

# 2022 Annual Review

of the construction and operation of the

# State Water Project



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*On the cover: Low water conditions at Bidwell Canyon Marina at Lake Oroville in Butte County. On October 5, 2022, the storage was 1,218,591 acre-feet, 34 percent of the total capacity.  
Photo by Florence Low/DWR*



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### Introduction

Planned, constructed, and operated by the Department of Water Resources (DWR), the California State Water Project (SWP) is the nation's largest state-built, multi-purpose, user-financed water project. Built in the 1960s, the system consists of 36 water storage facilities and 700 miles of rivers, pipelines, and canals that supply water to 27 million people and irrigate 750,000 acres of farmland. Thirty percent of SWP water is used for irrigation, mostly in the San Joaquin Valley, and the other 70 percent is used for residential, municipal, and industrial use. In addition to its primary purpose of supplying water, the SWP also provides flood protection, offers recreational opportunities such as boating and hiking, and generates hydroelectric power. Twenty-three pumping plants move water around the state, powered by a system of power-generation and power-recovery plants. The SWP is the fourth largest power generator in the state, and will be carbon neutral by 2035. DWR operates the SWP in coordination with the federal U.S. Bureau of Reclamation's (USBR) Central Valley Project (CVP), which also moves water throughout California. At almost 60 years old, the SWP requires innovative solutions to meet the challenges of the 21st century, especially how it operates in the more extreme scenarios brought on by a changing climate.

While the SWP was under construction, the public agencies and local water districts that receive water from the SWP signed long-term water supply contracts with DWR. Today, these 29 public agencies and local water districts are collectively known as the SWP contractors, and they serve communities in the Central Valley, desert, and coast of California, providing the water on which agriculture, industry, and households depend. The water supply contracts that were signed six decades ago specify the maximum amount of SWP water a contractor may request annually. However, the amount of SWP water available for delivery varies,

## California Water Commission

The nine-member California Water Commission uses its public forum to explore water management issues from multiple perspectives and to formulate recommendations to advise the director of the California Department of Water Resources, and as appropriate, the California Natural Resources Agency, the Governor and Legislature on ways to improve water planning and management in response to California's changing hydrology. For more information regarding the California Water Commission, visit [cwc.ca.gov](http://cwc.ca.gov).

based on rainfall, snowpack, runoff, water in reservoirs, pumping capacity in the Sacramento-San Joaquin Delta, and operating constraints that protect fish, wildlife, and Delta water quality. As California's hydrologic patterns shift, water deliveries will become increasingly variable, impacting water supply reliability for the SWP's users.

As the state continues to get hotter and drier, it will see, on average, less snowfall, increased evaporation, and greater consumption of water by vegetation, soil, and the atmosphere itself. These hotter, drier conditions, which scientists call "aridification," are impacting the entire American West. Scientists using hydrological modeling and tree-ring reconstruction conclude that the period from 2000 to 2021 was the driest 22-year span since the late 1500s in the American Southwest. Scientists predict a more extreme trend toward megadrought as global warming continues. The SWP is not impervious to these impacts, nor to the wildfires and sea level rise that accompany global climate change.

Over the next 20 years, California could lose 10 percent of its water supplies to aridification. Already, water supplies in the state are stretched thin, serving 40 million Californians. When the SWP was built, there were 16 million people in California, and water was considered more abundant in relation to the population it needed to support. The role of the SWP is more critical than ever and will continue to be hugely important for supplying water for agriculture, urban areas, and ecosystems in a changing climate. Positioning the SWP to be resilient to climate change will ensure the system's functionality for years to come.

In response to California's aridification and loss of water supplies, Governor Gavin Newsom's Water Supply Strategy, published in August 2022, calls for investing in new sources of water supply, accelerating projects, and modernizing how the state manages water through new technology. The actions outlined in the Water Supply Strategy include plans to expand the San Luis Reservoir in Merced



Photo by Kelly M. Grow/DWR

The South Bay Aqueduct was the first delivery system completed in the State Water Project, and has been delivering water to Alameda and Santa Clara counties since 1962 and 1965, respectively.

County by 135,000 acre-feet to capture more winter storm runoff, part of a set of inter-related joint projects to benefit the SWP and CVP; to improve the flexibility of current water systems to move water throughout the state by modernizing SWP conveyance in the Delta; and to repair four major San Joaquin Valley canals damaged by subsidence - the Delta Mendota Canal, the Friant Kern Canal, and two stretches of the California Aqueduct. These actions, once implemented, will spur the SWP's climate resilience.

Water Code section 165 requires the California Water Commission (Commission) to conduct an annual review of the progress of the construction and operation of the SWP. This review highlights SWP planning and operations in 2022 and includes findings and specific recommendations for DWR to keep the Commission apprised of operations and construction activities in 2023. This year, the Commission offers its report in the midst of ongoing drought conditions and the specter of increasing aridification.

In 2022, DWR made 10 presentations to the Commission on various SWP topics centered around the theme: "Preparing for climate extremes – ensuring a reliable State Water Project to meet the challenges of drought, flood, and wildfire." These presentations are a continuation of the public transparency that the Commission has provided since 1967: They utilize the Commission's public forum to help the public stay informed of DWR's efforts, and they provide the basis of the findings and recommendations that the Commission makes to DWR and the Legislature regarding operation of the SWP.

