

TRIENNIAL LEGISLATIVE REPORT
OCTOBER 2022-OCTOBER 2025

Oroville Dam Citizens Advisory Commission



May 2026



Letter

*Letter content
is pending*

Executive Summary

Between October 2022 and October 2025, the Oroville Dam Citizens Advisory Commission (Commission) held 10 meetings and two optional Commissioner site visits, one to the Oroville Dam and one to the Feather River via the California Department of Water Resources' (DWR) floating classroom. The Commission met on the following dates either in Oroville, CA or via a Zoom webinar:

- Meeting 12, October 21, 2022
- Meeting 13, February 24, 2023
- Meeting 14, July 7, 2023
- Meeting 15, November 15, 2023
- Meeting 16, March 1, 2024
- Meeting 17, August 2, 2024
- Meeting 18, December 6, 2024
- Meeting 19, March 7, 2025
- Meeting 20, June 13, 2025
- Meeting 21, October 24, 2025

Through meeting presentations and discussions, the Commission supports ongoing dialogue that elevates residents' questions and concerns to leadership at DWR, which operates the Oroville Dam, and at other State agencies including the California Natural Resources Agency (CNRA), California Department of Parks and Recreation (State Parks), and Governor's Office of Emergency Services (Cal OES). In turn, State employees have had the opportunity to share regular updates with the community on the considerations and analyses guiding their management and

maintenance of the Oroville Facilities. This report summarizes the Commission's second three-year term of work, which involved presentations on a wide range of topics, including but not limited to:

- Oversight and Third-Party Assessment of the Dam
- State Water Project Asset Management
- Risk Assessment and Project Prioritization and Selection for the Oroville Facilities
- Annual Oroville Dam Budget
- Dam Safety Infrastructure Project Updates
- Forecasting Research and Use in Operations
- U.S. Army Corps of Engineers' Water Control Manual Update Process
- Winter Operations Updates
- Downstream Flood Preparedness

As required by Senate Bill 955, this triennial report provides:

- An overview of ongoing maintenance and improvements made at the dam and its facilities;
- A register of communications received from the department and other parties to the Commission;
- Notice of upcoming plans made by the department for the dam and its site; and
- An overview of flood management projects on the Feather River affecting public safety and flood risk reduction.

Contents

Letter	i	Section 2. Notice of Upcoming Plans for the Dam and its Site	24
Executive Summary	ii	Section 2.1 Forecasting and Operations Planning	24
Introduction	1	Section 2.1.1 Forecasting and Modeling (Meetings 12, 15, 17, 18, 19, 20, 21)	24
Report Purpose	1	Section 2.1.2 Water Control Manual Process (Meetings 15, 17, 18, 19, 21) ..	31
Commission Background	1	Section 2.2 Oroville Facilities Infrastructure Planning	34
Commission Membership	3	Section 2.2.1 Studies and Analyses (Meeting 21)	35
Acronyms	5	Section 2.2.2 Project Implementation (Meeting 21)	36
List of Speakers	5	Section 3. Overview of Flood Management Projects along the Feather River	37
Report Structure	6	Section 3.1 Downstream Flood Preparedness	37
Section 1. Overview of Ongoing Maintenance and Improvements at the Oroville Facilities	7	Section 3.1.1 Inundation Maps (Meeting 12, 14, 17)	37
Section 1.1 Oversight and Independent Assessment	7	Section 3.1.2 City of Oroville Levee (Meetings 12, 19)	39
Section 1.1.1 Role of Division of Safety of Dams Briefing (Meeting 17)	7	Section 3.1.3 Downstream Flood Management Projects (Meeting 12)	41
Section 1.1.2 Independent Assessment of State Water Project Dam Safety Program (Meeting 17)	9	Section 3.2 Flood Emergency Response and Coordination	41
Section 1.1.3 Part 12D Safety Inspections and 5-Year Director's Safety Review Board for Oroville Complex (Meetings 14, 17, 21)	10	Section 3.2.1 Evacuation Planning and Communication (Meeting 12)	41
Section 1.2 Facility Infrastructure Analysis, Maintenance, and Improvements	12	Section 3.2.2 Local Emergency Response in Butte and Yuba Counties (Meeting 13)	41
Section 1.2.1 State Water Project Asset Management, Project Prioritization, and Expenditures (Meetings 14, 16, 21)	12	Section 3.2.3 State Emergency Preparedness Coordination (Meeting 16)	43
Section 1.2.2 Dam Safety Program Projects Update (Meetings 13, 14, 16, 17, 21)	15	Section 3.2.4 Oroville Emergency Response Exercises (Meeting 18)	44
Section 1.3 Ongoing Winter Operations	21	Section 4. Conclusion	46
Section 1.3.1 Start of Water Year 2023 (Meeting 12)	21	Section 5. Register of Communications Received from the Department of Water Resources and Other Parties to the Commission	47
Section 1.3.2 January 2023 Storms Update (Meeting 13)	22	Section 5.1 Communications Received as Part of the Triennial Legislative Report Process	47
Section 1.3.3 Start of Water Year 2024 (Meeting 15)	22	Section 5.2 Communications Received on Normal Commission Business from October 2022 through 2025	48
Section 1.3.4 Start of Water Year 2025 (Meeting 18)	23		



Introduction

Report Purpose

Under existing law¹, the Oroville Dam Citizens Advisory Commission (Commission) is required to publish a report every three years that provides:

1. *An overview of ongoing maintenance and improvements made at the dam and its site.*
2. *A register of communications received from the department and other parties to the commission.*
3. *Notice of upcoming plans made by the department for the dam and its site.*
4. *An overview of flood management projects on the Feather River affecting public safety and flood risk reduction.*

By summarizing the relevant content shared on these topics at Commission meetings over the past three years, this report serves as documentation of improvements, both planned and completed, at the Oroville Dam facility and downstream for public safety and flood risk reduction purposes.

