deliveries. Southern California also relies the most heavily on State Water Project water for its urban water supply, with State Water Project deliveries accounting for 28% of its total urban water consumption. Other major sources of urban water supply in Southern California include the Los Angeles Aqueduct, the Colorado Aqueduct, and local surface and groundwater supplies. In terms of salinity, the quality of State Water Project deliveries is significantly better than Colorado Aqueduct deliveries or local groundwater supplies, which in some cases must be treated or blended before use.[23] The State Water Project's Southern California service area has a population of over 22.1 million with a GDP of $1.6 trillion. The Southern California service area includes over 600,000 businesses employing over seven million individuals. The assessed value of property in the State Water Project Service Area is estimated to exceed $3.3 trillion.

The second largest recipient of State Water Project urban water is the South Bay region, including Santa Clara and parts of Alameda County, which receives 7% of total State Water Project urban water deliveries. The State Water Project accounts for 15% of all urban water use in the South Bay. The region's other major water sources include local surface- and groundwater supplies, the Central Valley Project, and the Hetch Hetchy aqueduct. The South Bay service area has a population of over 2.6 million. This region is home to the Silicon Valley tech industry and has a median household income over 50% higher than the State average.

In addition to the urban economies in Southern California and the South Bay, the State Water Project also delivered over eighty-six thousand acre-feet per year to urban customers in the other State Water Project service areas: the Feather River, North Bay, San Joaquin Valley, and Central Coast. These areas have a combined population of over 2.6 million and a combined GDP of over $160 billion.

[22] Note that these estimates include all individuals in the State Water Project service area, not only those who receive residential water from the State Water Project.

[23] The high salinity and contamination in groundwater supplies and Colorado Aqueduct deliveries in Southern California causes hundreds of millions of dollars' worth of damages each year, a disadvantage that is not shared by State Water Project Deliveries. See the results of the Bureau of Reclamation's Salinity Economic Impact Model.

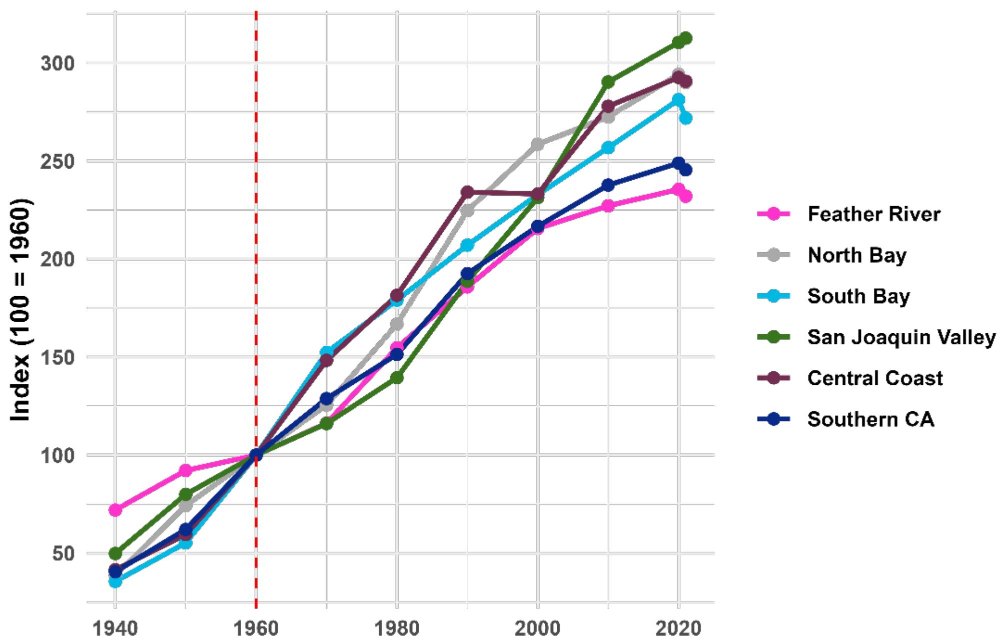
Table 1: Urban Water Use in the State Water Project Service Area

SWP Water Region	SWP Deliveries (TAF / yr)	SWP Deliveries as % of Total Urban Water Supply	Population in SWP Service Area	Median HH Income ($ 2021)	GDP Total ($ Bns 2021)	No. Businesses in SWP Service Area	Employment in SWP Service Area	Assessed Property Value in SWP Service Area ($ Bns 2021)
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Feather River	3.7	3%	318,208	$63,450	$3.4	8,110	18,751	$30.7
North Bay	31.4	7%	584,557	$90,862	$46.3	41,406	192,858	$93.4
South Bay	99.1	15%	2,555,414	$132,548	$460.8	90,219	975,767	$602.7
San Joaquin Valley	24.7	2%	1,043,142	$59,686	$59.5	66,071	259,060	$104.9
Central Coast	26.3	19%	656,421	$84,717	$52.1	20,846	212,092	$84.6
Southern CA	1,222.8	28%	22,051,662	$81,419	$1,630.1	596,652	7,078,430	$3,345.5
Total	**1,408.1**	**20%**	**27,209,404**	**$85,460**	**$2,252.2**	**823,304**	**8,736,958**	**$4,261.7**

Sources and Notes:
[2], [3]: California Department of Water Resources, "Water Balance Data." Annual averages based on data from 2002 to 2019 (missing 2017). Calculated from DAU level data aggregated to the service areas of State Water Project contractors.
[4]: "Bulletin 132-19 Table 1-6 Estimated Population, California Department of Water Resources.
[5]: "2021 American Community Survey 5-year Estimates, Census Tract-level median household income data." US Census Bureau.
Weighted average calculated across census tracts by population and State Water Project service area coverage.
[6]: "Regional GDP data (2021)," Bureau of Economic Analysis.
County-level GDP data aggregated to State Water Project service regions based on State Water Project contractor service area coverage.
[7]: "County Business Pattern," US Census Bureau.
County-level data on business establishment aggregated based on State Water Project contractor service area coverage.
[8]: "2021 American Community Survey 5-year Estimates," US Census Bureau.
Census Tract-level data on total employment data aggregated based on the population within the service areas of State Water Project contractors.
[9]: Bulletin 132-19, Table 1-6 Assessed Valuation, measured in 2021 dollars.