# State Water Project Facilities





## Findings

### The Commission finds that, in 2022:

- DWR took steps to better account for climate change in its water supply forecasting by pursuing data augmentation, forecast model improvements, and partner collaboration.
- DWR advanced multiple climate change-informed planning processes, which included initiating a SWP Climate Change Adaptation Plan, and integrating a range of risk-informed future climate change projections and robust data in the drafting of the 2023 Delivery Capability Report.
- DWR improved its modeling of burn-scarred areas in the Feather River watershed to evaluate how fire has and will continue to impact snowpack accumulation and the timing and amount of runoff.
- DWR took actions to mitigate the impacts from the 2022 drought by considering more extreme scenarios in its water supply planning and engaging in more frequent, earlier cross-agency coordination. DWR is involved in early drought planning for 2023, which entails conservative planning for increased resiliency and continued multi-agency collaboration.
- DWR apprised the Commission of its financial goals, SWP budget, and cost projections, indicating that its 2022 approved SWP budget was \$923 million, including operations and capital costs.
- To address the challenges of aging SWP infrastructure, DWR employed its Asset Management Program to use a risk-informed process to prioritize capital and extraordinary operations and maintenance projects for the repair, refurbishment, and replacement of SWP infrastructure. Additionally, DWR filled 67 positions during the 2021-2022 fiscal year to assist with these projects and received authorization for 35 new positions for fiscal year 2022-2023.
- DWR executed contract extension amendments with 25 SWP Contractors, extending their terms for an additional 50 years (from 2035 to 2085) to ensure long-term financing of SWP capital needs and to mitigate affordability concerns due to cost compression. DWR is in the process of executing the remaining four amendments.
- DWR informed the Commission about key construction activities undertaken in the past year to manage and maintain the SWP, including the installation of an emergency drought barrier to prevent Delta saltwater intrusion.

## Recommendations

### The Commission recommends that:

- DWR provide the Commission with information about how SWP operations will need to adapt to increasing aridity and the reduction in available water supply caused by hotter, drier conditions, including how this will impact water supply contracts.
- DWR inform the Commission of how it balances the needs of its multiple beneficiaries – including the environment and smaller water districts and communities – over the long term and particularly in years of extreme drought.
- DWR inform the Commission about how it is continuing to respond to drought conditions, including how it supports water transfers to offset drought impacts.
- DWR continue to provide the Commission with information about water supply forecasting and allocations.
- DWR keep the Commission updated on its employment of the latest technologies for real-time data collection and measurement to help with water management decision making.
- DWR keep the Commission apprised of its work to better understand atmospheric rivers, and how it is using this knowledge to prepare for flood and to improve SWP climate resiliency.
- DWR keep the Commission apprised of its work to understand the water supply implications of wildfire and any subsequent actions taken to address wildfire-related issues.
- DWR continue to provide the Commission with financial and capacity updates and projections that reflect future resource needs to address the anticipated challenges of climate change and aging infrastructure.
- DWR share with the Commission its long-term plans for aging infrastructure repair.
- DWR keep the Commission apprised of its efforts to advance large-scale infrastructure construction and maintenance in a manner that is inclusive of diverse stakeholders and accounts for the challenges of a changing climate. Specifically:
  - how planning for new Delta Conveyance Project is progressing, and how DWR is considering impacts to the Delta as place; and
  - how projects to address the near-term impacts of subsidence on the California Aqueduct are being coupled with efforts to stem the underlying causes of subsidence.
- DWR work with Commission staff to arrange in-person visits by the Commissioners to SWP facilities and project sites.