Commission Background

In the 2017 winter storms, Oroville Dam's main spillway and the emergency spillway suffered significant erosion scour damage while releasing flood waters that had flowed into Lake Oroville. Concerns for the stability of the spillway crest structures resulted in the temporary evacuation of approximately 188,000 residents downstream of the dam. Flood waters were successfully managed by making controlled reservoir releases down the damaged gated main spillway through May 2017, when the gates were closed for the year and the California Department of Water Resources (DWR) began repairs to the two spillways. By the fall of 2018, the entire 3,000-footlong chute for the gated main spillway had been completely

¹ Oroville Citizens Advisory Commission, Statutes of 2018, Chapter 509 (2018).

reconstructed, and major erosion-resistant armoring had been added to the emergency spillway. Following the spillways incident, the Commission was created to be a public forum for discussing issues related to the Oroville Dam facilities.

Senator Jim Nielsen's [Senate Bill \(SB\) 955](#) (2018), coauthored by Assemblyman James Gallagher, established the Commission. Passed by the legislature, SB 955 created the Commission "to serve as a representative to the public for the purposes of providing public input and receiving information from the dam operator" and to "act as a unified voice from the communities surrounding Oroville Dam to provide public feedback, advice, and best practices to the dam operator."

SB 955 housed the Commission within the California Natural Resources Agency (CNRA) and named its members as the leadership of CNRA, DWR, the Governor's Office of Emergency Services (Cal OES), and California Department of Parks and Recreation (State Parks) along with representatives appointed by the counties of Butte, Sutter, and Yuba and the City of Oroville, as well as law enforcement.

SB 955 states that the Commission "shall not make regulations or rules to bind operations at the dam," but that it shall "provide stakeholders with the opportunity to gather at a regularly appointed time to discuss maintenance and public safety activities at the site." Since 2019, three to four meetings have been held each year to provide the public and the Commission with the opportunity for learning about and to provide input and feedback on dam operations and maintenance.

California's Water Code requires that DWR supervise the maintenance and operation of dams and reservoirs in California as necessary to safeguard life and property. DWR operates the State Water Project (SWP), a multi-purpose water storage and delivery system that includes the Oroville Dam. As a result, DWR plays a unique role in the Commission – as a participant, the dam owner and operator, and a subject matter expert on many of the topics under discussion. SB 955 requires that DWR "provide all information reasonably requested by the Commission regarding construction, rehabilitation or reconstruction, operation, maintenance, or management of Oroville Dam" and authorizes the Commission to also request information on Feather River levees and levee-related flood risk from the State or relevant reclamation or flood management districts. This information is shared at the public Commission meetings.

After the spillways incident and creation of the Commission, the State's subsequent repair of the main and adjacent emergency spillway was just a first step. Over the past nine years, DWR has continued to assess and reassess the future needs of the 50+-year-old facility and provide regular updates on their planning and progress to the Commission.

Commission Membership

The Commission is comprised of the following 19 members as stipulated in SP 955:

- The Secretary of the California Natural Resources Agency or their designee, who shall be the Chairperson
- The Director of the Department of Water Resources or their designee
- The Director of the Department of Parks and Recreation or their designee
- The Director of the Governor's Office of Emergency Services or their designee
- The Commander of the Department of the California Highway Patrol field division that services the County of Butte or their designee
- The member of the California State Senate representing the City of Oroville or their designee
- The member of the California State Assembly representing the City of Oroville or their designee
- Two members appointed by the City Council of the City of Oroville
- Three members appointed by the Board of Supervisors of the County of Butte
- Two members appointed by the Board of Supervisors of the County of Sutter
- Two members appointed by the Board of Supervisors of the County of Yuba
- One county deputy sheriff appointed by the Sheriff of Butte County
- One county deputy sheriff appointed by the Sheriff of Sutter County
- One county deputy sheriff appointed by the Sheriff of Yuba County

Members representing city or county perspectives will be selected to reflect the interests of the communities they represent.

The members of the Commission representing city or county interests will select a vice-chairperson by a majority vote.

Member Entity	Member Names (Term Dates)
CA Natural Resources Agency	Wade Crowfoot (2019-present)
California State Senate	Jim Nielsen (2019-2023) Brian Dahle (2023-2025) Megan Dahle (2025-present)
Department of Water Resources	Karla Nemeth (2019-present)
Department of Parks and Recreation	Lisa Mangat (2019-2020) Armando Quintero (2020-2025)
Office of Emergency Services	Mark Ghilarducci (2019-2022) Tina Curry (2022-2024) Nancy Ward (2024-present)
Department of California Highway Patrol, Butte County Division	Steve Dowling (2019-2021) Larry Starkey (2021-2025) Marc Stokes (2021-2025) Patrick Leach (2025-present)
California State Assembly	James Gallagher (2019-present)
Oroville City Council	David Pittman (2019-present) Chuck Reynolds (2019-2023) Eric Smith (2023-present)
Butte County Board of Supervisors	Steve Lambert (2019-2021) Genoa Widener (2019-2021) Tod Kimmelshue (2021-present) Robert Bateman (2022-present) Bill Connelly (2019-present)