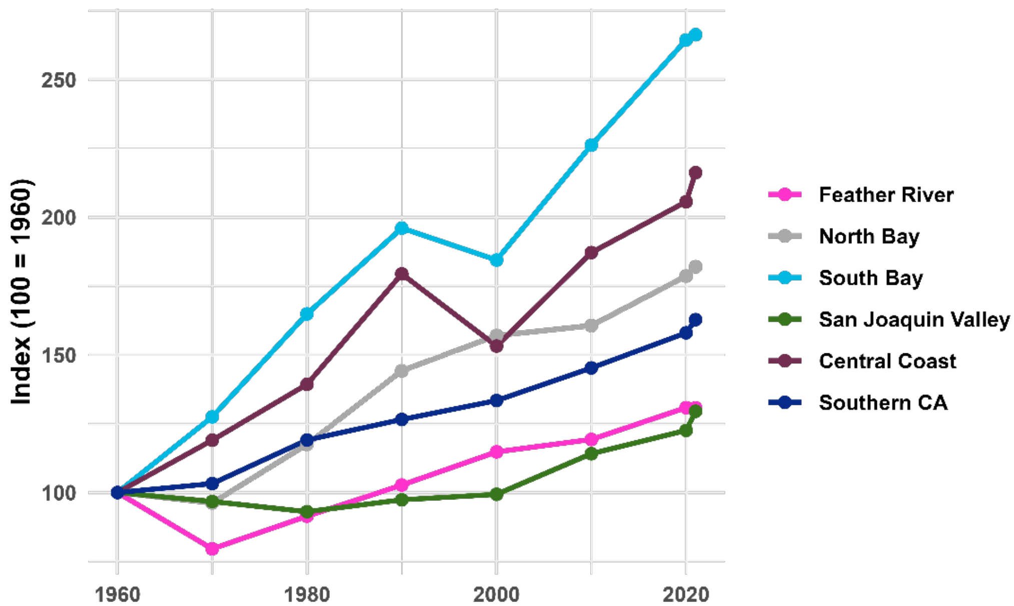
Figure 4 shows the changes in population in each State Water Project service region since 1940, while Figure 5 shows changes in median real household income since 1960. Data for both figures were sourced from the Decennial Census and the American Community Survey. Both population and median household income have grown in all regions over time. Since 1960, the population more than doubled in Southern California, nearly tripled in the Central Coast, South Bay, and North Bay, and more than tripled in the San Joaquin Valley. Household income increased by 25% in rural Feather River and San Joaquin Valley regions. The North Bay and Southern California regions saw increases exceeding 50% and the Central Coast more than doubled its household income. The South Bay saw the largest growth in median household income at over 150%.

Figure 4: Population Growth in the State Water Project Service Area (1940 – 2021)



Sources: Decennial Census (1940 to 2020), US Census Bureau; American Community Survey (2021), US Census Bureau.
Notes: 1960 Population = 100. County-level population data aggregated to State Water Project service regions.

Figure 5: Median Household Income Growth in the State Water Project Service Area (1960 – 2021)



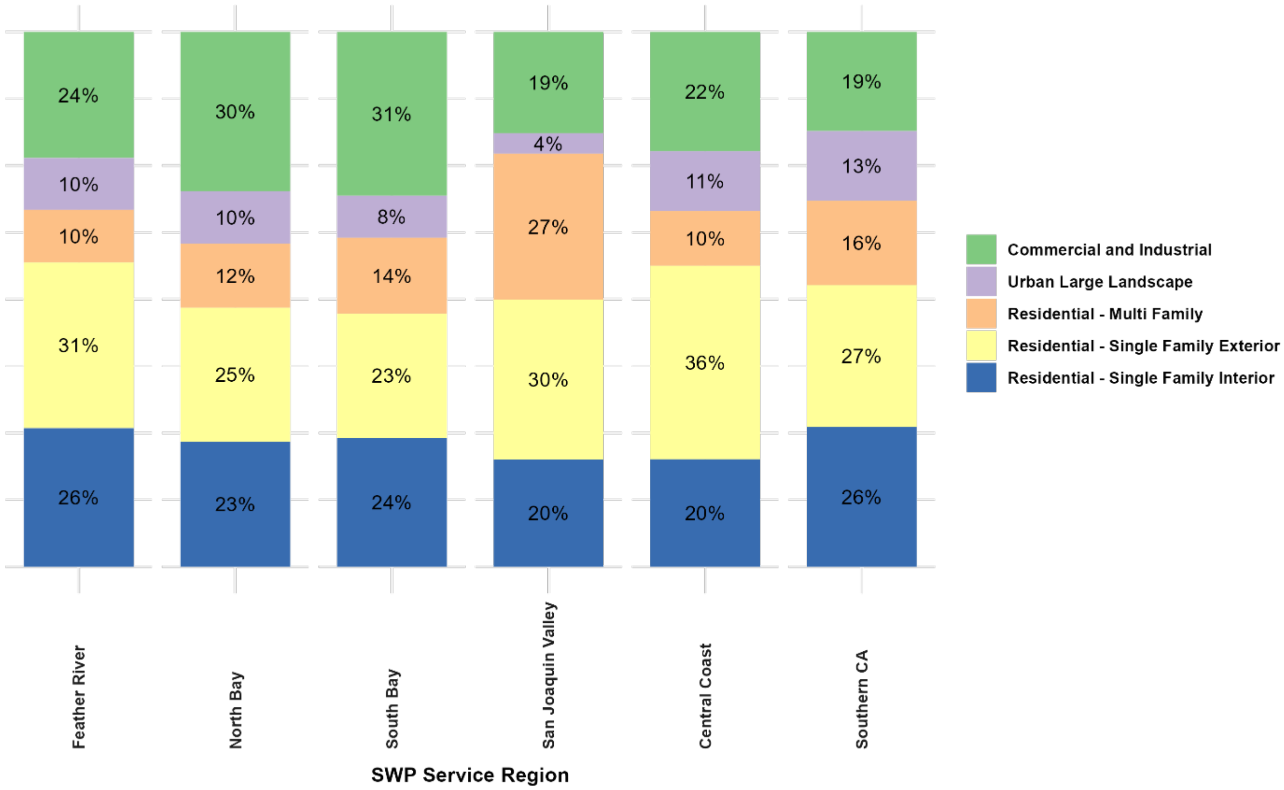
Sources: Decennial Census (1960 to 2020), US Census Bureau; American Community Survey (2021), US Census Bureau.
Notes: 1960 Median Household Income = 100. County level median household income data weighted and aggregated by population served by State Water Project.

Figure 6 shows the percentage breakdown by sector of urban water use within each service area. These sectors include commercial and industrial, urban large landscapes (e.g., parks, golf courses and urban green spaces), multi-family domestic water use, single family exterior (e.g., gardens and yards), and single-family interior.

