



2018 ANNUAL REVIEW OF THE STATE WATER PROJECT

The California State Water Project (SWP), consisting of 36 water storage facilities and 700 miles of rivers, pipelines and canals, supplies water to 27 million people and irrigates 750,000 acres of farmland. The system includes 23 pumping plants, powered by a system of power-generation and power-recovery plants. Department of Water Resources (DWR) also purchases energy needed to operate the pumps, including the world's tallest water lift – the Edmonston Pumping Plant – which pumps water more than 1,900 feet up and over the Tehachapi Mountains into Southern California.

As required by Water Code section 165, the California Water Commission (Commission) conducts an annual review on the progress of the construction and operation of the SWP and reports its findings and recommendations to the Department and the Legislature. Consistent with the Commission's responsibilities under Water Code Section 161 (to confer with, advise, and make recommendations to the Director of DWR), the Commission provides a forum to help the public stay informed of DWR's efforts, and to provide recommendations to the Department based on the information received through these interactions.

In 2018, the Department of Water Resources made several presentations before the Commission on various topics, including Article 21 water, asset management, the impacts of climate change on the SWP, an update on the Oroville Dam construction, and an overview of the SWP dam safety program. Commission staff worked closely with SWP staff to obtain additional information for this review.

This report outlines key issues, planning activities, and SWP operations in 2018. It includes findings and specific recommendations for DWR to keep the Commission apprised of operations and construction activities in 2019.

Key Issues in 2018

Aging Infrastructure

In 2017, the Oroville spillway highlighted the importance of SWP facilities as well as the challenges of operating aging infrastructure in increasingly frequent conditions of extreme hydrology. With much of the SWP's infrastructure approaching or exceeding 50 years of age, maintaining the levels of operation requires addressing the increasing refurbishment, renewal, and replacement needs of the facilities.

In October, DWR adopted a [new Strategic Plan](#) in which it acknowledged the aging infrastructure and committed to several objectives that will secure the functions of the SWP for future generations.

“...DWR’s assets and the supporting water management infrastructure are reaching end of life. DWR will need to address its aging infrastructure, and impacts associated with climate change, population growth, ecosystem stressors, and funding constraints. In the next three years, DWR will adopt a unified framework for condition assessment, risk management, and strategic planning for capital investments to prepare the SWP infrastructure for the next 50 years.” (DWR 2018 Strategic Plan, page 6)

DWR is pursuing several avenues to address aging infrastructure. The SWP’s Division of Operation and Maintenance is using asset management (as defined by ISO 55001) as an approach to improve coordination of all the SWP’s lifecycle activities – including maintenance, engineering, and project planning—and utilize all available information to realize the best value from investment decisions. In 2018, DWR completed an assessment of the SWP dam safety program, reorganized and expanded the Dam Safety Branch within the Operations & Maintenance Division, and established a SWP dam safety program steering committee. DWR also adopted a new dam safety policy, and completed spillway inspections, assessments, and maintenance efforts on seven SWP dams in 2018. DWR is also implementing a Financial Management Enhancements Program (FMEP), which will help to improve budgetary planning and flexibility for the SWP.

Climate Change

In August, California released its Fourth Climate Change Assessment which acknowledges that “California’s temperatures are already warming, heat waves are more frequent, and precipitation continues to be highly variable...” (Source: California’s Fourth Climate Change Assessment, Summary of Key Findings, page 3). Further, the Fourth Assessment acknowledges that the “complex network that stores and distributes water throughout the state was designed for historical hydrologic conditions that are now changing.” (Source: Fourth Assessment, Summary of Key Findings, page 10).

In the future, the SWP will need to adapt to a changing climate— increasingly variable weather from drought to atmospheric rivers, reduced snowpack, higher sea levels, and altered seasonal river flows from historic patterns. Groundwater use, wildfire risks, and flood risks will likely increase. DWR has modeled the potential impacts on the SWP in several technical studies, which were included in the Fourth Assessment. DWR also expects to complete a Vulnerability Assessment in 2019. While the assessment covers all of DWR’s programs, some vulnerabilities may apply specifically to the SWP. The asset management program’s risk management and project prioritization processes will be used to assess, prioritize, and implement any adaptations necessary to address the SWP’s physical vulnerabilities. Vulnerabilities may also lead to future operational changes, which will be a longer-term effort – such changes will need

to be coordinated with other agencies and regulatory environments, as warranted. For example, operational adaptations will require updated watershed hydrologic studies, which would then inform the U.S. Army Corps of Engineers' update of the Water Control Manual, which sets forth requirements for flood control operations of dams.

DWR is working on other approaches to address climate change, such as increasing groundwater storage by recharging aquifers with flood and storm water. In partnership with landowners, water agencies, and academia, DWR has launched a Flood-Managed Aquifer Recharge (Flood-MAR) program to investigate the potential use and limitations of this water management strategy. DWR released a [Flood-MAR White Paper](#) in 2018 that described the Flood-MAR concept and identified barriers and challenges to implementation. DWR is evaluating Flood-MAR opportunities in the Merced River Basin as a watershed-scale pilot study (published findings expected in Fall 2019) and providing technical assistance to local landowners and water agencies interested in implementing Flood-MAR projects. Potential benefits include reduced risk of flooding, replenished aquifers, enhanced ecosystems, improvements to water quality, and improved working landscapes. Flood MAR requires additional study and work before it is widely implemented as a resource management strategy. While Flood MAR does not currently affect SWP operations, potential widespread implementation of Flood-MAR may have implications for future operations. For example, the SWP could play a role in conveying flood flows for aquifer recharge.

Reducing greenhouse gas emissions (GHGs) is critical to mitigate climate change. In recent years, DWR has reduced GHG emissions associated with operation of the SWP by changing power supplies to cleaner and renewable sources and increasing the efficiency of water pumps and generators. As for its current carbon footprint, the SWP derives 65 percent of its power from emissions-free sources, including both large and small hydroelectric plants and solar power resources, with that figure expected to increase to 96 percent by 2050. This is significant considering the SWP is one of the largest consumers of energy in California.