Member Entity	Member Names (Term Dates)
Yuba County Board of Supervisors	Gary Bradford (2019-2021) Doug Lofton (2019-2021) Seth Fuhrer (2021-present) Andy Vasquez (2021-2023) Oscar Marin (2023-present)
Sutter County Board of Supervisors	Dan Flores (2019-2023) Mat Conant (2019-2025) Nick Micheli (2023-2024) Jeff Boone (2025-present) Jeff Stevens (2025-present)
Butte County Sheriff's Office	Steve Collins (2019-2022) Brian Evans (2022-2025) James Beller (2025-present)
Yuba County Sheriff's Office	Joe Million (2019-2022) Brandon Spear (2022-2023) Nathan Lybarger (2023-present)
Sutter County Sheriff's Office	Deputy Andre Licon (2019-present)

Acronyms

Cal OES - California Governor's Office of Emergency Services

cfs - cubic feet per second

CNRA - California Natural Resources Agency

CNRFC - California Nevada River Forecast Center

DSOD - Division of Safety of Dams

DWR - California Department of Water Resources

FEMA - Federal Emergency Management Agency

FERC - Federal Energy Regulatory Commission

FIRO - Forecast-Informed Reservoir Operations

NEPA - National Environmental Policy Act

NOAA - National Oceanic and Atmospheric Administration

OEM - Office of Emergency Management

SB - Senate Bill

SBFCA - Sutter Butte Flood Control Agency

SWP - State Water Project

USACE - U.S. Army Corps of Engineers

WCM - Water Control Manual

List of Speakers

Mike Anderson, CA State Climatologist, Department of Water Resources

Robert Bateman, Commissioner, Oroville Dam Citizens Advisory Commission

Michael Bessette, Executive Director, Sutter Butte Flood Control Agency

Bill Connelly, Supervisor, Butte County Board of Supervisors

Ted Craddock, Former State Water Project Deputy Director, Department of Water Resources

Wade Crowfoot, Secretary, California Natural Resources Agency

Chris Fritz, Director of Engineering, Sutter Butte Flood Control Agency

Jennifer Fromm, Chief, Water Management Section, Sacramento District, U.S. Army Corps of Engineers

David Gordon, State Water Project Principal Engineer, Department of Water Resources

Jeremy Hill, Manager, Hydrology and Flood Operations Branch, Department of Water Resources

Laura Hollander, Deputy Director, Flood Management & Dam Safety, Department of Water Resources

Erik James, District Levee Safety Program Manager/Chief of Levee Safety, Sacramento District, U.S. Army Corps of Engineers

Joshua Jimmerfield, Deputy Chief Administrative Officer for Emergency Management, Butte County Office of Emergency Management

Bibek Joshi, Manager, River Forecasting Unit, Department of Water Resources

John Leahigh, Former SWP Water Operations Manager,
Department of Water Resources

Hong Lin, State Water Project Financial Manager, Department of
Water Resources

Matt Mentink, Member, Feather River Recovery Alliance

Mike Mierzwa, Technical and Policy Advisor, Department of Water
Resources

Karla Nemeth, Director, Department of Water Resources

Lori Nezhura, Deputy Director of Planning, Preparedness, and
Prevention, California Office of Emergency Services

David Pittman, Mayor, City of Oroville

Marty Ralph, Director, Center for Western Weather and Water
Extremes, Scripps Institution of Oceanography

Chuck Reynolds, Former Mayor, City of Oroville

Brian Ring, City Administrator, City of Oroville

David Sarkisian, Dam Safety Services Manager, Department of
Water Resources

Sharon Tapia, Division Manager, Division of Safety of Dams,
Department of Water Resources

Scott Turnquist, Oroville Field Division, Department of Water
Resources

Molly White, State Water Project Operations and Maintenance
Assistant Division Manager of the Water Management Office,
Department of Water Resources

Joel Wortley, Principal, HDR Engineering

John Yarbrough, State Water Project Deputy Director, Department
of Water Resources

Report Structure

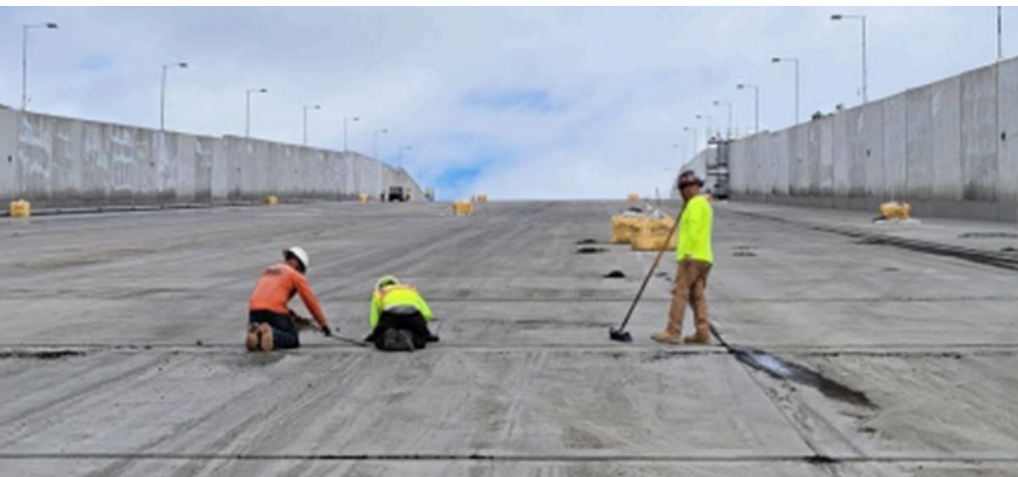
This report addresses the four overarching areas stipulated under SB 955's reporting requirements. It presents and summarizes content from presentations delivered to the Commission between October 2022 and October 2025. Subtopics related to each SB 955 requirement that were a focus for the Commission during the last three years are also indicated.