Most of Southern California's urban water use is in the residential sector, accounting for 69% of the 4.2 million acre-feet used per year. Within the residential sector, 77% of water is consumed by single family units, with a similar split across interior domestic water consumptions and exterior landscape use. Multi-family water consumption only accounts for less than a quarter of all residential water use. Southern California uses the lowest percentage of water in commercial and industrial sectors, but the highest percentage of water in managing large urban landscapes.

Across all service areas, the single-family exterior water use remains the highest at 1.77 million acre-feet per year, 27% of the total urban water consumption. The second highest water use is in the single-family interior sector at 1.6 million acre-feet per year, 25% of the total urban water consumption. Overall, single-family water consumption accounts for more than half of all urban water use across all service areas. Commercial and industrial water use comes third at 1.35 million acre-feet per year, 20% of the total urban water consumption.

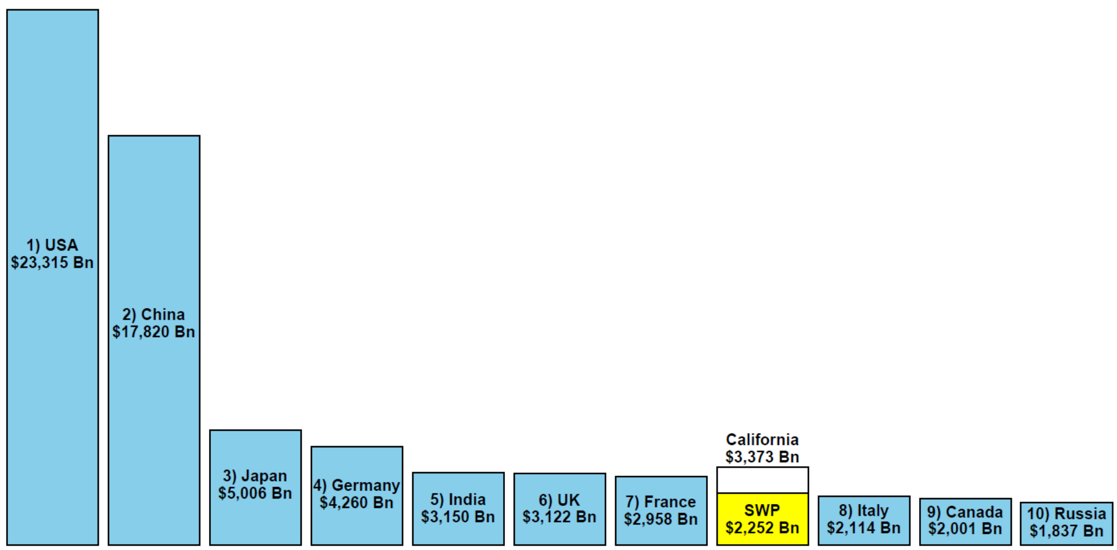
Figure 6: Breakdown of Urban Water Use by Sector



Source: Department of Water Resources, "Water Balance Data."
Note: Water use averaged over 2002 to 2019, except 2017 where data is unavailable.

Figure 7 compares the economy served by the State Water Project with the major world economies, as measured by their GDPs. The State Water Project serves a region equivalent to almost 10% of U.S. GDP and two-thirds of California's GDP, at $2.2 trillion. The State Water Project service area's economy is between the size of those of France and Italy, the 7th and 8th largest economies in the world.

Figure 7: If the State Water Project Service Area Were a Country, it Would Be the World's 8th Largest Economy



Source: "GDPRanking," The World Bank Group.
Notes: GDP measured in billions of 2021 United States Dollars. GDP of economy served by State Water Project calculated by aggregating GDP of counties served by State Water Project, weighted by the proportion of population served by State Water Project.

Table 2 compares the State Water Project with other major domestic water conveyance projects in the USA, as well as the economies they serve. The State Water Project is the largest domestic water transfer infrastructure in the country, in considering distance of water transferred, size of economy served, population served, and size of associated water infrastructures. Although the Central Valley Project and the All-American Canal both convey larger volumes of water than the State Water Project, these projects primarily supply the agricultural sector, and thus support a much smaller economy.

Other projects serve areas that overlap with the State Water Project. The Colorado River Aqueduct, which diverts water from the Colorado River to Coastal Southern California, delivers 1.2 million acre-feet annually to Los Angeles, San Bernadino, Orange, and San Diego Counties. The Los Angeles Aqueducts, serving the City of Los Angeles, transfers around 425 thousand acre-feet of water per year from the Owens River to San Fernando and Los Angeles. The Central Valley Project serves the San Joaquin Valley.

Table 2: Comparison of the State Water Project to Other Water Conveyance Projects in the USA

	Project Name	Economy Served (Billions of 2021 US$)	Water Source(s)	Destination(s)	Purposes of Water Transfer	First Operations	Total Water Transfer Distance (Miles)	Total Water Transfer Volume (TAF/Year)
[1]	California State Water Project	$2,252	Lake Oroville	Southern California, SF Bay Area, San Joaquin Valley	Domestic Supply; Irrigation	1962	701	2,700
[2]	Colorado River Aqueduct	$1,501	Colorado River	Southern California	Domestic Supply	1939	242	1,216
[3]	New York City Water Supply System	$1,068	Catskill / Delaware Watersheds	New York City	Domestic Supply	1842 (Expanded in 1890, 1916, and 1953)	251	2,240
[4]	Los Angeles Aqueducts	$836	Owens River	Los Angeles	Domestic Supply	1913 (Second Aqueduct 1970)	370	425
[5]	Central Valley Project	$663	Trinity, San Joaquin, Sacramento River Basins	San Joaquin Valley and SF Bay Area	Domestic Supply; Irrigation	1933	373	7,003
[6]	Central Arizona Project	$366	Colorado River	Central and Southern Arizona	Domestic Supply; Irrigation	1992	336	1,500
[7]	All-American Canal	$10	Colorado River	Imperial Valley	Domestic Supply; Irrigation	1942	81	18,934

Notes: Estimates of the size of the economy served by each project are calculated based on the service area of each project using BEA county-level GDP data. All other information was referenced from the sources below.

Sources: Shumilova, Oleksandra, et al., "Global Water Transfer Megaprojects: A Potential Solution for the Water-Food-Energy Nexus?," *Frontiers in Environmental Science*, Vol. 6 (2018), https://doi.org/10.3389/fenvs.2018.00150; "Regional GDP data (2021),"Bureau of Economic Analysis; Rennenkampf, Lenore, "National Register of Historic Places nomination, Old Croton Aqueduct," *U.S. National Archives*; "A History of the NYC Water Supply System," Duke Geological Laboratory; "Out of the Archives: 75 Years of Delaware System Water," NYC Water.