Oroville Construction Update

The Oroville spillway incident in 2017 triggered a heightened awareness of dam safety in California and throughout the dam safety industry. DWR initiated a comprehensive needs assessment for the Oroville Dam complex to identify priorities and solutions to bolster the integrity and resilience of the complex to assure public safety;

Due to the severity of the damage to much of the 3,000-foot long spillway, the entire spillway needed to be replaced and reconstructed using modern design criteria and construction practices. The Oroville Emergency Recovery Spillways Project completed its first phase in November 2017, rebuilding much of the 3,000-foot long main spillway and restoring its ability to pass 100,000 cubic feet per second of flood flows. In the second phase of reconstruction during the summer of 2018, DWR completed the reconstruction of the spillway, including

replacing the upper 730 feet of the main spillway chute and placing structural concrete over the roller compacted concrete (RCC) on the spillway's 1,050-foot middle section. The finished spillway can now pass flood flows of 270,000 cubic-feet per second.

DWR also is in the process of reconstructing the emergency spillway. The upper portion of the hillside spillway has been armored under several feet of RCC and a concrete cut-off wall has been placed in the bedrock to prevent any erosion from migrating uphill.

Findings and Recommendations

The Commission finds that:

- As California moves forward with sustainable groundwater management, managed aquifer recharge could be an important strategy for improving groundwater storage and recharging depleted aquifers;
- DWR is modernizing its organizational structure and utilizing an asset management approach. These efforts will help to incorporate aging infrastructure and climate change into decisions regarding maintenance and updating facilities;
- DWR has kept the Commission apprised of its efforts to improve dam safety;
- DWR has taken significant steps to address climate change, including modeling the impacts and assessing the vulnerability of the SWP to climate change;
- Improvements in watershed function, or green infrastructure, could aid in the operation of the SWP. Cooperative relationships to manage and monitor watersheds will be important to realizing such improvements;
- DWR continues to make progress in reducing its greenhouse gas emissions from SWP operations;
- DWR efficiently performed repairs to the Lake Oroville flood control spillway and emergency spillways by November 1, 2018, to handle flows of up to 270,000 cubic-feet per second in advance of the 2018-19 rain season;
- The cost to date of the Oroville reconstruction and emergency response is \$1.1 billion (\$940 million for reconstruction and \$116 million for emergency response).

The Commission recommends that:

- DWR should keep the Commission apprised on the role of the SWP as conveyance in support of increasing groundwater recharge efforts in the State;
- DWR should update the Commission on continuing work performed through the Dam Safety Program including the status of emergency planning in communities within the inundation areas of SWP dams;
- DWR should inform the Commission on the continued use of Asset Management and key SWP maintenance and infrastructure investments, including those in response to any identified SWP climate change vulnerabilities.;

- DWR should keep the Commission apprised on efforts leading to operational adaptations to the effects of climate change, such as updates to watershed hydrologic studies;
- DWR should brief the Commission if or when efforts or activities are undertaken to cooperatively manage green infrastructure in relation to SWP operations;
- DWR should continue to brief the Commission on progress in achieving greenhouse gas reduction goals and the SB 100 requirement that state agencies use 100% emissions-free electricity by 2045;
- DWR should update the Commission on the status and schedule for a Delta conveyance project.

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2018 State Water Project Annual Review

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Overview of The State Water Project (SWP)

Rain and melted snow collect in SWP storage facilities located within the Feather River watershed. The water flows into the Sacramento-San Joaquin Delta, where the SWP pumps deliver it to the SWP water contractors. In addition to its primary purpose of supplying water, the SWP system also provides flood protection, generates hydroelectric power, and offers recreational opportunities such as boating and hiking. Other SWP facilities, such as fish hatcheries, fish screens and passages, as well as restricted pumping schedules and cool water releases, help to preserve and protect endangered and threatened fish species.

While the SWP was being constructed in the 1960s, public agencies and local water districts signed long-term water supply contracts with DWR. Today, the 29 public agencies and local water districts are collectively known as the SWP water contractors. The water supply contracts (which expire in 2035) specify the maximum amount of SWP water a contractor may request annually. However, the amount of SWP water available for delivery varies, based on rainfall, snowpack, runoff, water in reservoirs, pumping capacity in the Delta, and operating constraints that protect fish, wildlife, and Delta water quality.

California's water sustainability depends on the water quality and environmental health of the Sacramento-San Joaquin Delta. The SWP operates to limit salinity intrusion into the Delta and Suisun Marsh by allowing fresh water to flow through the Delta to the ocean. During certain times of the year, water exports are limited to protect sensitive species. As the operator of the SWP, DWR maintains the delicate balance between fulfilling the state's need for fresh water and protecting the environment.

ADD GRAPHIC SHOWING SWP

1. SWP Planning Initiatives

This section describes several planning initiatives underway at DWR. Some, such as the Flood-managed aquifer recharge (Flood-MAR) effort, are broader efforts that affect some of DWR's programs and activities, although they are not part of the SWP's planning program. They are included here because the SWP may play a role in their success or may be affected by their outcomes.

Dam Safety

The Oroville incident increased the focus on dam safety for the SWP and throughout the entire Dam Safety Industry. In 2018, DWR adopted a formal [SWP Dam Safety Policy](#), which assigns roles and responsibilities to the SWP Deputy Director, Chief Dam Safety Engineer, and all other DWR staff. The policy also establishes program elements for the SWP dam safety program, including surveillance, dam safety assessments, and other actions.

DWR performed various assessments to strengthen the SWP Dam Safety program. Resulting initiatives include: enhanced Executive-level accountability for SWP dam safety; establishment of a program steering committee to facilitate communication and coordination at the Executive level among the SWP Divisions supporting the dam safety program and provide a venue for the Chief Dam Safety Engineer to communicate dam safety issues and program performance directly with DWR Executives; an improved training plan for all dam safety staff; increased participation with the dam safety industry; greater use of external dam safety and engineering expertise and expanded outreach to local agencies regarding emergency preparedness.