- 1. Overview of Ongoing Maintenance and Improvements at the Oroville Facilities**
 - 1.1. Oversight and Independent Assessment
 - 1.2. Facility Infrastructure Analysis, Maintenance, and Improvements
 - 1.3. Ongoing Winter Operations
- 2. Notice of Upcoming Plans for the Dam and its Site**
 - 2.1. Forecasting and Operations Planning
 - 2.2. Oroville Facilities Infrastructure Planning
- 3. Overview of Flood Management Projects along the Feather River**
 - 3.1. Downstream Flood Preparedness
 - 3.2. Flood Emergency Response and Coordination
- 4. Register of Communications Received from the Department and Other Parties to the Commission**

The report narrative that follows provides an overview of reporting and progress in these areas. Additional detail and information on topics covered in the report, and topics that were covered but are beyond the stipulated focus of this report, can be found in the materials and summary for each meeting. These reference materials are available online on the Commission's webpage at <https://resources.ca.gov/Initiatives/Oroville-Dam-Citizens-Advisory-Commission>

Section 1. Overview of Ongoing Maintenance and Improvements at the Oroville Facilities

This section focuses on the maintenance and improvements implemented at the Oroville Facilities in the past three years as reported to the Commission. Maintenance and improvements are interpreted broadly to include work for its dam safety program, asset management, and operations, as well as ongoing studies and capital improvement projects. Presentations to the Commission on ongoing or completed work between October 2022 and October 2025 covered a wide range of activities and improvements, including the oversight and independent assessment of Oroville Dam and the State's Dam Safety Program broadly; the preparatory analysis, design, implementation, and ongoing maintenance of dam safety projects; and the pre-planning, forecasting, and decision rules that support safe dam operations each winter.



DWR Contractor performing joint sealant repair on the Flood Control Outlet spillway

Section 1.1 Oversight and Independent Assessment

Following the 2017 Oroville spillways incident, there was increased scrutiny around governance and regulatory oversight of the Oroville Facilities. The Oroville Facilities are owned by the State Water Project (SWP), which is part of California's Department of Water Resources (DWR), but is regulated by both state and federal entities. On the state level, Oroville Dam is regulated by DWR's Division of Safety of Dams (DSOD). On the federal level, Oroville's hydroelectric facility is regulated by the Federal Energy Regulatory Commission (FERC), and its flood management capacity and operations are regulated by the U.S. Army Corps of Engineers (USACE). The roles of these regulators as well as the outcomes of their audits and inspections have been an area of interest for the Commission since 2019.

In the past three-year period, the Commission received specific presentations on the role of California's DSOD (discussed in [Section 1.1.1](#)) and on the outcomes of FERC's mandated audit of the dam owner's dam safety programs ([Section 1.1.2](#)). The Commission also received regular updates on the 5-Year Director's Safety Review Boards conducted by DSOD and Part 12D Safety Inspections conducted by FERC ([Section 1.1.3](#)).

Section 1.1.1 Role of Division of Safety of Dams Briefing (Meeting 17)

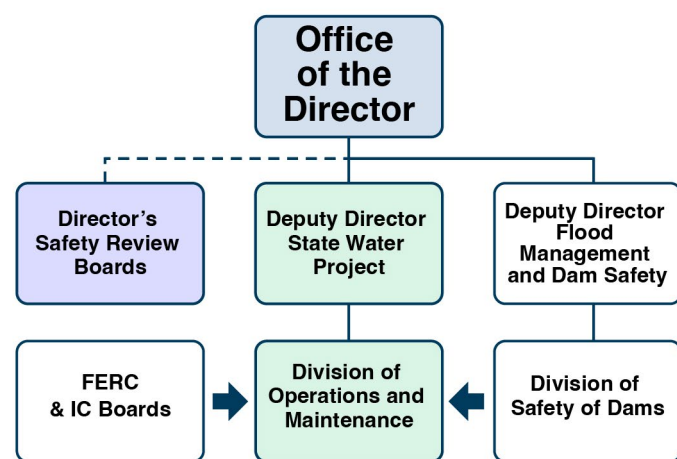
In August 2024 (Meeting 17), the Commission received an overview of California's state-level oversight of dam safety. Sharon Tapia,

Division Manager of DWR's DSOD, presented on California's comprehensive dam safety oversight program. She explained that DWR houses both dam ownership and dam regulatory functions, but it organizationally separates those responsibilities under different deputy directors (see Figure 1).

The SWP is the ownership branch. The SWP is a multi-purpose water storage and delivery system that extends over 705 miles. It is the largest state-built water and power system in the United States, designed to move water from Northern California to supply millions of Californians and large areas of farmland in the Central Valley and Southern California. The project is a vast network of canals, pipelines, reservoirs, and hydroelectric power facilities. The Oroville Facilities are the SWP's most important reservoir; the SWP is responsible for Oroville's operation to provide flood control, water supply, power production, environmental benefits, and recreation.

Figure 1. *DWR dams and dam safety oversight organizational chart.*

DWR Dams and Dam Safety Oversight



The DSOD is the regulatory branch. As defined by the California Water Code and California Code of Regulations, DSOD holds authority to independently regulate the safety of all dams in California over ~25 feet and 50-acre-feet of storage. This authority extends to dams owned by DWR's SWP and includes Oroville Dam.

Ms. Tapia described DSOD's mission: to reduce life loss and property damage from uncontrolled dam releases due to failure or uncontrolled reservoir release. The program represents one of the nation's largest dam safety programs, employing 93 full-time staff with a \$27.8 million budget and regulating 1,234 dams statewide, including 200 over 100 feet high.