Table 3 below compares the State Water Project with other major domestic water conveyance projects in the world. Many countries have adopted similar large-scale water transfer projects to mediate the imbalance of water distributions.[24] Like the State Water Project, most of these projects serve multiple purposes, including energy generation, agricultural, residential, and commercial water supply. Of all the projects, the State Water Project serves the second largest economy, and is among the top three projects in terms of distance water is conveyed. The largest projects in this table from China, Israel and Mexico are briefly described below:

China operates the highest volume and longest water conveyance system in the world.[25] China's water shortage problem is prominently a water distribution problem, exacerbated by a large population. To address these issues, the South-to-North Water Diversion Project was approved, and construction commenced in the

[24] Rodell, M. et al, "Emerging trends in global freshwater availability," *Nature* 557, doi: 10.1038/s41586-018-0123-1.
[25] "South-to-North Water Diversion Project," Water Technology.

early 2000s.[26] The eastern route serves three provinces, benefiting more than 83 million residents with an annual delivery of more than 7 million acre-feet of water.[27] The central route delivers nearly 12 million acre-feet of water to Beijing, Tianjin, Hebei, and Henan. The current two operating routes now transfer almost 20 million acre-feet of water over 1,600 miles, supporting a residential, industrial, and agricultural economy of nearly five trillion dollars, and a population of over one billion. Upon completion, all three routes are estimated to deliver a total of 35 million acre-feet.

Israel's National Water Carrier transports desalinated sea water from the north, which makes up about half of the country's freshwater supply, to replenish Lake Kinneret and service domestic water supply across the country.[28] Managed by the state-owned national water company Mekorot, the project delivers more than 500 thousand acre-feet of residential, commercial, and agricultural water across the country, as well as Jordan, the Palestinian Authority and Gaza Strip.[29] Israel now has a 20% water surplus, and exports some excess water to neighbors like Jordan, even during the drought years.

The Cutzamala System in Mexico was constructed to divert water from the Cutzamala and Lerma-Balsas River systems to the north of Mexico City and the State of Mexico. The water traverses nearly 150 miles and is pumped to a height of more than 1,300 meters using 102 pumping stations.[30] Despite the high energy cost of operation, the system delivers 388 thousand acre-feet of water for urban, industrial, and agricultural uses that support an economy of $338 billion. Despite this conveyance system, Mexico City still struggles with water supply reliability; many neighborhoods receive have intermitted water supplies.

[26] "South-to-North Water Diversion Project, China," University of Chicago.
[27] "南水北调东线工程通水十年：直接受益人口超 8300 万 综合成效显著," Tibet.cn.
[28] "Reverse water carrier launched to refill Kinneret," Globes.
[29] "Israel Has Become a Water Powerhouse," The Jerusalem Post.
[30] "Summary: Cutzamala System," Auburn Sciences and Mathematics.
"The Cutzamala System," Water for Urban Areas, Foods and Nutrition Library.

Table 3: Comparison of State Water Project to Other International Water Conveyance Projects

	Project Name	Country	Economy Served (Billions of 2021 US$)	Water Source(s)	Destination(s)	Purposes of Water Transfer	First Operations	Total Water Transfer Distance (Miles)	Total Water Transfer Volume (TAF/Year)
[1]	California State Water Project	USA	$2,252	Lake Oroville	Southern California, SF Bay Area, San Joaquin Valley	Domestic Supply; Irrigation	1962	701	2,700
[2]	South-to-North Water Diversion Project (Eastern)	China	$3,953	Yangtze River	Shandong, Anhui, Jiangsu Province	Domestic Supply; Irrigation	2013	718	11,999
[3]	South-to-North Water Diversion Project (Central)	China	$1,063	Yangtze River	Henan, Hebei, Beijing Province	Domestic Supply; Irrigation	2014	890	7,296
[4]	Jiang Shui Bei Diao Project	China	$440	Yangtze River	Northern Jiangsu Province	Domestic Supply	1980	249	2,675
[5]	National Water Carrier of Israel	Israel	$391	Galilee Sea	Most of Israel	Domestic Supply; Irrigation	1964	81	503
[6]	Cutzamala System	Mexico	$338	Cutzamala River	Greater Mexico City	Domestic Supply	1993	138	388
[7]	Tagus-Segura Transfer	Spain	$59	Upper Tagus River	Murcia Region	Domestic Supply; Irrigation	1978	178	247
[8]	Indira Gandhi Canal	India	$48	Harike Wetland	Northwest Rajasthan	Domestic Supply; Irrigation	1983	244	8,600
[9]	Goldfields Water Supply Scheme	Australia	$5	Helena River	Coolgardie and Kalgoorlie	Domestic Supply; Irrigation; Mining	1903	329	26,632
[10]	Yin Da Ru Qin Project	China	$5	Datong River	Lanzhou New District	Domestic Supply	1995	549	3,591

Sources: Shumilova, Oleksandra, et al., "Global Water Transfer Megaprojects: A Potential Solution for the Water-Food-Energy Nexus?," *Frontiers in Environmental Science*, Vol. 6 (2018), https://doi.org/10.3389/fenvs.2018.00150;
[2]: Yang, Zitong, et al., "Benefit Evaluation of East Route Project of South to North Water Transfer Based on Trapezoid Cloud Model," *Agricultural Water Management*(2021).
[3]: 人民网, 央广网, 网易新闻, China Briefing.
[4]: Jiangsu Province Water Board, Frontiers in Environmental Science, Baijiahao.
[5]: The Jerusalem Post, The World Bank.
[6]: Frontiers in Environmental Science, Statista.
[7]: El Regadío, One World - Nations Online, City Population, Expansíon.
[8]: PRS Legislative Research.
[9]: Remplan, Water Technology.
[10]: 甘肃经济信息网, 搜狐新闻, 安徽农业科学.

IV. The Agricultural Economy of the State Water Project

The State Water Project water is used in the agricultural sector primarily in the southern San Joaquin Valley, but State Water Project water is also used in agriculture in most other regions supplied by the project. Kern, Kings, San Diego, and Ventura receive the vast majority of all agricultural State Water Project deliveries, at over 93%, based on Department of Water Resources Water Balance Data. Table 4 below provides an overview of agricultural water use in the four top State Water Project delivery counties. Kern is by far the largest recipient of agricultural water deliveries, receiving 75% of all deliveries. These State Water Project agricultural deliveries are a component of all agricultural water use in these four counties, as they make up between 6 and 29% of total agricultural water use per county. State Water Project agricultural deliveries comprise nearly one quarter of all agricultural water used in Kern County.

In total, the State Water Project service area employs around 160,000 farm workers, according to 2021 data from the Employment Development Department (EDD) Current Employment Statistics (CES) dataset.[31] Farm employment in the top four counties totals over 113,000. Kern County alone makes up about 43% of total farm employment within the State Water Project Service Area.