DWR completed spillway inspections, assessments and maintenance efforts on seven SWP dams: Pyramid, Castaic, Cedar Springs, Grizzly Valley, Frenchman, Antelope, and Del Valle. DWR's focus in 2019 will include further spillway inspections, emergency plan and inundation map updates, Oroville facilities analysis and risk assessment workshops, and a continued alignment of the SWP Dam Safety Program with the Operations and Maintenance Asset Management Program Initiatives.

In January of 2019, DWR briefed the Commission on some of the changes that it is making to strengthen the dam safety program. DWR updated the Commission on the progress with the SWP dam and spillway inspections, and explained how dam safety is addressed within the broader risk-informed decision making and prioritization processes of Asset Management.

Asset Management

"Asset management" describes the coordinated activities of an organization to realize value from its assets. Since much of the SWP's infrastructure exceeds 50 years of age, the maintenance needs of the system have increased to require more frequent refurbishment, renewal, and replacement. DWR has adopted asset management as an approach to decision making, using all available information to make the best infrastructure investment decisions for the SWP. This includes creating a framework for lifecycle management of infrastructure by incorporating risk assessment into investment planning as well as potential threats from climate change.

The SWP Division of Operations and Maintenance completed the O&M Asset Management Program Development Strategy in May 2017. This document describes the vision, principles, and approach to manage the SWP storage and conveyance infrastructure. The Strategy includes over two dozen asset management initiatives designed to align, develop, and or update new tools and business processes to advance O&M's asset management practices.

Key activities in 2018 included initiatives to develop a new division-wide Risk Management Framework that establishes common, industry standard definitions, tools, and processes to integrate risk assessments and risk-informed decision-making across a number of O&M program areas including maintenance, compliance, capital prioritization, resource planning, and dam safety. The program also led the development of a formal Maintenance Management

Strategy to ensure safe, reliable, and predictable operation of SWP infrastructure managed by the Division of O&M. This strategy promotes maintenance system consistency and enhanced planning and engineering support across all five field divisions.

The Asset Management Program has also moved into a lead role in the O&M Division's project, resource, and budget planning processes. Many of these new tools and processes were used in the SWP's mid-year budget review, 2019-2020 budget planning processes, and in the process and system design for the Financial Management Enhancements Program (FMEP) and budget planning tools.

Financial Management Enhancements Program

The SWP delivers water to the 29 SWP Contractors, who repay the water- and power-related costs associated with constructing, operating, and maintaining SWP facilities. DWR bills the SWP Contractors annually for all anticipated costs for the upcoming year, based on cost projections that depend on accurate budget planning and effective project management to control costs. DWR monitors the SWP's financial needs and expenditures throughout the year to ensure there is sufficient funding to meet SWP obligations. In addition to the calendar year-based SWP budget cycle, DWR also follows the State's fiscal year-based budget planning and approval process for the entire department. These overlapping financial management systems pose challenges for budget planning.

In response, DWR initiated the FMEP to assess the organizational, budgeting, billing, and financial processes and reporting needs of the SWP. Scoping for FMEP began in 2014, and DWR has since completed several stages of analysis, evaluating alternatives, and developing a design and cost estimate. Stage 3 of implementation began in February 2018 and will include the implementation of integrated project management and budget planning systems, an enhanced cost allocation and billing system, and cross-modular reporting system. FMEP will increase budgetary flexibility for the SWP by allowing DWR to incorporate unanticipated changes, such as new environmental requirements, fluctuations in water supply, or infrastructure emergencies, into Contractors' bills. FMEP system design for the new integrated project management and budget planning tools utilize new tools and processes developed by the O&M Asset Management Program to develop risk-informed, resource balanced program plans and budgets

DWR Strategic Plan

In October 2018, DWR's executive team released a Strategic Plan, consisting of goals, objectives, and strategies that are essential to the Department's success in the next several years. The plan includes four over-arching priorities: secure the functions of the State Water Project for future generations; implement a comprehensive and state-wide approach to dam safety, flood protection, and emergency management; improve and expand integrated

watershed management and bring groundwater basins into balance; and make the Department an employer of choice for our field of expertise and practitioners of good government.

Under the heading of securing the functions of the SWP for future generations, the plan calls for adopting a unified framework for assessing the condition of the facilities, managing risk, and planning for capital investments. The accompanying six goals and associated objectives are listed here, as they indicate the department's priority activities (many of which are addressed in other sections of this report) that the Commission will follow in its role of advising the Director and preparing this annual review of the SWP.

Goal 1: Invest and be innovative in solutions to modernize SWP infrastructure.

Objectives:

1. Complete the reconstruction of the Oroville Flood Control Spillway and the Emergency Spillway to their original design capacity (achieved in 2018);
2. Build upon and expand the current SWP Asset Management Program and incorporate business practices across all SWP divisions.
3. Review and update the Coordinated Operating Agreement with the Bureau of Reclamation.

Goal 2: Strengthen the SWP Dam Safety Program to incorporate risk informed decision-making and improved risk communication to public safety administrators and downstream communities.

Objectives (most of these were achieved in 2018):

1. Launch an executive level office to develop and maintain SWP dam safety policies, and to emphasize the importance of public safety throughout the organization.
2. Assign clear SWP Dam Safety Program roles and responsibilities to managers and employees.
3. Align dam safety initiatives with the SWP Asset Management strategies and incorporate into a long-term SWP investment plan.
4. Improve SWP facility Emergency Action Plans and relationships with local emergency management agencies.

Goal 3: Be innovative to meet and surpass power market requirements.

Objective: Develop new and refine current strategies for the SWP power portfolio.

Goal 4: Be innovative to meet and inform environmental regulatory requirements.

Objectives:

1. Meet applicable environmental regulatory requirements.
2. Utilize the best available science to support and drive policy and management decision-making.

3. Work cooperatively with the Division of Flood Management and the Division of Integrated Watershed Management programs to pursue multi-benefit restoration projects.

Goal 5: Complete final permitting for and begin implementation of California WaterFix.