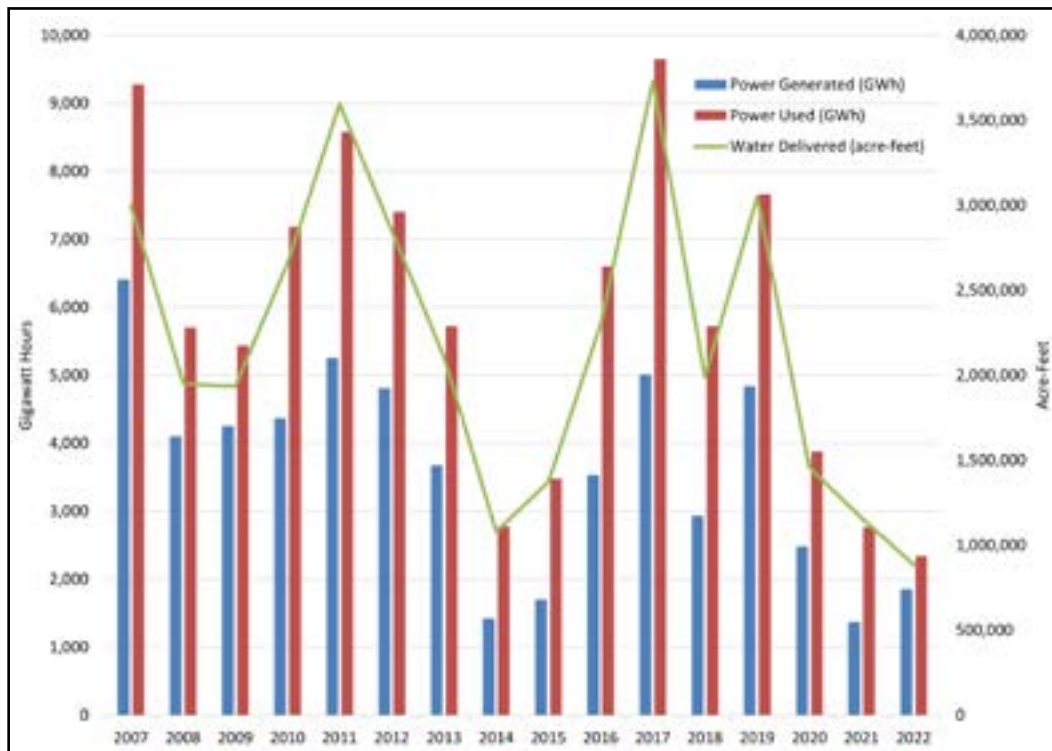


<b>Table 1: SWP Water and Power Statistics<sup>1</sup></b>			
Year	Water Delivered (acre-feet)	Power Generated (GWh/year)	Power Used (GWh/year)
2000	3,584,667	6,832	8,518
2001	2,042,118	4,588	6,358
2002	2,850,215	5,631	8,191
2003	3,167,604	6,117	8,862
2004	3,119,578	6,887	9,661
2005	3,627,004	5,661	8,282
2006	3,691,568	7,515	9,109
2007	2,996,629	6,410	9,276
2008	1,950,968	4,100	5,701
2009	1,933,735	4,255	5,438
2010	2,660,960	4,368	7,184
2011	3,596,749	5,258	8,583
2012	2,848,082	4,810	7,404
2013	2,107,572	3,679	5,721
2014	1,079,839	1,426	2,780
2015	1,375,536	1,699	3,483
2016	2,299,679	3,535	6,598
2017	3,732,527	5,011	9,652
2018	1,984,723	2,933	5,723
2019	3,049,485	4,842	7,662
2020	1,457,500	2,484	3,877
2021	1,160,082	1,371	2,771
2022 <sup>2</sup>	885,311	1,854	2,339

1) Source: Department of Water Resources' State Water Project Analysis Office. (In addition to Table A, reported deliveries include Carryover, Article 21, other SWP deliveries such as Settlement, Permit and Flexible Storage, and other non-SWP deliveries such as Dry Purchase, Temporary Transfer and Water Bank Recoveries.)

2) Table A Water is the maximum amount of SWP water that the State agreed to make available to an SWP Contractor for delivery during the year. Table A amounts determine the maximum water a contractor may request each year from DWR. The State and SWP contractors also use Table A amounts to serve as a basis for allocation of some SWP costs among the contractors.

3) Estimate as of October 31, 2022 (water delivered is through September 2022).

**Figure 1: SWP Water Deliveries and Power**

### SWP Water Deliveries, Power Generation, and Use

The SWP delivered 885,311 acre-feet of water in 2022. The initial allocation to SWP Contractors was limited to any unmet human health the safety needs. The allocation was increased to 15 percent in January 2022, then decreased to five percent in March 2022. The contractors' allocations were based on their maximum Table A2 amount, which equals 4,172,786 acre-feet for all 29 contractors combined. During 2022, the SWP facilities generated 1,854 gigawatt hours (GWh) of energy. During the same period, the SWP used 2,339 GWh of energy.<sup>3</sup>

Table 1 displays recent years' water deliveries and energy generation and usage. In general, SWP power usage increases with SWP water deliveries. Figure 1 shows that 2022 power generation was higher than in 2021, and power use was lower. Low water deliveries numbers were driven by the limited precipitation and diminished runoff in 2022.

### Preparing for Climate Extremes

During the 2021-2022 water year, California experienced torrential rain; a record-breaking, prolonged spring dry spell; a record-breaking fall heat wave; and its third year of drought. The year was preceded by massive, destructive wildfires – made worse by drought – that continued to impact water supplies long after they were extinguished. Like all aspects of water management in California, the SWP



Photo by Florence Low/DWR

Andrew Schwartz, UC Berkeley's Central Sierra Snow Laboratory manager and lead scientist, conducts a snow survey on January 26, 2022, in Soda Springs. DWR partners with UC Berkeley in joint efforts to research better tools and understanding of the hydrometeorological data and processes in the Sierra Nevada.

must adapt its operations and increase its resiliency to the hydrologic extremes caused by climate change.

## Forecasting

Extreme climate conditions over the past three years highlighted issues and challenges related to forecasting capabilities. Above-average warm years have gone from an extreme event in the 1930s, to episodic events in the 1980s, to commonplace the last decade. The comparative precipitation index shows wet years are not offsetting accumulated dryness of dry years over the last decade.