She described some of DSOD's key activities, beginning with how DSOD issues classifications for dams based on potential downstream impacts to life and property, rather than dam condition or age. Classifications include Low, Significant, High, and Extremely High categories, with the latter reserved for dams that could impact 1,000 or more people with potential extensive loss of life. Oroville falls within this Extremely High category, reflecting the serious downstream consequences that could result from dam failure.

DSOD conducts independent reviews of proposed new dams and any enlargement, alteration, repair, or removal of an existing dam. The SWP submits reports to DSOD, as well as applications if modifications are proposed on the Oroville Dam. DSOD also conducts re-evaluation studies of existing dams, which may include components such as a seismic stability analysis or an updated hydrology analysis. DSOD maintenance inspections are conducted annually except for Low Hazard dams, which are inspected every other year. DSOD also maintains emergency operation center capability for major earthquake response, reflecting the comprehensive approach needed to manage California's complex dam safety landscape.

Ms. Tapia explained that with a current average age of 70 years, California dams face unique safety challenges. Aging infrastructure often predates modern design and earthquake engineering methods, and many facilities are located around fault lines and/or in or upstream of densely populated urban areas.

In recent years, DSOD has implemented enhanced safety programs to address these challenges, including a risk-informed decision-making program for more than 700 High and Extremely High Hazard dams and a civil administrative enforcement program to address non-compliant dam owners.

The risk program transitioned from a pilot to formal program status in 2025 and is being used to inform and prioritize DSOD's evaluation of dams with potential deficiencies or weaknesses that could lead to dam failure.

Section 1.1.2 Independent Assessment of State Water Project Dam Safety Program (Meeting 17)

FERC, the federal agency that licenses hydropower projects and Oroville Dam's federal regulator, mandates that for any dam classified as High Hazard there be an independent external audit of the dam owner's dam safety program at least every five years. In August 2024 (Meeting 17), the Commission received a briefing on the results of the most recent audit of the SWP Owner's Dam Safety Program conducted for HDR Engineering and GEI Consultants by Joel Wortley, a principal and geotechnical engineer from HDR.

The audit included review of more than 500 documents, field division visits, and interviews with SWP staff between March and September 2023. Mr. Wortley stated that the SWP's Oroville Dam Safety Program compares favorably to industry practice and other

dam safety programs and noted that the program has been significantly strengthened since the 2017 Oroville spillways incident. This evolution is demonstrated in the SWP's Dam Safety Policy, which meets and even exceeds FERC standards, and the strong organization and communication of the program, particularly from the Chief Dam Safety Engineer, who is a strong champion and leader. Other strengths included: effective program administration and field deployment, surveillance and monitoring that includes plans and reports for all dams as well as use of advanced technology, implementation of ongoing training and development for staff, and increased use of risk-informed decision-making to inform projects, budgets, and schedules.

The audit identified a series of opportunity areas for improvement. Wortley stressed that two areas manifested the largest challenges:

- **Organizational Change:** Aging infrastructure is driving a focus on asset management at the SWP; this is necessarily driving organizational change. Staff for SWP's Oroville Dam Safety Program will need to remain proactively involved in all these discussions to keep up with changes.
- **Succession Planning:** Attraction and retention of qualified staff at all levels - engineers, technical staff, and field staff - is an ongoing challenge. Focused succession planning will be essential to maintain the institutional knowledge that is a vital

"The [SWP's Dam Safety] program has made big strides over the last five years. The SWP has an appropriate organizational emphasis on dam safety. The program is adequately resourced. Senior management have an appreciation for dam safety risks, and staff understand their dam safety responsibilities... The program meets FERC's expectations [with the one exception, a minimal nonconformance discussed below] and it does compare favorably to industry practice and other dam safety programs we have been exposed to."

– Joel Wortley, HDR

component of dam safety. Wortley emphasized that while technological advances are important, dam safety ultimately relies on people and judgment.

Mr. Wortley identified the following additional areas and examples of specific recommended improvements made by the audit team.

- **Dam Safety, Policy, Objectives, and Expectations:** Ensure the Dam Safety Policy is regularly updated to keep up with current activities; issue an annual dam safety philosophy communication from the director to the staff. Note, the absence of this communication was the only area of non-conformance with FERC standards for the whole program.
- **Dam Safety Organization and Responsibilities:** Document who within the governance structure has ultimate decision authority and therefore, responsibility for various dam safety decisions; clarify and document where SWP responsibility extends and ends with respect to adjacent canals, aqueducts, etc.
- **Dam Safety Training Program:** Improve program documentation of the training and qualifications its staff are already receiving.
- **Communications, Coordination, Reporting, and Reports:** Provide reporting in a “scorecard format,” such that metrics are in the context of minimums required. Promote shared learning among the many field divisions. Track timeliness of responses to instrumentation exceedances. Rethink where performance-based thresholds make sense, because they were causing excessive false positives and promoting unnecessary reporting.
- **Records-keeping and Databases:** Review quality assurance processes for manual data collection and entry. Leverage technology to reduce workload in data collection, synthesis, and reporting. Ensure construction close-out documentation

is timely, so that staff always have the appropriate operating manuals and guidance.

- **Continuous Improvements:** Formalize the excellent quality management practices already being implemented into a quality management system, such that they are consistent and uniform across the SWP system. Roll up the risk-informed decision-making and potential failure mode analysis being done across the system into a portfolio view of dam safety risk that aggregates those individual risks, gives them context, and promotes risk communication. Institute regular self-assessments/reviews of the program’s strengths and weaknesses.