Objectives:

1. Effectively manage and reduce risks associated with project implementation.
2. Provide technical and financial oversight, and ensure compliance with SWP standards, safety protocols, regulatory compliance, and other requirements and policies.
3. Ensure project specifications meet DWR standards for safety, durability, and long-term operations and maintenance of facilities.
4. Engage with Delta counties and other agencies with authorities and responsibilities in the Delta to improve transparency and communication across the project.

Goal 6: Ensure affordability and fiscal responsibility of the SWP.

Objectives:

1. Negotiate affordable and diversified power contracts, manage compliance costs, and capture revenue from surplus generation.
2. Implement the new Financial Management Enhancement Program.

Climate Change Planning and Adaptation

In August 2018, California released its [Fourth Climate Change Assessment](#), which stated that:

“California’s temperatures are already warming, heat waves are more frequent, and precipitation continues to be highly variable. Since the Third Climate Change Assessment was released in 2012, California has experienced several of the most extreme natural events in its recorded history: a severe drought from 2012 to 2016, an almost non-existent Sierra Nevada winter snowpack in 2014-15, increasingly large and severe wildfires, and back-to-back years of the warmest average temperatures.”

(Source: California’s Fourth Climate Change Assessment, [Summary of Key Findings](#), page 3.)

The Fourth Assessment includes several findings specific to water: by 2100, water supply from snowpack is projected to decline by two-thirds. In addition, by 2015, under certain precipitation conditions, one study estimates that California’s agricultural production could face water shortages of up to 16 percent in certain regions. These conditions will challenge California’s water managers to develop and implement options to lessen the impacts of climate change.

DWR’s Climate Change Program plans and implements mitigation and adaptation measures for water supply, flood control, and ecosystem improvements. In 2012, DWR adopted Phase I of

the 3-Phase¹ Climate Action Plan, which is the department's guide to addressing climate change in all of its programs and activities. In 2019, DWR will complete a vulnerability assessment of the potential risks and effects of climate change on DWR and the ability of existing DWR facilities to accommodate the impacts. Specifically, the Department is evaluating expected increases in wildfire, extreme heat, and sea-level rise, as well as changes in hydrology and ecosystems that will impact DWR's facilities, operations, and other activities. Adaptation planning will also begin in 2019.

System Reoperation Study

DWR is conducting the System Reoperation Study to identify opportunities for enhanced systems efficiencies through coordinated operations between the SWP and CVP and between water supply and flood management infrastructure. In addition to improving water supply reliability, the study also addresses how to respond to the hydrologic variations expected from climate change.

Phase IV of the System Reoperation Study is underway and includes the evaluation of several strategies (described below) recommended in the Phase III Report² related to climate change. These strategies have not been incorporated into the operations of the SWP, nor are they part of SWP planning efforts. However, they are included here because they may have implications for the future role of the SWP in supporting groundwater basin recharge/storage efforts that are necessary in managing the state water system.

Flood-Managed Aquifer Recharge (Flood-MAR): DWR is evaluating the use of high flows and planned reservoir releases for managed aquifer recharge on farmland, working landscapes, and managed natural lands for groundwater replenishment, water supply reliability, flood risk reduction, and ecosystem enhancement. DWR released a Flood-MAR White Paper in 2018 that described the Flood-MAR concept and identified barriers and challenges to implementation. DWR is evaluating Flood-MAR opportunities in the Merced River Basin as a watershed-scale

¹ Phase I, the Greenhouse Gas Emissions Reduction Plan, laid out DWR's emission reduction goals and strategies for the short-term (2020) and the longer term (2050). These reduction targets cover all aspects of DWR's operations, including the SWP, state flood control infrastructure, business operations, maintenance, and construction activities. (see SWP Operations Section for update on DWR's progress on meeting its GHG reductions and renewable energy goals).

Phase II: Analysis Guidance, establishes a process for project managers to screen for and evaluate risks to planning and operational activities posed by climate change. This was completed in September 2018.

Phase III: Vulnerability Assessment and Adaptation Plan describes, evaluates, and quantifies, where possible, the vulnerabilities of DWR's assets based on projected changes in temperature, wildfire, sea level rise, and hydrology.

² To date, the study has completed reports on the first three phases: Phase I [Plan of Study](#) (completed March 2011), Phase II [Strategy Formulation and Refinement](#) (completed February 2014), and Phase III Report [Assessment of Reoperation Strategies](#) (completed August 2017).

pilot study (published findings expected in Fall 2019) and providing technical assistance to local landowners and water agencies interested in implementing Flood-MAR projects.

Climate Change Vulnerability of Reservoir Operations: DWR is working with the U.S. Army Corps of Engineers (USACE) to determine the vulnerability of the Tuolumne River watershed and the operations of Don Pedro dam and reservoir to the effects of climate change. This study also includes the identification of adaptation strategies to mitigate the effects of climate change, which may include reservoir reoperation strategies and broader implementation of Flood-MAR. Findings of this study are expected in late 2019. DWR plans to work with USACE, the U.S. Bureau of Reclamation (USBR), and other reservoir owners and operators to evaluate other watersheds and dam and reservoir operations vulnerability to climate change and climate-induced extreme events (floods and droughts).

Reoperation Challenges and Opportunities: Through a Research Advisory Committee (RAC), DWR is working with State and federal agencies, local/regional flood and water managers, nongovernmental organizations, and academia to identify opportunities and barriers to implementing Flood-MAR projects. A subcommittee of the RAC is specifically tasked with identifying priority actions to improve evaluation and implementation of reservoir reoperation to achieve multiple benefits.

Aqueduct Subsidence

Over-pumping of groundwater in the San Joaquin Valley has caused significant land subsidence. In 2017, DWR produced the California Aqueduct Subsidence Study to analyze the effects of this subsidence on SWP aqueducts and flood control structures. The study found that the continual subsidence along the western edge of the San Joaquin Valley, both north and south of Kettleman City, has altered the hydraulic profile of sections of the California Aqueduct.

The subsidence has lowered reaches of the aqueduct, diminishing its operational capacity. In 2017, DWR initiated several short-term actions to address some of the locations. Short sections of the concrete liner in Pool 20 and in Pool 17 (both north of Kettleman City) were raised one to two feet, and minor repairs were made to the aqueduct and to a turn out. These short-term actions continued into 2018 and were completed.