The total value of agricultural production in regions served by the State Water Project exceeds $19 billion, with over $8 billion worth of production in Kern County alone. Table 4 below also lists the top value agricultural products in each of the four counties and for the entire State Water Project service area. The largest crops in Kern County include table grapes, oranges, tangerines/tangelos, pistachios, and almonds. In Kings County there is significant dairy and cattle production, and cotton is grown in the Tulare Lakebed. In coastal areas such as San Diego and Ventura Counties, nursery crops, raspberries and avocados predominate.

Table 4: Agricultural Water Use in the State Water Project Service Area

County	Average SWP Agricultural Deliveries (TAF / yr)	% of Total SWP Agricultural Deliveries	% of SWP Water Use in Agriculture	Farm Employment	Value of Agricultural Production ($ Bns 2021)	5 Highest Value Agricultural Products
[1]	[2]	[3]	[4]	[5]	[6]	[7]
Kern County, CA	803	74.9%	23.9%	69,000	$8.22	Grapes, Citrus, Pistachios, Almonds, Milk
Kings County, CA	99	9.2%	6.4%	8,095	$2.32	Milk, Pistachios, Almonds, Cotton, Cattle
San Diego County, CA	64	6.0%	29.2%	8,945	$1.67	Nursery, Flowers, Avocados, Vegetables, Citrus
Ventura County, CA	38	3.6%	11.6%	26,677	$2.04	Berries, Citrus, Nursery, Avocados, Vegetables
Other	68	6.3%	0.5%	47,261	$4.80	Grapes, Berries, Nursery, Milk, Lettuce
Full SWP Service Area	**1,072**	**100%**	**5.24%**	**159,978**	**$19.06**	**Grapes, Nursery, Berries, Milk, Almonds**

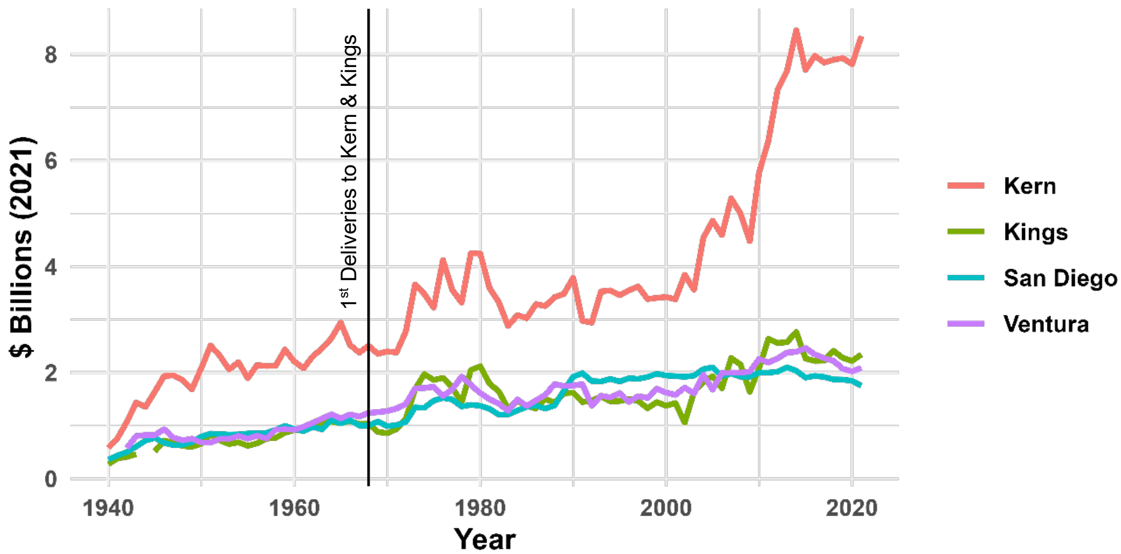
Notes:
[1]: 4 counties with largest average volume of agricultural water deliveries from the State Water Project.
[2]: Department of Water Resources, "Water Balance Data." Annual averages based on data from 2002 to 2019 (missing 2017). Calculated from DAU level data aggregated to the service areas of State Water Project contractors.
[3]: State Water Project agricultural water deliveries in county as a share of total State Water Project agricultural water deliveries. Calculated based on [2]
[4]: State Water Project agricultural deliveries in county calculated as a share of total agricultural water use in the county. Calculated based on Department of Water Resources Water Balance Data.
[5]: 2021 Employment Estimates by Sector, Employment Development Department, aggregated monthly data (maximum)

31 Note the CES data may undercount farm labor because the data does not include the self-employed, unpaid family workers, and private household employees. The data may also undercount farm contract laborers.
"Current Employment Statistics (CES)," State of California Employment Development Department.

[6], [7]: 2021 County Agricultural Commissioners' Annual Crop Reports, measured in Billions of 2021 USD.

Figure 8 captures the growth in agricultural production value over time for Kern, Kings, San Diego, and Ventura counties. All four counties have steadily grown in agricultural value since the first State Water Project deliveries in 1968. The value of agricultural production has about doubled since then, in the case of Kings, San Diego, and Ventura counties, and has more than tripled in Kern County. Kern County experienced a significant uptick in production value over the past couple of decades, due in large part to almonds and pistachios.

Figure 8: Agricultural Production in Counties with Significant State Water Project Water Use in Agriculture



Source: County Agricultural Commissioners' Annual Crop Reports.
Notes: Top 4 Counties based on volumes of State Water Project Agricultural Delivery based on Department of Water Resources Water Balance Data. Total value of agricultural production measured in billions of 2021 USD. The first deliveries to Kern & Kings counties began in 1968. First deliveries to San Diego via Metropolitan Water District began in 1971. Some communities in Ventura began receiving State Water Project water from Metropolitan in 1971, however Ventura County itself did not become a State Water Project contractor until 1990.

In Kern and Kings counties in particular, agriculture plays a dominant role in the local economy and labor market. Farm employment makes up almost 20% of all employment in these counties, and many other jobs are in adjacent sectors supporting the agricultural economy.