Water years 2021 and 2022 brought new extremes and consequences. Water year 2021 was the second worst single year and driest two-year period in statewide precipitation, the second-warmest year for statewide mean temperature, and the driest and warmest spring in 126 years. Water year 2022 had record-setting October precipitation, record snowfall at the Central Sierra Snow Laboratory in December, and the driest start to a calendar year on record. The historical relationships between precipitation, snowpack, and runoff did not accurately predict available water for 2021 because they did not account for the record heat



and dryness during the fall of 2020, the lack of fall precipitation, and the record warmth and dryness of spring 2021. The timing, pace, and scale of storms in 2022 set the stage for better forecasts, but the amounts were among the lowest in history. To increase climate resilience, DWR is adapting its water forecasting processes for climate change to improve its ability to determine SWP water allocations for the coming year, and to better manage water availability over longer time horizons.

As a result, DWR engaged in multiple efforts to improve forecasting practices for water management. DWR is pursuing data augmentation, forecast model improvements, and partner collaboration. DWR is updating hydrologic averages from a 50-year to a 30-year average to better reflect most recent years; updating precipitation and snow median increments based on new averages; improving automation of daily precipitation data collection, full natural flow calculations, and the quality control process; and developing new statistical models based on updated data. Forecast improvement efforts include adopting emerging technologies to improve and expand the collection of weather and water data used in the forecasting models. New models are being developed that can simulate watershed processes and their change with climate change. These new forecasting capabilities synthesize and include observations, modeling methods, and tools to help the forecaster understand the influence of different components of the climate system. For instance, the changing patterns of snow and changing relationships between precipitation, snowpack, and runoff can be accounted for with the new tools, which should lead to fewer surprises if conditions are not the same as they have been. DWR is currently collaborating with the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, and Scripps Institution of Oceanography Center for Western Weather and Water Extremes to advance observing capabilities and help to develop the physically based watershed modeling that will provide the foundation for improved forecasting.

DWR has divided its improvement efforts into two groups: those that can be immediately implemented, and others that DWR will implement over multiple years as long-term adaptation efforts. DWR has initiated a 12-month project to develop machine learning models that incorporate new variables (like the climatic water deficit), observe daily full natural flow, incorporate May 1 snow data, and separate out precipitation and snow parameters that were previously lumped together. These models help modernize forecasting by improving empirical data and removing outdated assumptions. Some of those models will be available to forecasters for their use in the coming forecasting season. The airborne remote sensing of snow data (see Airborne Snow Observatory box, below) is being expanded to cover the Feather River basin and watersheds above Shasta Reservoir. Over the next three years, DWR will integrate airborne remote sensing of snow data and modeling into the forecasting process, expand coverage of airborne lidar data collection, integrate weather and climate forecast information into the modeling process, and continue partner collaborations to improve observation and forecast capabilities.



Photo by Kelly M. Grow/DWR

The Airborne Snow Observatory (ASO) makes a stop at Truckee Tahoe Airport in Nevada County. The ASO is a private company that contracts with DWR and the Bureau of Reclamation to provide snow measurement data to inform water supply forecasts. Use of the ASO and the data it is capable of collecting is part of DWR's effort to utilize the latest technology to improve forecasting models.

## **Airborne Snow Observatory**

Airborne Snow Observatory (ASO) involves the flying of manned aircraft equipped with specialized radar and sensors over the snowpack to assess its extent and depth. Collecting this data will help correct estimates of snow, which will improve forecasting of water availability. In 2022, the SWP funded DWR's Division of Flood Management to expand their ASO program into the Feather River watershed that feeds Oroville Reservoir. Combining this information with the long-standing, ground-based Cooperative Snow Survey network of sensors provides for significant improvements in the estimates of water supply trapped in the Sierra snowpack. In 2022, four flights occurred over the Feather watershed, allowing water supply forecasters to predict end-of-year water supply conditions more accurately. SWP staff has committed to funding of ASO again in 2023 and is supporting the Division of Flood Management as they incorporate additional data, modeling, and other improvements to their forecasting process.

## **Climate Change Planning**

### **Delivery Capability Report**

The Delivery Capability Report (DCR), issued every two years, is a key source of information for SWP water contractors and other water districts that use SWP water. The DCR provides SWP water users and the public with information about the existing capability of the SWP to deliver water over a range of hydrologic conditions. The most important information used by SWP contractors is the long-term average and single dry year delivery. It also includes analysis of extended drought periods, such as the period from 1928-1935, and how such conditions would play out with today's infrastructure, operations, and regulations. DWR started incorporating climate change projections in the DCR in 2007. The current DCR provides existing delivery capability and future capability informed by climate change. The DCR serves as a default climate change scenario for SWP planning.

The 2023 DCR, anticipated in late 2023, will move away from a single future climate change projection, as has been provided in the past, and will provide a range of risk-informed future climate change projections. This range of projections will give water agencies more information about potential future conditions and the ability to plan for more extreme outcomes. Each agency will have a different risk tolerance and dependence on SWP supplies. DWR is working with climate scientists, hydrology experts, and agency partners at the U.S. Bureau of Reclamation to develop new tools and data that will retain important information from historical observational records while incorporating adjustments to reflect more recent changes in climate demonstrated by recent extreme dry (2014), extreme wet (2017), and anomalously low runoff efficiency (2021) events. The 2023 DCR's new risk-informed future climate projections will also contain new guidance on using those projections.