In 2018 DWR began preparing for some medium-term actions. DWR identified additional areas in Pools 20 and 21 where both the embankment and the liner need to be raised, as well as other areas that need various improvements. Developing the design basis and outlining the permitting process for those projects is now underway. In addition, work has started on a hydraulic study to help inform modifications of over chutes (aqueduct crossings). DWR expects to start the permitting for those repairs and raises in 2019 as well as addressing impacts to the structure of Check 17.

Delta Conveyance

DWR has been planning the Delta conveyance project known as “California WaterFix” as a proposed upgrade to 50-year old SWP infrastructure intended to protect water supply reliability; restore more natural flows in the Delta to benefit salmon, smelt, and other species; and provide more flexibility to capture water during peak flows without harming fish. In May 2018, participating public water agencies formed two joint powers authorities, the Delta Conveyance Design and Construction Authority (DCA) charged with the design and construction of WaterFix, and the Delta Conveyance Finance Authority (DCFA) charged with the financing for WaterFix implementation.

Also in May, DWR entered into a Joint Exercise of Powers Agreement (JEPA) with the DCA, forming a partnership for the design and construction of California WaterFix. This reorganization allows roles and responsibilities to align around the shared vision to build the project on time and on budget. DWR will provide the critical oversight of the DCA to ensure key standards are met.

To implement this important oversight responsibility, DWR created the Delta Conveyance Office (DCO) in the spring of 2018. The DCO will ensure that the project meets DWR standards for safety, durability and long-term operations and maintenance. Additional DCO responsibilities include ensuring compliance with the JEPA agreement between DWR and the DCA, and reviewing and approving the California WaterFix annual budget.

DWR posted a Draft Supplemental EIR/EIS for public comment under CEQA/NEPA in July and September, respectively. The documents analyzed recent project changes designed to reduce the impacts of the project on both the environment and local communities. The updated project description also prompted revisions to the permit applications before the U.S. Army Corps of Engineers and the State Water Resources Control Board, as well as revised Biological Assessment information being considered by CDFW, USFWS, NMFS and Reclamation.

DWR staff provided expert testimony and participated in the Change in Point of Diversion (CPOD) hearings at the State Water Resources Control Board as well as hearings before the Delta Stewardship Council on DWR’s Certification of Consistency with the Delta Plan. These proceedings will continue into 2019.

In his “State of the State” address in February 2019, Governor Gavin Newsom announced his support for a smaller capacity project featuring a single tunnel. The Governor said modernized conveyance, paired with a portfolio of water management strategies, is necessary to build climate resilience and meet the needs of water users and the environment through the 21st century. Elements of the portfolio include stronger conservation and efficiency, more water recycling projects, expanded multi-benefit floodplains, and intensified groundwater recharge.

DWR expects to build on the extensive work and analyses already done for WaterFix and incorporate the latest in science and engineering as it moves forward with a smaller project that meets the state's needs.

2. Summary of SWP 2018 Operations

California experienced a below normal water year in 2018 after a significant wet year in 2017.

SWP Water Deliveries and Power

The State Water Project contractors received an initial allocation of 15 percent which eventually increased to 35 percent by May 2018. The contractors' allocations were based on their maximum Table A amount, which equals 4,172,786 acre-feet for all 29 contractors combined.

During 2018, the SWP generated 2,950 gigawatt hours (GWh) of energy. During the same period, the SWP used 5,731 GWh of energy. About 71 percent of this power was used by the Valley String Pumping Plants which are pumping plants in the San Joaquin Valley ranging from Dos Amigos to Edmonston Pumping Plants. The Valley String Pumping Plants work to lift the water more than 3,000 feet from the floor of the southern San Joaquin Valley, over the Tehachapi Mountains, and into Southern California. Table 1 reflects recent years' energy generation and usage. As expected, SWP power usage increases with SWP water deliveries. Moreover, DWR's divestiture of Reid Gardner Unit 4 coal-fired power plant in 2013 resulted in a reduction in SWP power generation of about 1,500 GWh annually, most of which has been replaced by power purchase agreements.

Table 1. SWP Water and Power Statistics¹

Year	Water delivered (acre-feet)	Percent of Table A Maximum (4,172,786 acre-feet)	Power Generated (GWh/year)	Power Used (GWh/year)
2000	3,584,668	85.9%	6,832	8,518
2001	2,042,130	48.9%	4,588	6,358
2002	2,850,219	68.3%	5,631	8,191
2003	3,167,607	75.9%	6,117	8,862
2004	3,119,583	74.8%	6,887	9,661
2005	3,627,007	86.9%	5,661	8,282

2006	3,691,573	88.5%	7,515	9,109
2007	2,996,638	71.8%	6,410	9,276
2008	1,950,972	46.8%	4,100	5,701
2009	1,933,739	46.3%	4,255	5,438
2010	2,660,964	63.8%	4,368	7,184
2011	3,596,754	86.2%	5,258	8,583
2012	2,848,085	68.3%	4,810	7,404
2013	2,107,574	50.5%	3,679	5,732
2014	1,079,385	25.9%	1,432	2,787
2015	1,375,538	33.0%	1,699	3,483
2016	2,299,679	55.1%	3,535	6,598
2017 ²	3,732,527	89.4%	5,011	9,652
2018 ²	1,990,357	47.7%	2,950	5,731

¹Source: 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.)

²As of February 2019.

Greenhouse Gas Reduction and Renewable Energy

The SWP is one of the largest consumers of energy in California, using electricity to pump water from the Sacramento San Joaquin Delta to southern California, over the Tehachapi Mountains. As shown in Table 1, the SWP consumes and generates significant quantities of energy. In 2018, the SWP generated 2,950 million kWh (typically expressed as Gigawatt hours or GWh), while consuming 5,713 GWh.