In [Section 5](#), DWR provides a written update on changes they have implemented in response to the dam owner’s Dam Safety Program audit recommendations since this August 2024 presentation.

Section 1.1.3 Part 12D Safety Inspections and 5-Year Director’s Safety Review Board for Oroville Complex (Meetings 14, 17, 21)

Once each year, David Sarkisian, DWR’s Dam Safety Services Manager, reports on the status of various projects, studies, and the two regular inspection processes overseen by Oroville’s regulators: FERC’s Part 12D Safety Inspections and DSOD’s 5-Year Director’s Safety Review Board. Mr. Sarkisian provided an inspection status update in July 2023 (Meeting 14) and a report on its outcomes in August 2024 (Meeting 17). For the latest inspections, consultants were selected through a Request for Qualifications process in 2022 and approved by both DSOD and FERC as having the appropriate expertise.

In 2022, FERC issued updated regulations and guidelines for their Part 12 inspection, creating two types of Part 12, a Periodic Inspection and a Comprehensive Assessment. Both include field inspection and performance monitoring evaluation of a project, but the Comprehensive Assessment adds workshops to analyze potential failure modes and risks associated with those potential failure modes (Level 2 Risk Analysis). Part 12 inspections will continue to be conducted every five years but rotate between the two types.

Director's Safety Review Board inspections were held in December 2023 and reports finalized in May 2024. Both SWP and DSOD staff participated in the Director's Safety Review Board inspections and process. FERC inspections were held in January 2024 and Part 12D Periodic Inspection reports were finalized in July 2024.

Both processes determined that Oroville, Parish Camp Saddle, and Bidwell Bar Canyon Saddle Dams were safe for continued use and reservoir impoundment.

At the August 2024 Commission meeting (Meeting 17), Mr. Sarkisian described recommendations provided in the latest reports, which included the following:

- Develop and/or adopt universal standards and best practices for structural deformation monitoring (surveying) to ensure consistency between different surveyors over the service life of the structures.
- Include details on LiDAR surveys to ensure consistency of methods and to establish the frequency of their performance.
- Add new survey reference points (benchmarks) at Bidwell Bar Canyon Saddle and Parish Camp Saddle Dams.

- Repair the Oroville Dam toe access road (and drainage) to prevent further damage. The SWP anticipates these repairs to be completed under the ongoing River Valve Outlet Rehabilitation project, as the heavy equipment used for the project caused the pavement damage.
- Conduct a wave run-up analysis for Oroville and Bidwell Bar Canyon Saddle Dam, which includes hydrodynamic modeling of wave generation and propagation due to landsliding. The next round of inspections will occur in 2028 with reports due in 2029 and will include a Part 12D Comprehensive Assessment.
- In October 2025 (Meeting 21), Mr. Sarkisian provided the schedule for the next round of inspections, which will include Part 12 Comprehensive Assessments by FERC. Inspections are anticipated in 2028 and submittal of reports in 2029.

In [Section 5](#), DWR provides updates on changes the SWP has implemented in response to the 2024 FERC Part 12D Safety Inspection and DSOD 5-Year Director's Safety Review Board recommendations.

Section 1.2 Facility Infrastructure Analysis, Maintenance, and Improvements

Over the last three-year period, CNRA Secretary Wade Crowfoot, the Commission's chair, asked DWR to provide regular updates on the following questions with the goal of ensuring local leadership has a clear understanding of the risks at Oroville Dam, the projects prioritized to address those risks, and the funding allocated to complete them. Updates are informed by three questions:

1. Do Commission members have a comprehensive understanding of the risks associated with Oroville Dam?
2. Is DWR prioritizing projects that effectively address the identified risks?
3. Is there sufficient funding allocated to complete these prioritized risk-mitigation projects?

DWR responded to this request with a series of introductory presentations on SWP expenditures, asset management, risk analysis, and project prioritization. Now, annual updates have been instituted on project prioritization alongside the existing annual update on the progress of individual dam safety projects.

Section 1.2.1 State Water Project Asset Management, Project Prioritization, and Expenditures (Meetings 14, 16, 21)

Section 1.2.1.1 State Water Project and Oroville Expected Expenditures

In July 2023 and March 2024 (Meetings 14 and 16, respectively), Hong Lin, Chief Financial Manager of the SWP provided a financial overview of the SWP broadly and Oroville specifically, including the budget and process for annual planning. She explained that sources of the SWP's more than \$1 billion annual revenue include payments from the 29 SWP contractors, power revenue from project facilities, cost-sharing from other agencies such as the Bureau of Reclamation, and the State General Fund under the Davis-Dolwig Act (Assembly Bill 261, 1961). This budget funds operations, maintenance, debt service, and capital projects at all SWP facilities, including Oroville. The SWP operates on a two-year rolling budget, which means that the current year's budget was planned for two years in advance. For example, bills for water contractors for 2025 were prepared in March 2024 based on plans established in 2023.

Ms. Lin shared that the capital projects planning portion of the budget has averaged approximately \$300 million annually for the past four or five years, noting that this average does not include the cost of repairs related to the 2017 Oroville spillways incident. Ms. Lin and Scott Turnquist, SWP's Oroville Field Division Manager, regularly present Oroville Facilities expenditures for past years and planned expenditures for the subsequent year. In October 2025 (Meeting 21), Mr. Turnquist reported planned outlays for 2025 and 2026 as \$94.9 million and \$91.7 million, respectively.