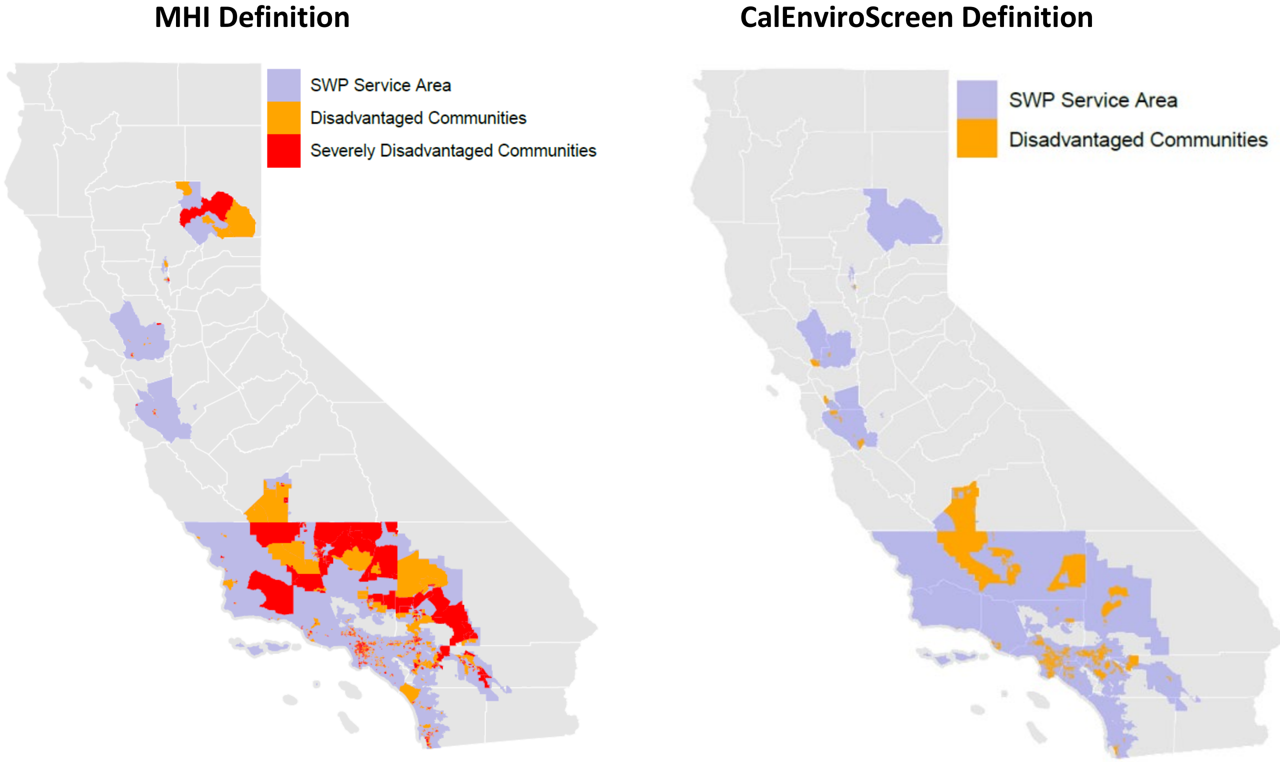
V. Underrepresented Communities Served by the State Water Project

Low-income and environmentally impacted communities make up a sizable number of the residents in the State Water Project service area. California's Human Right to Water Law (Assembly Bill 685) requires that every resident have access to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes. Furthermore, many state-run bonds and grants have requirements that target funds at projects that benefit communities that are identified as “disadvantaged.”

Defining "disadvantaged communities" (DACs) in state programs began in the early 2000s, when the term was used to allocate drinking water bonds to communities with a median household income (MHI) below 80% of the state average. However, DAC definitions that focus only on income are not able to capture other comprehensive social, environmental, and climate-related impacts that led to disparities in quality-of-life outcomes. Different state programs have adopted differing definitions of DAC over time to include some of these additional vulnerabilities. Most notably, the California Environmental Protection Agency (CalEPA) was assigned the responsibility of defining DACs for the purposes of grant programs they manage related to California’s cap and trade program, and they developed a metric called CalEnviroScreen. CalEnviroScreen uses environmental, health, and socioeconomic information to produce scores for every census tract in the state. Census tracts within the bottom 25% of scores using CalEnviroScreen are considered disadvantaged communities. A recent report sponsored by the Department of Water Resources recommended retiring the MHI definition of DAC from future legislation. The report also discusses how the use of the term “disadvantaged community” has been identified as stigmatizing during community outreach processes and encouraged the use of more inclusive terms such as “underrepresented community.”[32]

[32] Haalan, O., & Ortiz, P., “Disadvantaged communities nomenclature within the State of California: Findings and conclusions — A recommendation document,” *California Department of Water Resources*, 2022.

Figure 9: DAC Communities in the State Water Project Service Area



Sources: Disadvantaged Communities Categorization, Department of Water Resources; Disadvantaged Communities Nomenclature Within the State of California: Findings and Conclusions, Department of Water Resources; CalEnviroScreen 4.0, OEHHA.
Notes: Based on Department of Water Resources' income-based disadvantaged communities definition (Left) and OEHHA's CalEnviroScreen score (right).
Disadvantaged communities have a median household income at or below 80 percent of the statewide MHI. Severely disadvantaged communities have a median household income at or below 60 percent of the statewide MHI. Calculated based on Census tract-level median income data from 2021 American Community Survey 5-year Estimates. Aggregated based on the service regions of Department of Water Resources contractors. Note that these service areas might not reflect recipients of municipal water supplies from the State Water Project. CalEnviroScreen identifies California communities most affected by pollution and where residents are more vulnerable due to socioeconomic factors. Disadvantaged communities are defined as the top 25% highest scoring census tracts based on a combined measure of environmental, health, and socioeconomic burdens. This map displays disadvantaged communities in census tracts that have more than half of their population served by the State Water Project.

Figure 9 maps census tracts that meet different definitions of 'disadvantaged community'. The map on the left panel shows census tracts within the State Water Project service area that are defined as disadvantaged or severely disadvantaged according to Department of Water Resources' definition based on median household income. Under this definition, DACs have a MHI at or below 80 percent of the statewide median household income. Severely disadvantaged communities have a MHI at or below 60% of the statewide median household income. Currently, these definitions correspond to a MHI between $47,000 and $63,000 for DACs and below $47,000 for SDACs, respectively. The map on the right panel shows the communities that are defined as DACs according to the CalEnviroScreen definition.

Comparing the distribution of DACs between the two definitions, the MHI definition classifies significantly more census tracts in the San Joaquin Valley as DACs, as average household incomes in this region are significantly lower than the state average. It also classifies significantly fewer households in the South Bay as DACs compared to the CalEnviroScreen definition, which highlights that although average household incomes are significantly higher in the South Bay, there are still many communities that face adverse health and environmental conditions.