The Global Warming Solutions Act of 2006, or Assembly Bill (AB) 32, along with Executive Order (EO) S-3-05 established greenhouse gas emission (GHG) reduction targets for the State. In 2012, DWR adopted a GHG emissions reduction plan, which covers DWR operations, including operations of the SWP and state flood control infrastructure. DWR outlined 11 GHG emissions reduction strategies in the plan, including eliminating use of coal-fired power, energy efficiency improvements, and procuring renewable energy. The strategies aim to reduce emissions from all sources. The plan included a near-term goal to reduce GHG emissions to 50 percent below 1990 levels by 2020, and a long-term goal to reduce emissions to 80 percent below 1990 levels by 2050. DWR's GHG emissions reduction goals were more aggressive than statewide goals set forth in AB32 and EOS-3-05. However, in September 2018, SB100 was signed into law and requires California's electricity sector to be 100 percent emissions-free by 2045. DWR is updating the Climate Action Plan and GHG emissions reduction plan to reflect SB100 requirements.

Approximately 65 percent of power for the SWP currently comes from emissions-free sources. DWR intends to increase the emissions-free share of electricity to 75 percent by 2030 and 100 percent by 2045. Those emissions-free sources include both large and small hydroelectric plants and solar power resources. DWR currently has one contract for natural gas, three contracts for hydroelectric power, and three contracts for solar power. DWR will increase the amount of contracted renewable energy resources to meet the new SB100 target. By 2045 SWP's portfolio mix is expected to consist of 50 percent large hydro and 50 percent renewable resources.

DWR's Greenhouse Gas Emissions Reduction Plan calls for annual monitoring reports. The most recent report (for 2017 emissions) found that DWR's 5-year average of GHG emissions spanning years 2013-2017 was 1,018,852 metric tons of carbon dioxide equivalents (mtCO₂e). This number is 62 percent below 1990 levels and 50 percent below 2010 levels. This level of emissions is the lowest ever recorded by DWR and represents substantial and consistent reductions in emissions over the last decade. DWR is already well ahead of schedule for achieving its 2020 GHG Emissions Reduction Goals. The GHG Emissions Reduction Plan projected that 2015 emissions should be around 2.1 million metric tons CO₂e to be on track to achieve the reduction goals by 2020. In fact, DWR achieved its target emissions reductions for 2020 in 2015, five years ahead of schedule.

DWR's emissions vary greatly from year to year because SWP operations depend on hydrology, and increasing water deliveries increases emissions. Even with these variations, DWR is currently on track to meet its 2020 and 2050 emissions reduction targets. However, DWR's long-term emissions reduction targets will need to be revised in accordance with SB100 which requires 100 percent emissions-free electricity by 2045. DWR monitored the increase in emissions due to the Oroville spillways recovery effort, and does not expect that activity to change the overall trajectory of emissions reduction.

Coordinated Long-Term Operation of the Central Valley Project and SWP

The Coordinated Operation Agreement (COA), originally signed in 1986, defines how the state and federal water projects share water quality and environmental flow obligations imposed by regulatory agencies. The agreement calls for periodic review to determine whether updates are needed as conditions change.

Updated Coordinated Operating Agreement with the Bureau of Reclamation

In November 2018, DWR and the Bureau of Reclamation reached agreement on updating how the SWP and CVP are operated to meet environmental regulations.

After completing a joint review process, DWR and the Bureau agreed to an addendum to the COA to reflect water quality regulations, biological opinions and hydrology updated since the original agreement was signed.

DWR and the Bureau also signed an agreement to formalize the cost sharing formula for projects needed to meet joint responsibilities under the Endangered Species Act, including monitoring and habitat restoration.

Every five years, or prior to the operation of a new or significantly modified facility, DWR and the Bureau jointly review the operations of both projects and compare the relative success each party has had in meeting its objectives, review operation studies supporting the agreement, and assess the influence of the factors and procedures in meeting each party's future objectives.

Ecosystem Restoration

DWR and the Bureau of Reclamation coordinate operations of the SWP and the Central Valley Water Project (CVP) to comply with the Endangered Species Act.

In 2009, the National Marine Fisheries Service (NMFS) issued its Biological Opinion and Conference Opinion on the Long-term Operation of the Central Valley Project (CVP) and SWP (NMFS Operation BO). The NMFS Operation BO concluded that, if left unchanged, CVP and SWP operations were likely to jeopardize the continued existence of four federally-listed anadromous fish species: Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, and Southern Distinct Population Segment (DPS) North American green sturgeon.

The NMFS Operation BO sets forth Reasonable and Prudent Alternative (RPA) actions that would allow continuing SWP and CVP operations to remain in compliance with the federal Endangered Species Act (ESA).

- Action 1.6.1 of the RPA requires creating 17,000 to 20,000 acres of salmonid floodplain rearing habitat.
- Action 1.7 of the RPA requires improvement of adult fish passage in the Yolo Bypass.

Construction status of three projects to address regulatory compliance are as follows:

Wallace Weir Fish Rescue Facility Project: In 2018, the construction of the Wallace Weir Fish Rescue Facility Project was completed. The project was scheduled for commissioning in early 2019. This project is now in its operations and maintenance phase which is being done in cooperation with Reclamation District 108 and California Department of Fish and Wildlife (CDFW).

Fremont Weir Adult Fish Passage Modification Project: Construction of this project was started and completed in 2018. This project is intended to improve fish passage and be operational for the 2018-19 winter migration season. DWR is the lead on operating the facility in coordination with CDFW. See link to website for video and more detail

<https://water.ca.gov/News/Blog/2019/Feb-19/Fremont-Weir-Project>

Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project: This is a large project intended to enhance fish passage and juvenile rearing habitat for up to 20,000 acres in the Yolo Bypass. Public scoping occurred in 2013 and draft EIR/EIS was issued in 2017. The final EIR/EIS and associated decision documents will be issued in 2019. Planning and design are ongoing. The current schedule calls for construction to start 2021.

In 2008, the US Fish and Wildlife Service issued its Biological Opinion on the Long-term Operation of the CVP and SWP (USFWS Operation BO). The USFWS Operation BO concluded that, if left unchanged, CVP and SWP operations were likely to jeopardize the continued existence of federally- threatened delta smelt. The USFWS Operation BO sets forth RPA actions that would allow continuing SWP and CVP operations to remain in compliance with the federal ESA. Action 6 under RPA 4 requires the creation or restoration of a minimum of 8,000 acres of intertidal and associated subtidal habitat in the Delta and Suisun marshes to improve habitat conditions for delta smelt by enhancing food production and availability.