Section 1.2.1.2 State Water Project Prioritization and Selection

In March 2024 (Meeting 16), John Yarbrough, then Assistant Deputy Director for the SWP, presented an overview of SWP's capital planning process, including the criteria for project selection and examples from Oroville Dam safety projects. In October 2025 (Meeting 21), Scott Turnquist, DWR Oroville Field Division Manager, reviewed the process again and shared the list of 2025 capital improvement projects.

At Meeting 16, Assistant Deputy Director Yarbrough described the SWP's long-term planning and multi-year approach to project selection. He stressed that projects currently under construction were first conceptualized and planned many years in advance. The SWP refines a 5-year strategic plan each year through a process that integrates any new or urgent priorities (e.g., an asset that needs replacement after an inspection or an emergency incident) and builds out existing projects. This annual refinement of the project portfolio allows for adjustments to scopes of projects, identification and securing of resources, and eventually finalizing of a detailed plan for implementation.

Figure 2. SWP project capital prioritization process.

State Water Project Capital Prioritization Process

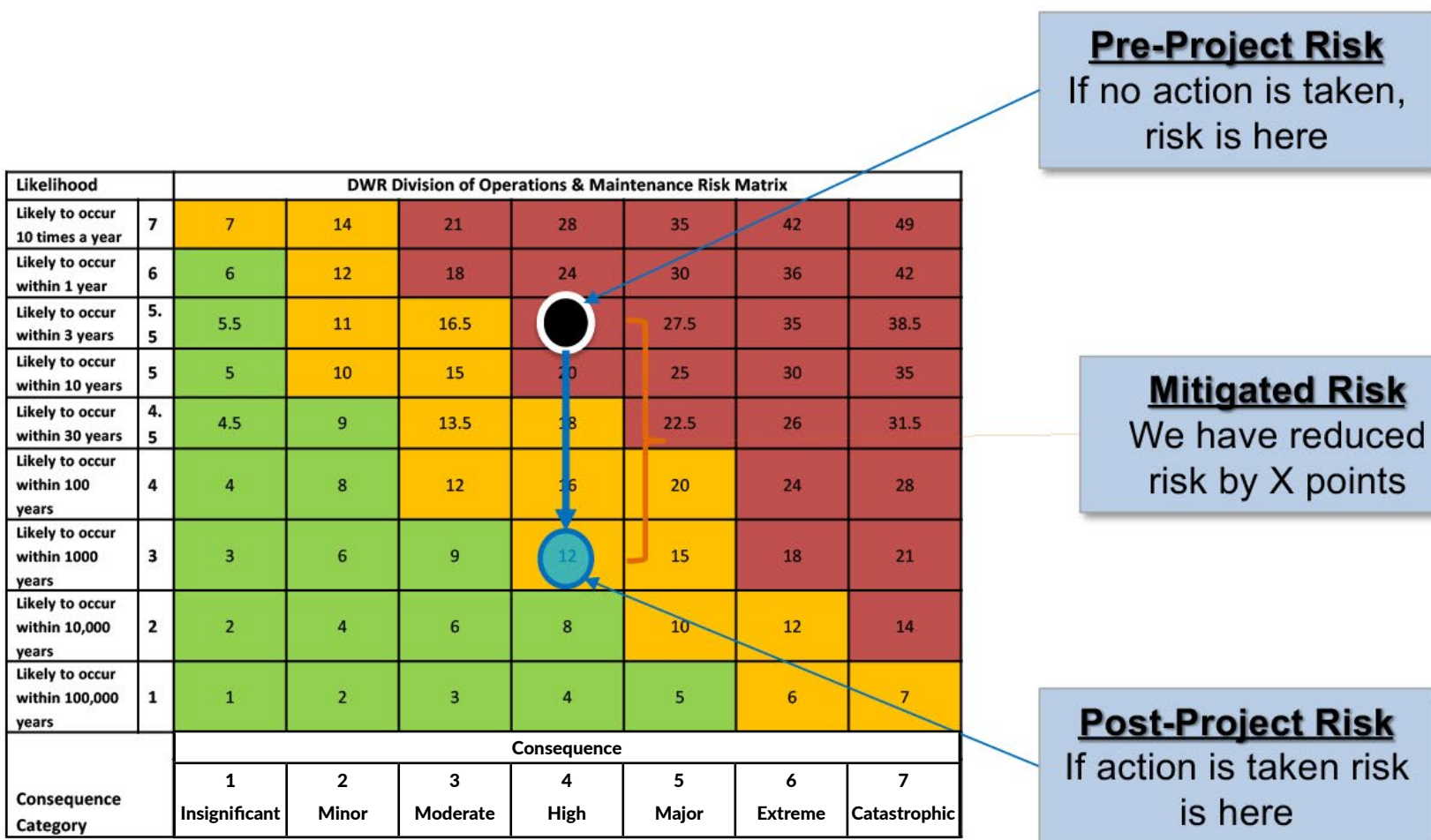


Mr. Yarbrough explained that the SWP begins each year's work plan with a foundation of "annual activities," which include the essential maintenance tasks performed every year. Then, additional projects are identified through proactive assessments such as construction needs evaluations, risk studies, and use of asset management principles. Once a project is identified, the project will go through a larger systematic prioritization process to refine the scope and resource needs over multiple years before a work plan is ultimately developed (see Figure 2).

Mr. Yarbrough explained that to prioritize additional projects effectively, DWR relies heavily on risk assessment to categorize risks as tolerable or non-tolerable, using a risk matrix (see Figures 3 & 4) based on FERC guidelines. This risk assessment process was updated during the Comprehensive Assessment, overseen by FERC.