### **Climate Change Adaptation Plan**

In July 2022, the SWP completed scoping and began work on its first Climate Change Adaptation Plan, which will provide SWP's portion of DWR's broader Climate Action Plan Phase 3: Adaptation Process. The goal of the SWP Climate Change Adaptation Plan is to evaluate the extent to which projects that are currently in the planning stage would adapt the SWP and make it resilient to expected future changes in climate. The Adaptation Plan will evaluate how the system would perform under future extreme climate conditions if several major improvement projects, including Delta conveyance and a California Aqueduct subsidence project, are implemented. It will consider a suite of operations and management adaptations, including forecast informed reservoir operations, improved seasonal forecasting, an update to the Lake Oroville water control manual, Feather River watershed wildfire mitigation, and SWP enhanced asset management. The Adaptation Plan will use the same baseline and climate change hydrology data as the 2023 DCR so that users are able to evaluate future water supply availability estimates under a business-as-usual scenario (DCR) and with potential adaptations (Adaptation Plan).





Photo by Kelly M. Grow/DWR

Fuel load management work, including controlled burns, is conducted by CalFire in conjunction with DWR at Loafer Creek State Recreation Area in Oroville. The work is part of the fuel load management program which reduces fire risk, protects public safety, and enhances forest and watershed health.

### **Wildfire Response Planning**

The Upper Feather River Watershed is the water source for the SWP's largest storage project, Lake Oroville. Since 2018, 57% of the Feather River watershed has burned. The impacts of a wildfire on a watershed are many, including black carbon deposition onto snowpack (increasing snow albedo), vegetation change, hydrophobic soils, debris flows, and sedimentation in rivers. To respond to these conditions, DWR has stepped up activities to monitor, coordinate, and assess conditions in the Upper Feather River Watershed. DWR did a comprehensive impact assessment after the 2021 fire season, looked at all watershed systems and processes, and identified a need to better understand fire-related changes to hydrology and water supply, which could result from the changes in forest structure and groundcover. To fill this gap, DWR has begun work with the National Center for Atmospheric Research and the Airborne Snow Observatory (ASO) to improve modeling of burn-scarred areas in the Feather River watershed and evaluate how fire has and will continue to impact snowpack accumulation, as well as the timing and amount of runoff. DWR anticipates having a series of model runs available in January of 2023; this data would be used to evaluate the impact of burn areas on water supply operations in February and March 2023.

## 2022 and 2023 Drought Planning

California endured its third year of drought in 2022, and drought conditions are expected for the coming year. The hydrologic extremes of 2021 – with record dry and hot conditions – challenged traditional water supply forecasting methods, resulting in inaccurate run-off projections. Heading into the 2022 dry season, DWR heeded the lessons learned from 2021 and took proactive steps to prepare for dry conditions. It considered more extreme scenarios in its water supply planning, adjusted water supply forecasting approaches, and engaged in more frequent and earlier cross-agency coordination. SWP staff coordinated with the USBR and senior water rights holders to facilitate water transfers and closely monitored and evaluated on-the-ground conditions. In 2022, DWR set the following objectives for drought-responsive water management:

- provide minimum health and safety needs,
- maintain Delta water quality,
- meet environmental needs to protect endangered species,
- conserve water storage to meet future critical needs, and
- deliver water based on priority.

A staircase hydrologic pattern in water year 2022 exemplifies new extremes and variability associated with climate change. Two storms in October and December were followed by three straight dry months. Those two storms gave the state the bulk of the water supply for the year. Patterns like this challenge how DWR plans and operates the State Water Project for the next year and underscore the need for improved forecasting. Because of the low carry-over storage in key reservoirs, instead of completely removing the West False River Salinity Barrier, DWR coordinated with the various resource agencies to only partially remove the barrier so that it would be more readily re-installed if needed.

Seeing the potential for its need, in December 2021, DWR and USBR filed a Temporary Urgency Change Petition (TUCP) at the State Water Resources Control Board for the SWP and the CVP. The TUCP sought to modify certain Delta water quality standards during February through April in a way that would allow the SWP and CVP to reduce releases from key storage reservoirs such as Oroville. The TUCP filing was made well in advance of when the modified standards might be needed in order to increase the time for the SWRCB to conduct its public review process. In January 2022, after the wet October and December, DWR withdrew the TUCP. After the driest January to March period on record, SWP filed a new TUCP for modification of certain Delta water quality standards for April through June. In April, SWP re-installed the salinity barrier. The TUCP example illustrates the difficulty of planning for water management under variable hydrologic conditions.

Other drought actions taken in 2022 include limited deliveries to Feather River settlement contractors for rice decomposition to preserve storage and an SWP allocation of five percent.



Photo by Ken James/DWR

Low water conditions at Enterprise Bridge (looking west) located at Lake Oroville. On December 21, 2022, the water storage was 1,042,146 acre-feet, 29 percent of the total capacity.

At the conclusion of the 2022 dry season, water storage levels were slightly better than the prior year, but still well below average. Similarly, mean temperatures were very warm in 2022 but cooler than water year 2021, and precipitation overall was very dry but wetter than water year 2021. Recently observed extremes require conservative planning and continued aggressive multi-agency action.