DWR is pursuing implementation of this action. To date, DWR has more than 8,000 acres of tidal restoration projects in various stages of planning. In terms of actual construction, the following three projects have been started or completed:

Tule Red Restoration Project: Tule Red is the first tidal restoration project counting toward the 8,000-acre requirement under the USFWS BO for Delta smelt to break ground. Construction started in 2016 and continued into 2018. It will be completed in 2019. When completed, the project is expected to receive approximately 600 acres of credit toward the 8000-acre requirement.

Yolo Flyway Farms: Construction on this tidal restoration project started and was completed in 2018. Approximately 290 acres of credit are expected for this project. See link to website for video and more detail <https://water.ca.gov/News/Blog/2018/Nov-18/Flyway-Farms>.

Decker Island: Construction on this tidal restoration project started and was completed in 2018. Approximately 110 acres of credit are expected for this project. See link to website for video and more detail <https://water.ca.gov/News/Blog/2018/Nov-18/Decker-Island-Project>

Nine additional tidal restoration projects are in the planning phase and are expected to be completed by 2022. The current estimate is that these projects along with Yolo Flyway Farms, Tule Red, and Decker will give DWR more than 9,000 acres of credit for Delta smelt tidal habitat. These projects also provide floodplain habitat for protected salmon.

3. Status of SWP Construction Projects

This section highlights key projects and projects of interest to the Commission—it is not a comprehensive list of SWP construction projects. The Department of Water Resources provided the following information to the Commission.

State Water Project – Oroville Field Division

Hyatt Powerplant Fire Detection System

The Hyatt Fire Protection Modernization project will increase personnel safety and protect equipment by modernizing the fire protection systems and improving emergency egress at Hyatt Powerplant, Oroville Field Division Operations and Maintenance Center, Thermalito Diversion Dam Powerplant, Hyatt Intake, Oroville Spillway Control Structure, Feather River Outlet Control Structure, and the Area Control Center.

The project was significantly impacted by the 2017 Oroville Spillway Incident, resulting in a five-month delay. In addition, the project scope expanded to include fire suppression control structures at Oroville Spillway, Thermalito Diversion Dam, and Feather River Outlet, as well as, new domestic and raw water supply lines. The project is 90 percent complete and is currently in testing and commissioning, which is scheduled to be finished by May 2019.

Hyatt Unit 1 Turbine Upgrade and Turbine Shutoff Valve Refurbishment

The Hyatt Unit 1, 3, and 5 turbine generators have been in service for over 50 years and have exhibited numerous thrust bearing failures over the years. As a result, DWR issued an order to design and furnish new robust thrust bearings and a new turbine runner for Unit 1, which have been received at the Hyatt Powerplant. In addition, the turbine shaft and many other turbine embedded components were refurbished to maintain overall unit efficiency. .

The Hyatt turbine shut-off valves (TSV) seats were worn and in need of replacement to ensure the future reliability of the valves. The refurbishment work includes retrofitting the TSV with mechanical locks on the upstream valve seats, designing new valve seats, replacing portions of the TSV, and pressure testing the refurbished TSV.

The Hyatt Unit 1 turbine runner replacement and TSV refurbishment was initially delayed by the Oroville Spillway Incident and has subsequently been delayed further because of challenges

encountered with reassembling the TSVs with the new seats. Commissioning and testing of the turbine and the TSV is now scheduled for completion in Spring 2020.

Thermalito Pumping-Generating Restoration and Modernization

On November 22, 2012, the Ronald B. Robie Thermalito Pumping-Generating Plant (THPP), part of the Oroville complex, suffered a catastrophic fire that rendered the plant inoperable. A fire clean-up project removed damaged plant components and hazardous materials resulting from suppressing the fire, and was completed in April 2014.

The THPP Restoration Project commenced in April 2015 to restore the plant's electrical, protection, controls, and communications systems. The plant is being modernized to maximize fire protection and life safety, enhance reliability, reduce maintenance, and minimize unplanned outages. Full operation of the plant will provide as much as 300,000 MWh annually and potentially restore SWP pump-back operational flexibility.

Completion of the Restoration Project which includes all four units restored to full operation, is scheduled for September 1, 2019. The project is currently on-schedule and on-budget.

State Water Project – Delta Field Division

North Bay Aqueduct Alternate Intake

The environmental review process is currently underway for the North Bay Aqueduct Alternate Intake Project (NBA AIP), a new facility that will improve water quality and provide reliable delivery of SWP water to the Solano County Water Agency (SCWA) and the Napa County Flood Control and Water Conservation District (Napa County FCWCD). The draft Administrative EIR was updated in response to comments received in July 2016. Completion of the final EIR is on hold.

State Water Project – San Luis Field Division

Gianelli Pumping and Power Plant Unit 7 – Butterfly Valve, Motor, and Turbine Refurbishment.

DWR operates and maintains the San Luis Joint-Use Complex, which serves the California State Water Project and federal Central Valley Project. The Gianelli Pumping Plant, located between San Luis Reservoir and O'Neill Forebay, pumps water into San Luis Reservoir for storage and release as needed. The Unit 7 Refurbishment consists of three separate and concurrent projects (Turbine Refurbishment, Motor Generator Rewind, and Main Unit Butterfly Valve Refurbishment). The Turbine Refurbishment (including volute overlay, wear ring replacement, and new coating) is complete. The Motor Generator Rewind is complete (replacement of the 120 RPM and 150 RPM stator coils and the replacement of the 120 RPM rotor poles). The Butterfly Valve is in the final stages of testing and acceptance. The entire project is on schedule for completion in August 2019.

State Water Project – San Joaquin Field Division

Edmonston Pumping Plant Unit 7 Pump Refurbishment

Edmonston Pumping Plant, the highest-lift pumping plant in the State Water Project, moves water across the Tehachapi Mountains into southern California. This project involves partially disassembling the pump, cleaning, inspecting, and documenting component conditions, manufacturing a new pump shaft, and conducting electrical and mechanical tests on the pump before returning the unit to service.