Table 5 presents statistics for population and employment in DACs within the State Water Project service area under each definition of DAC. Under the MHI definition of DAC, there are almost 8.2 million individuals living in DAC communities in the State Water Project service area. Most of these individuals (87% or 7.1 million) live in the Southern California service area. Based on the MHI definition, 32% of individuals in the State Water Project service are considered part of DACs. In the rural San Joaquin and Feather River areas, 67% individuals are within the DACs. Overall, the CalEnviroScreen definition of DAC is less stringent than the Department of Water Resources definition. By construction, the CalEnviroScreen definition contains 25% of California's population. The measure also contains 25% of the population of the State Water Project service area, or around 6.5 million individuals, making the State Water Project service area representative of the entire state in terms of DAC populations.

Table 5: DAC Populations in the State Water Project Service Area

SWP Service Area	Disadvantaged and Severely Disadvantaged Communities (Median Household Income Definition)				Disadvantaged Communities under SB535 EnviroScreen			
	Population in DACs	% of Total Population in DACs	Full-Time Employment within DACs	Full-Time Agricultural Employment within DACs	Population in DACs	% of Total Population in DACs	Full-Time Employment within DACs	Full-Time Agricultural Employment within DACs
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Feather River	53,351	75%	19,550	2,087	23,497	33%	8,610	919
North Bay	83,473	14%	31,560	1,273	48,547	8%	18,355	741
South Bay	104,264	4%	60,303	157	109,292	4%	63,211	165
San Joaquin Valley	640,503	60%	241,204	46,192	230,075	22%	86,643	16,593
Central Coast	171,383	24%	83,419	9,143	6,243	1%	3,039	333
Southern CA	7,116,232	34%	3,192,844	19,107	6,119,975	29%	2,745,853	16,432
Full SWP Service Are	**8,169,205**	**31%**	**3,628,881**	**77,958**	**6,537,628**	**25%**	**2,925,711**	**35,182**

Sources and Notes:
[2]: Based on the Department of Water Resources' income-based disadvantaged communities definition.
Disadvantaged communities have a median household income at or below 80 percent of the statewide median household income (MHI).
Severely disadvantaged communities have a median household income at or below 60 percent of the statewide MHI.
Calculated based on Census tract-level median income data from 2021 American Community Survey 5-year Estimates. Aggregated based on the service regions of Department of Water Resources contractors. Note that these service areas might not reflect recipients of municipal water supplies from the State Water Project.
[3]: [2] / Total Population in service areas of State Water Project contractors.
[4], [5]: "2021 Current Employment Statistics (CES)," State of California Employment Development Department.

[6]: Based on CalEnviroScreen disadvantaged communities definition. CalEnviroScreen identifies California communities most affected by pollution and where residents are more vulnerable due to socioeconomic factors. Disadvantaged communities are defined as the top 25% highest scoring census tracts based on a combined measure of environmental, health, and socioeconomic burdens.
[7]: [6] / Total Population in service areas of State Water Project contractors.
[8], [9]: "2021 Current Employment Statistics (CES)," State of California Employment Development Department.

VI. The Costs of State Water Project Deliveries and Alternative Supplies

Between 2012 and 2021, the growth in retail water rates paid by households in the United States increased by 43%, surpassing growth in household income.[33] Rate increases present economic challenges particularly for low-income and underrepresented households. Although it is only one of multiple factors that have driven price increases over the past decade, the costs of water supplies, and particularly of developing new supplies, have directly influenced changes in retail rates. This section analyzes the costs paid by contractors for State Water Project deliveries in the context of the costs of developing alternative water supplies.

Under the original water supply contracts, the costs that State Water Project contractors pay for water have two main components: a Conservation Charge, and a Transportation Charge. The Conservation Charge recovers both capital costs and operation, maintenance, power, and replacement (OMP&R) costs for facilities that store and convey water, including the Oroville Dam complex, Delta facilities, and the San Luis Reservoir. This is a fixed charge based on each contractor's Table A allocation, rather than the volumes of water delivered.[34]

The Transportation Charge covers the capital and OMP&R costs of the facilities that pump and convey water from the Delta to each individual contractor. Transportation costs have a fixed component that covers the costs of conveyance facilities, as well as a variable component that covers the power-related costs needed to convey water to each contractor. The fixed component of this charge varies depending on the cost of specific segments of aqueduct the contractor uses, and the variable component depends on the cost energy used to convey water conveyed in a particular year. Contractors also pay financing costs that fully repay the revenue bonds that finance the State Water Project. These bonds account for 82% of State Water Project financing and are fully repaid by State Water Project contractors through their rate payers instead of the general taxpayers. The objective of these charges is to fully recover the costs of the original facilities by 2035.

Please note that on January 1, 2024, the Department of Water Resources is implementing the State Water Project contract extension amendment. This amendment extends the water supply contracts to 2085 and

[33] "Up 43% over Last Decade, Water Rates Rising Faster than Other Household Utility Bills," Bloomfield Research, August 23, 2021.
[34] Note that the impact of new payment terms starting in 2024 under the recent Contract Extension Amendment has not been considered in this report.

institutes a new cost recovery methodology. This report focuses on the legacy cost recovery methodology used from inception of the State Water Project.

The per acre-foot cost of water delivered by the State Water Project varies significantly from year to year because deliveries are highly variable whilst the costs are mostly fixed. However long-term average costs for project water can be estimated on an acre-foot basis by comparing the long-term averages of costs and deliveries. The approximate cost of delivering State Water Project water ranges between $250 per acre-foot in the San Joaquin Valley, to $600 per acre-foot in Southern California, and as high as $1,440 per acre-foot on the Central Coast.[35] These estimates can then be used to compare the costs of project water to the costs of developing alternative water supplies.

The costs of alternative water supplies are estimated based on various independently conducted studies from research institutes with expertise on California water issues, including the Public Policy Institute of California, California Public Utilities Commission, and the Pacific Institute. Each of them reviewed recently completed alternative water supply projects to analyze yields and cost.

These reports consider the costs of developing four alternative water supplies: desalination projects that produce potable water from seawater using reverse osmosis, recycling projects that reclaim and treat wastewater for reuse, stormwater capture projects that harvest rainwater for storage and local irrigation, and water conservation programs that include use of water-efficient appliances and toilets, as well as landscape rebates for households to replace grassy areas with drought-tolerant plants or artificial turf to reduce water consumption. From the projects reviewed by these studies, we produced cost estimates at the 25th percentile, median, and 75th percentile for each type of project.