Looking ahead to 2023, DWR has developed the following principles for operating the SWP:

- support the human right to water,
- protect imperiled fish and wildlife,
- balance and protect beneficial uses of water,
- honor water rights,
- promote fairness and equity in policy decisions,
- prioritize effective and efficient strategies,
- harness science and collaboration, and
- and continue to explore and implement creative ideas.

The 2023 drought objectives are the same as those for 2022. October through December 2022 saw continued reduced releases at Oroville to conserve storage and a low initial water allocation to SWP contractors. Potential 2023 drought management actions will again include rigorous multi-agency coordination; an SWP allocation focused on meeting critical domestic, sanitary, and fire suppression needs; potential modifications of Delta water quality standards; and continued support for robust conservation measures.



## Annual Budget and Multi-year Cost Planning

The SWP annually plans its budget for operation, maintenance, and capital improvements, a process that is integrated with the State budget process. The process involves reviewing annual programs, extraordinary activities, and projection of the capital projects that help secure the reliable operation of the system as it addresses the impacts of climate change and the challenges of aging infrastructure. SWP conducts financial analysis to forecast future revenue needs. The cost projection includes personnel, operating expenses and equipment, costs for water supply and other purposes such as recreation and flood control, and cost-share. Costs are fairly allocated across reaches, project purposes, cost components, and SWP contractors.

DWR bills the 29 SWP contractors annually through the Statement of Charges (SOCs) based on the projected costs and true-up of the historical costs. The SOCs are issued no later than end of June annually for the next calendar year. During annual budget planning (September through December), the plans for the next calendar year are validated by DWR through project planning and prioritization. DWR may make changes due to unplanned work, therefore requiring adjustment of the budget even though the SOCs have been issued to the Contractors. The objective of the annual planning is to prioritize work activities and maintain a budget in line with the SOCs. The SOCs, which make up 90 percent of the SWP revenue, only include the water supply and power generation costs that are reimbursable by the contractors.

Having a solid, sustainable financing plan is critical to the SWP, whose annual revenue is more than \$1 billion, not counting the revenue from power sale, which was \$68 million in 2021. Without a reliable financing plan, the SWP will not be able to collect revenues to sustain its operation and capital improvement, resulting in significant impacts to California's economy and life. Funding for the SWP primarily comes from the 29 SWP contractors. Other funding sources include USBR, which contributes funding for facilities that are jointly operated; revenue from power generation and sales; and the Davis-Dolwig Fund, annually appropriated under a 60-year-old state law that specifies that the cost of fish and wildlife enhancements and recreation components of the SWP be paid for from the state General Fund. Funds are used for operations and maintenance (O&M), debt service payments for capital projects, and other associated financing costs. The approved SWP budget for calendar year 2022 was \$313 million in capital improvement projects, and \$610 million for O&M.

## Asset Management

The SWP Division of O&M Asset Management is responsible for developing and implementing asset management policies, strategies, and objectives for operations, maintenance, repair, and replacement of SWP equipment and infrastructure. At its most basic level, asset management effectively manages the lifecycle of SWP water storage and conveyance assets. Prioritization of capital



Photo by Florence Low/DWR

A worker carries a core sample drilled from the spillway at Cedar Springs Dam at Silverwood Lake, a large reservoir in San Bernardino County.

## Additional Staffing to Address Aging Infrastructure

In 2021, the SWP received legislative authorization to recruit 150 positions to support its aging infrastructure initiatives. These initiatives include the SWP's asset management and maintenance management efforts to enhance the planning, execution, and documentation of operations, maintenance, repair, refurbishment, and replacement of aging SWP infrastructure, as well as related efforts such as emergency preparedness and aqueduct subsidence. These positions will be phased in over four years and funded entirely by the SWP. Sixty-seven positions began in fiscal year 2021-22.

### Division of O&M

No. of positions	Department
28	Asset and Maintenance Management
20	Maintenance
3	Emergency Preparedness
2	Operations Planning

### Division of Engineering

No. of positions	Department
14	Engineering and Support

DWR received authorization for 35 new positions for fiscal year 2022-2023.

and extraordinary O&M projects is a key component of the asset management system. During any given year, there are more than 200 studies and projects being worked on, many of which are dam safety projects.

The primary climate change-induced challenges to asset management include changing hydrology, wildfire impacts to watersheds, and aqueduct subsidence, which represents the greatest current threat to operational flexibility south of the Delta. Proactive management of SWP assets is needed to prepare for climate extremes and to maintain system resilience and operational flexibility.

DWR's asset management efforts are modeled after the International Standard Organization (ISO) 55001 standard for asset management systems which defines best practices, including risk management, maintenance planning and tracking, capital investment planning, and emergency preparedness. Current SWP Strategic Asset Management Initiatives include reliability actions, such as the development of asset management plans for SWP transformers and the South Bay Aqueduct, and resilience actions, which include emergency response exercises, forecast-informed reservoir operations in the Feather River Watershed, and an update of the Lake Oroville Water Control Manual.