The new pump shaft and coupling are on site and ready for installation. The motor rotor has been installed and final Unit assembly is underway. Difficulties in disassembling the pump, due to a bent pump shaft, has extended the estimated completion date from December 2018 to October 2019.

State Water Project – Southern Field Division

Perris Dam Remediation Program (PDRP) - Dam Remediation

Lake Perris, located in northern Riverside County, is the southernmost SWP facility and the southern terminus of the East Branch of the California Aqueduct. The remediation of Perris Dam facilities is a major capital improvement program and comprises four projects: foundation remediation, outlet tower improvements, an emergency release facility, and seepage recovery.

Perris Dam Foundation Remediation: In 2005, DWR identified potential seismic safety risks in the foundation of Perris Dam. While there was no imminent threat to life or property, in the interest of ensuring the maximum public safety, DWR lowered the water level of Lake Perris until repairs were made. The EIR for the Perris Dam Remediation Project was certified in November 2011 and the foundation remediation and outlet tower improvements were approved to move forward with design. DWR advertised the construction contract for the project in April 2014 and awarded to Pulice Construction Inc. in July 2014. The contractor completed the stabilizing berm and deep soil cement mixing system to strengthen a portion of the dam's foundation in November 2017. The project was completed in 2018.

Outlet Tower Improvements: Analyses of the Perris Outlet Tower have indicated the tower can survive the Maximum Credible Earthquake. This project is now focusing on a seismic retrofit of the tower's bridge, retrofits to and replacement of critical operating equipment, modification to the outlet structure to receive a redundant roller gate and refurbish the existing slide gate and penstock steel liner. The roller gate will replace a bulkhead that poses an impractical feature to remove in the midst of an emergency drawdown. Design efforts are currently underway, and the Tower Bridge Seismic Retrofit work is anticipated to complete by September of 2020. The remaining retrofit and replacement work are anticipated to be completed by November of 2021.

Perris Dam Emergency Release Facility: The Emergency Release Facility project (ERF) will reduce the risk to public safety and property resulting from the execution of an emergency

operation to drawdown Lake Perris. The design for the Emergency Release Facility began in March 2018. The Draft EIR was recirculated between September 29, 2017 and November 13, 2017, and certified in March 2017. Construction of the facility is anticipated to start in late 2020 with major features to include the construction of bridges at Lake Perris Drive and Evans Road to allow for conveyance of emergency releases to the Perris Valley Channel.

Perris Seepage Recovery: This project will install an integrated recovery well system to recover SWP water that is seeping out of Lake Perris through a subterranean bedrock channel under Perris Dam. The EIR should be completed in 2019 and the project design should be completed in 2020. Construction of the project should start in 2021 and be complete by the end of 2021.

East Branch Extension - Phase I Improvements

The East Branch Extension (EBX) is a cooperative effort among DWR, San Bernardino Valley Municipal Water District (SBVMWD), and San Geronimo Pass Water Agency (SGPWA) to deliver SWP water to the east side of SBVMWD's and SGPWA's service areas in Riverside and San Bernardino counties. The project conveys water from the Devil Canyon Powerplant Afterbay to Cherry Valley through a series of existing and new facilities. Construction for Phase I was completed in 2003, however, subsequent construction of Phase I Improvements followed with the construction of the Yucaipa Connector Pipeline and Crafton Hills Reservoir Enlargement, which provide additional storage for operational reliability and reduce energy demands during peak demand periods. Yucaipa Pipeline created a bypass around the Crafton Hills Reservoir during the enlargement and maintained water deliveries while the Crafton Hills Reservoir is off-line and under construction. Spare pump units were added at Greenspot Pump Station, Crafton Hills Pump Station, and Cherry Valley Pump Station. EBX Phase I Improvements were completed in 2017, and environmental mitigation was completed in 2018.

East Branch Extension - Phase II

The East Branch Extension Phase II Project increased the conveyance capacity of the East Branch Extension and provided additional pumping capacity to convey the full contracted amount of SWP water (17,300 acre-feet) to the SGPWA. In addition, the project allowed the SBVMWD to increase its distribution system capacity to the Redlands and Yucaipa Valley service areas. Construction of Phase II was completed in 2017. Principal features of this project included approximately six miles of a new large diameter pipeline, a new reservoir (Citrus Reservoir) with a capacity of 400 acre-feet, a new 160 cfs pump station (Citrus Pump Station), expansion of the existing Crafton Hills Pump Station from 60 cfs to 135 cfs, and installation of an additional pump at the existing Cherry Valley Pump Station to increase the capacity from 32 cfs to 52 cfs. Weed removal and monitoring in the Santa Ana River channel and monitoring for San Bernardino Kangaroo Rat in reaches 1, 3, 4 and Staging Area 2 will continue in 2019 in accordance with the site's Long-Term Management Plan.

Alamo Powerplant Unit 2

Installing a second generating unit at Alamo Powerplant would capture the hydroelectric power generating potential of flows that are currently diverted through the spillway during outages on Alamo Unit 1 and during high flow conditions. The estimated design and construction cost of Alamo Unit 2 is \$57 million. The estimated generation value of Alamo Unit 2 is \$40 million over 30 years.

DWR has sought “Cap and Trade” funds for a portion of the design and construction to bridge the gap between the cost to the SWP and the benefits the SWP will receive. DWR submitted a funding package to the California Air Resources Board (CARB) in April 2016. In October 2016, the CARB deferred DWR’s funding request and requested that DWR resubmit in the spring of 2017. In April 2017, DWR submitted a Cap and Trade funding package for \$1.4M in FY 18-19 and \$10.6M for FY19-20. However, the request was denied without prejudice. The proposal was also denied because the framework of the Administration’s expenditure plan already accounted for the funds in the Greenhouse Gas Reduction Fund, and this proposal was not part of that framework. This project is not economically viable without the Cap and Trade funds, and will be removed from next year’s SWP Annual Review unless and until funding is available.