These cost estimates should be interpreted cautiously since they describe projects that vary substantially in context and scope. Some alternative water supplies, such as recycling, and stormwater capture have significant scale economies: only large projects achieve costs at the low end of the ranges reported below, whilst small projects have significantly higher costs. Furthermore, there are geographic constraints on the locations of alternative water projects: recycled water projects are most viable when located near both water sources and potential customers; the cost of stormwater capture varies based on urban hydrology, and desalination projects need to be located near the ocean or other saline water source. The reported cost estimates only apply specifically to Southern California and projects requiring additional conveyance will be more costly. Finally, these estimates do not account for additional treatment and compliance costs associated with newer and upcoming water quality regulations; these regulations challenges for stormwater capture and recycled water projects that risk exposure to emerging contaminants.

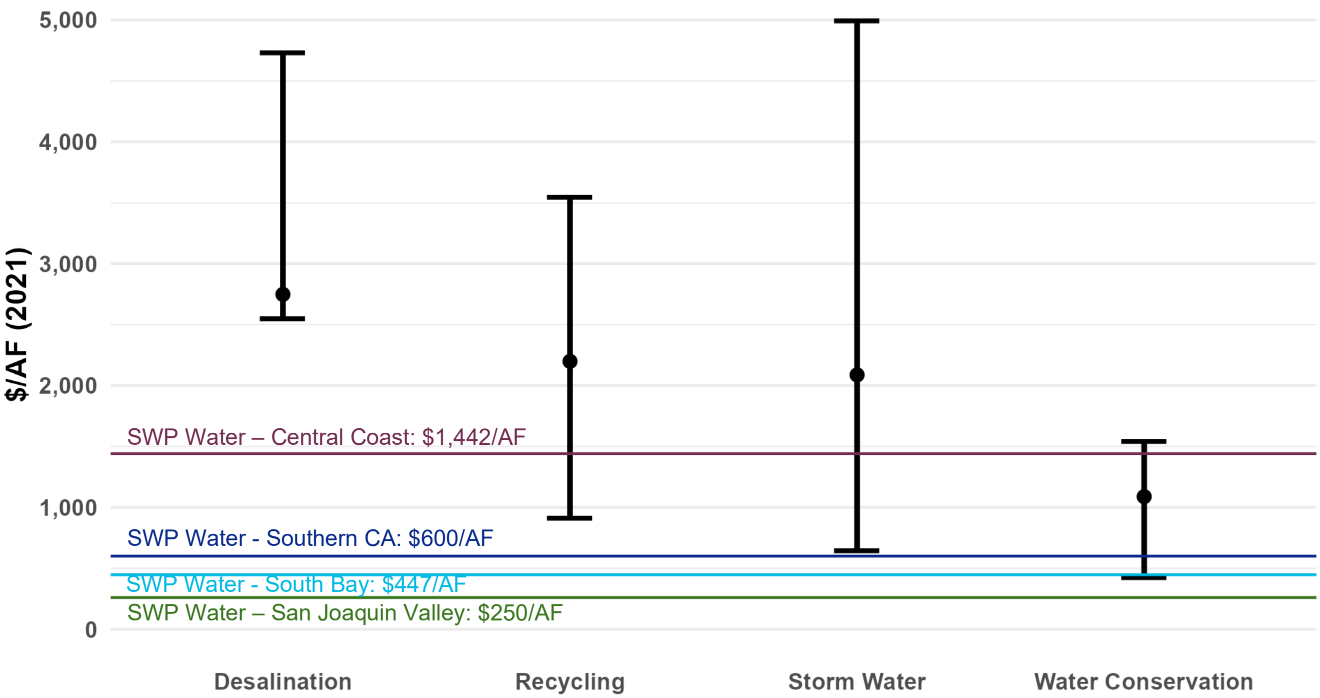
[35] California Department of Water Resources, "Bulletin 132-19, Table 13-12."

Figure 10 below compares the costs of State Water Project deliveries to the costs of alternative water supplies. State Water Project water is more cost-effective than most water recycling programs, which have a median cost of $2,200 per acre-foot, with a range of $1,000 to $3,500, and seawater desalination facilities, which have a median cost of $2,800 per acre-foot, with a range of $2,500 to $4,700. The costs of State Water Project water are competitive when compared to alternatives like stormwater conservation programs ($600 to $5,000 per acre-foot, with a median of $2,100) and water conservation ($420 to $1,500 per acre-foot, with a median of $1,100). The water conservation efforts we consider include replacing toilets and clothes washers with high efficiency models, installing weather-based controllers and rotating nozzles for irrigation, and water capture using rain barrels. Although some water conservation programs have the lowest unit cost of water among the alternatives we consider, they are small in nature and difficult to scale. It would be difficult for these programs to replace a significant volume of State Water Project deliveries.

In addition to cost considerations, permitting and building desalination facilities in Southern California has proven to be challenging, often due to environmental considerations. Currently, desalination accounts for less than one percent of Southern California's water supply. Additionally, alternatives like recycling, stormwater management, and conservation programs are often limited in scale, often less than 10,000 acre-feet of water per year.

California's largest desalination plant in Carlsbad has an annual capacity of 56,000 acre-feet. To replace the volume of water currently provided by the State Water Project to Southern California, twenty-five additional desalination plants of the same size as the Carlsbad facility would need to be permitted and constructed. This highlights the significant challenges in ensuring water supply reliability and underscores the crucial role the State Water Project will continue to play in California's future water security.

Figure 10: The Cost of Developing Alternative Water Supplies to the State Water Project



Sources: Cooley, H., and Phurisamban, R., "The Cost of Alternative Water Supply and Efficiency Options in California," *Pacific Institute*; Sencan, G. and Escriva-Bou, A., "Water Partnerships between Cities and Farms in Southern California and the San Joaquin Valley," *Public Policy Institute of California*; Marie, S., "What Will Be the Cost of Future Sources of Water for California?," *California Public Utilities Commission*; Bulletin 132-2019.

Notes: State Water Project Water Costs for Central Coast, Southern CA and South Bay denoted with solid horizontal lines. State Water Project Water Costs based on Bulletin 132-2019 Table 13-2. Based on Capital, OM&R and Power Charges. Costs adjusted for inflation to 2021 dollars.

Costs of Developing alternative water supplies based on 25th percentile, median and 75th percentile cost estimates included in PPIC, CPUC and Pacific Institute report. The medians of low, median and high estimates are calculated across the three reports. Cost estimates include both large and small water supply projects (> 10,000 & < 10,000 AFY). Desalination cost estimate includes costs for saltwater desalination, but not brackish water. Recycling costs are for indirect potable reuse recycling projects. Water Conservation estimates cover a range of different conservation programs including efficient appliance replacements for toilets and clothes, installing weather-based controllers and rotating nozzles for irrigation, and water capture using rain barrels. Stormwater capture costs are based on the quantiles of proposed projects included in various state databases; See Cooley et. al (2019) for further details.

Costs adjusted for inflation to 2021 dollars.

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