### **SWP Long-term Contract Extensions**

The State of California entered into long-term water supply contracts with water agencies in the 1960s. Under the contract terms, DWR provides water service from the SWP to the SWP contractors in exchange for payments that will recoup all costs associated with providing this water service over the repayment period of the SWP. The contracts originally included 75-year stated terms with ending dates that ranged from November 2035 to August 2042, depending on when each specific contract was executed. The Water Supply Contract Extension Amendment will extend them for 50 more years to secure long-term financing and help mitigate cost compression to the contractors, making it more affordable by extending capital financing from 13 years (with the original contract ending by 2035) to 30 years (typical long-term bond terms for repayment).

The majority of the capital costs associated with the development and maintenance of the SWP are financed using revenue bonds. These bonds have historically been sold with 30-year terms, but bonds cannot be sold with maturity dates that extend beyond the year 2035, the year the original contracts begin to expire. Issuance of bonds with shorter repayment periods (15-year bonds versus 30-year bonds, for instance) compresses the timeframe for repayment and results in higher annual costs. DWR and the SWP contractors agreed to extend the contract termination date to ensure the affordability of the SWP's water supply. The Water Supply Contract Extension Amendment will allow DWR to sell bonds with 30-year terms or longer, commensurate with the economic life of the project being financed. Longer bond terms ensure the debt service on these bonds remains affordable to SWP contractors and their water customers.



## Status of SWP Construction Projects

DWR manages the SWP to ensure adequate water supplies are available under various hydrologic and legal conditions while maintaining SWP operational flexibility. Key construction activities undertaken in the past year to manage and maintain the SWP occurred across the entire length of the SWP and include all major facility types – dams, canals, pipelines, and pumping and generating plants – and represent DWR’s efforts to modernize fire and life safety programs, to upgrade physical security, to identify and implement needed repairs, and to refurbish aging infrastructure. The 13 projects or programs that follow are a sampling of the more than 300 distinct projects and programs that are contributing to the no-fail operation of the SWP.





Photo by Jonathan Wong/DWR

A sign provides details for the construction of the Big Notch project at the Fremont Weir Wildlife area in Yolo County. The name “Big Notch” refers to the large section of earth and concrete that will be removed from the Fremont Weir. In that space, a headworks structure containing three bladder gates will be constructed that allows the fish to pass through. DWR and U.S. Bureau of Reclamation are partnering to reconnect floodplain habitat and improve fish passage in the Yolo Bypass, the largest contiguous floodplain remaining in the Central Valley.

**SWP Fire and Life Safety Modernization:** This program was implemented in response to the 2012 Thanksgiving Day fire at Thermalito (Robie) Pump-Generating Plant and covers fire detection and alarms, fire suppression systems, protected egress routes, HVAC modifications, new domestic and raw water lines, and emergency responder communications. In the Oroville Field Division, Thermalito was completed in 2021, and the Hyatt Powerplant was completed in 2022. Construction is to begin in the San Luis Field Division in June 2023, and in the San Joaquin Field Division in January 2025.

**SWP Physical Security Upgrades:** Physical security upgrades at each Field Division include security operations centers, guard shacks, impact rated gates and bollards, security fencing and cameras, hardened doors and windows, and key card readers and door contacts. In the Oroville Field Division, the project is expected to be completed by March 2023, with construction in the Delta and San Luis Field Divisions to begin in early 2023, and in the San Joaquin and Southern Field Divisions in 2024.

**Salmonid Habitat Restoration and Fish Passage (Big Notch):** The Big Notch project will create critical floodplain habitat for juvenile fish and improve a migration corridor for adult fish, as required by the SWP Biological Opinion



Photo by Kelly M. Grow/DWR

One of the refurbished gates is reinstalled with the help of a large crane at the Suisun Marsh Salinity Control Gates. Located at the eastern end of the Montezuma Slough in the Sacramento-San Joaquin Delta near Collinsville, the Suisun Marsh Salinity Control Gates maintain proper salinity levels in the Suisun Marsh during periods of low Delta outflow.

and Incidental Take Permit. The project includes an intake channel, headworks structure and control building, transport channel, pedestrian bridge, and an electrical communications connection to the adult fish passage facility. The contract was awarded in May 2022. Construction is expected to be completed in November 2023.

**California Aqueduct Canal Liner and Embankment Repairs:** There are several regionally based construction contracts awarded to address liner and embankment issues along the California Aqueduct. Repair sites were identified through a condition assessment team and prioritized based upon risk. There are multiple panel replacement and repair methodologies, and the repairs are scheduled based on operational constraints and environmental limitations. Fifty-two sites were completed in 2022, with 40 sites planned for 2023. The project should be completed in 2025.

**California Aqueduct Radial Gate Maintenance and Repairs:** Radial gates on the California Aqueduct control the flow between canals and pipelines. Many of the radial gates have been in place for more than 50 years. Refurbishment includes structural improvements, blasting and recoating, and modifications for future maintenance. Four new gates have been installed in 2022, followed by two more in 2023 and the remaining four in 2024.



Photo by Kelly M. Grow/DWR

Bethany Dams and Reservoir, located on the California Aqueduct and downstream from the Harvey O. Banks Pumping Plant, serves as the forebay for the South Bay Pumping Plant and recreational opportunities in Alameda County.

**Montezuma Slough Radial Gates Refurbishment:** The Montezuma Slough radial gates refurbishment project includes the repair and recoating of all gate trunnions, fabricating stoplogs for bay isolation during the gate outage, and maintenance and repairs on the gate hoists and gearboxes. All onsite work must occur between August and October of each year due to environmental permitting requirements and is limited to one gate at a time due to operations. One gate has been refurbished and reinstalled, another is currently out for refurbishment and will be installed in August 2023, and a third is expected to be finished by October 2024.

**Bethany Dams Restoration and Rodent Burrow Prevention:** Construction was completed in 2022 on the Bethany Dams Restoration and Rodent Burrow Prevention Project, ensuring dam safety by refacing dam with wire mesh and armoring with rip rap. Rodent burrowing at Bethany Dams has been a long-standing problem that could lead to a piping failure mode for the dams, but the presence of endangered species and habitat prevented routine maintenance and led to a lengthy environmental permitting process. DWR's Division of Engineering designed a veneer of permanent armoring to protect the dams from future burrowing.





Photo by Andrew Innerarity/DWR

Construction crews remove the Emergency Drought Salinity Barrier on the West False River near Oakley in the Sacramento-San Joaquin Delta in Contra Costa County. The rock barrier was placed to help deter the tidal incursion of saltwater from San Francisco Bay into the central Delta.

**Clifton Court Forebay Initial Burrow Remediation and Maintenance:** The Clifton Court Forebay Initial Burrow Remediation and Maintenance will address long-standing maintenance needs at Dyer, Patterson, and Clifton Court Forebay dams. The presence of endangered species and habitat has prevented routine maintenance and led to a lengthy and costly environmental permitting process. Enhanced monitoring is being performed at all three dams until maintenance is complete. Work on Clifton Court Forebay began in October 2022. Work on Dyer and Patterson Dams will take longer due to greater impacts and significant mitigation costs.

**Oroville Dam River Valve Outlet System Rehabilitation Project:** This project will install two additional 72-inch spherical valves over a 12-month construction schedule, and will include demolition and reconstruction of thrust block, pressure relief wall, and existing hydraulic and electrical equipment; and installation of a new hydraulic system, electrical system, ventilation system, and seat water system. This is a drought- and safety-critical project as it allows DWR to safely meet water delivery requirements during periods of low water elevations at Lake Oroville. This multi-year planning effort requires approval from DWR's Division of the Safety of Dams and, because the Oroville Complex is a power-generating facility, the Federal Energy Regulatory Commission. Phase one construction activities are underway, and phase two construction start is dependent upon a favorable water year.





Photo by Andrew Innerarity/DWR

A view of the San Luis' B.F. Sisk Dam Safety Modification Project underway in Merced County.

**Gianelli Pumping-Generating Plant Unit Refurbishment:** This project includes redesign, replacement, and refurbishment of rotating and embedded components to Original Equipment Manufacturer (OEM) design, as components are at the end of their service life. Components include pump-turbine head cover and impeller, packing box and equalizing line, 156-inch butterfly discharge valve, stator cores, and rotor poles. Seven of the eight units have been refurbished to date; the last unit will be completed by 2024.

**Dos Amigos Pumping Plant Unit Refurbishment and AVR Replacement:** This project includes the redesign, replacement, and refurbishment of rotating and embedded components to OEM design, as components are at the end of their service life. Components include blade trolley carts, impeller stands, variable pitch pumps, rotor poles, stator platforms, and automatic voltage regulators. The project is a multi-year effort to complete the six units at Dos Amigos, approximately one unit every two years. The first unit is scheduled for completion by the end of 2023.

**Emergency Drought Barrier – West False River:** During extreme drought conditions, the West False River barrier mitigates the negative impacts of drought by slowing salinity intrusion into the central and south Delta to prevent contamination of water supplies. The barrier was constructed in 2021. Construction of a notch to facilitate fish and boat passage began in January 2022 and the barrier was refilled in April 2022 due to the ongoing drought. The barrier was fully removed by December 2022.

**SB 626 – New SWP Construction Delivery Authorization:** Senate Bill 626, signed by the Governor in 2021, includes two additional public works construction procurement methods: Construction Management/General Contractor (CM/CG) and Design-Build (DB). These went into effect on January 1, 2022, and authorization ends January 1, 2033. The bill allows contractors to be selected on qualifications and not solely on cost, and to become partners in the development of the project. Risks are reduced or transferred to the contractor, and the construction phase can commence prior to completion of design. Authorization is limited to projects necessary for the construction, maintenance, or operation of elements of SWP facilities, and limited to seven projects under each procurement method. New procurement methods are not authorized for Delta conveyance. SWP will implement a Project Delivery Selection Method framework to document why a particular delivery method was selected for a project. CM/GC Pilot Project Procurement Development in 2022 include the Chipps Island Tidal Habitat Restoration and San Joaquin Field Division Fire and Life Safety Modernization. Options for DB Pilot Project Procurement in 2023 include the Electric Vehicle Charging Station Phase 3.

## Conclusion

This document fulfills the Commission’s requirement to review the progress of the construction and operation of the SWP. The Commission has determined that DWR is working to maintain the operations of the SWP, preparing for and responding to climate extremes so that the SWP continues to benefit California. The Commission requests that DWR continue to keep the Commission apprised of operations and construction activities in 2023. These findings and recommendations will be presented to DWR and the Legislature.



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