In Figure 3, the matrix rows represent the likelihood of failure (on a scale from 10 times a year to only likely once in a 10,000,000-year timescale), and columns represent the severity of potential consequences. As seen in Figure 4 consequences are evaluated across seven categories: public safety, financial impacts to the community at large, personnel safety, compliance, flexibility and reliability for water delivery, flexibility and reliability for other SWP purposes (e.g. ability to generate power), and reputation (including public trust in DWR's ability to manage the project). Each category carries a different weight in the overall risk score. For example, public safety has a broader risk scale compared to water reliability; that is, consequences to public safety weigh more than any other category of risk. As a result, public safety projects will always be ranked higher, resulting in prioritization and funding.

Figure 3. Project driven risk reduction.



The goal of a specific project or portfolio of projects is to move risks from red (high risk) to green (low risk) by solving for or mitigating the risk (see Figure 3).

Mr. Yarbrough next reviewed three aspects of project prioritization that occur after the risk assessment phase:

- DWR uses an asset ranking method (A/B/C priority tiers) for projects to be completed: “A” projects rank as top priority, “B” as second rank priority, and “C” as last priority. Projects ranked “B” and “C” are considered less urgent and can occur further in the future if need be.
- After the risk assessment, ABC ranking, and resource planning (i.e., identifying the appropriate staff, equipment, and financial resources needed to complete the scoped work) are finished, a finalized workplan is developed with a list of activities for the next two years, including the resources assigned and cost estimates for each activity.
- The cost estimate determines the bill rates that get sent to SWP contractors.

Between 2024 and 2025, there were 327 planned projects; 62 of those at Oroville. Of the 62 projects listed in the final work plan for Oroville, there were six A projects, 29 B projects, and 27 C projects. The cost of those projects totaled \$125 million over the two-year period. The six A ranked projects included three dam safety-oriented projects: Oroville Dam Flood Control Outlet Spillway Maintenance, Oroville Dam Grout Gallery Piezometer Installation, and Oroville River Valve Outlet System Project.

Section 1.2.2 Dam Safety Program Projects Update (Meetings 13, 14, 16, 17, 21)

The following section summarizes progress made on key dam safety projects and supporting studies and analyses that were reported by David Sarkisian, DWR’s Dam Safety Services Manager, in July 2023 (Meeting 14), March 2024 (Meeting 16), August 2024 (Meeting 17), and October 2025 (Meeting 21). This list is not comprehensive of all the projects or studies that DWR completed; it instead focuses on those highlighted at Commission meetings.

Section 1.2.2.1 Inspections, Studies, and Analyses

Before SWP’s dam safety and field division staff select and refine projects for implementation, there is a thorough process for identifying potential dam safety issues and evaluating their risk. Dam Safety Services Manager Sarkisian most recently described the steps in this process at the October 2025 Commission meeting (Meeting 21), using the flowchart in the Dam Safety Risk Process (see Figure 5). Generally, routine dam safety activities (e.g., monitoring, inspections, five-year regulatory reviews, or periodic risk analyses) identify a potential dam safety issue (green box in figure). DWR then examines the issue to determine whether it rises beyond a routine dam safety activity/maintenance need and should be evaluated via specific studies and quantitative risk analysis (top center yellow box).

Over the past three years, DWR has advanced numerous studies intended to help answer important questions about whether identified risks are high enough to justify risk reduction actions and be advanced to the corrective action alternatives stage (light yellow box at right) at which a range of options to reduce risk are considered. A number of these options are described below, and the next steps they have prompted in the Dam Safety Risk Process are outlined in Section 2.2.

Figure 4. Consequence category matrix.

Consequence Category	Consequence										
	1	2	3	4	5	6	7	8	9	10	11
Public Safety	No injury	Near miss	Minor injuries not requiring medical attention	Single injury requiring medical attention	Multiple injuries or permanent disability	Fatality 0 – 1	Fatalities 1 – 10	Fatalities 10 – 100	Fatalities 100 – 1,000	Fatalities 1,000 – 10,000	Fatalities >10,000
Financial Impact	< \$100K	\$100K – \$1M	\$1M – \$10M	\$10M – \$100M	\$100M – \$1B	\$1B – \$10B	\$10B – \$100B	> \$100B			
Personnel Safety	No injury	Minor injuries not requiring medical attention	Single injury requiring medical attention	Multiple injuries requiring medical attention or permanent disability	Fatality 0 – 1	Fatalities 1 – 10	Fatalities >10				
Compliance	No violation	Minor restrictions or increased oversight	Violation or fines	Violation(s), fines, restricted use or prosecution	Sanctions, lose rights to operate a facility						
Flexibility and Reliability – Water Delivery	No impact	Unable to meet delivery schedule in a Field Division	Unable to meet water delivery schedules in multiple Field Divisions	Inability to meet SWP water deliveries; Cascading effect results in damage to other facilities	Inability to meet health and safety water needs; Cascading effect results in uncontrolled release of water						
Flexibility and Reliability – Other SWP Purposes	Questions raised by elected local officials	Questions by State or Federal officials	Negative local media coverage; Concerns from State or Federal officials	Negative state media coverage; Legislative hearing	Negative national media coverage; Legislative action	Consent to operate SWP revoked					

Flood Control Outlet – Post-Spill Radial Gate Inspection

Mr. Sarkisian’s annual presentations included updates on gate inspections and ongoing repairs. The radial gates on the spillway (see Figure 8) are tested every year for potential issues. The annual inspections include non-destructive ultrasonic testing by DWR engineers of the gate’s steel anchor rods, which “tie” the gates to the headworks structure, for any cracking or corrosion. In 2022, DWR conducted a 10-year structural, mechanical, and electrical inspection of the gates, including evaluation of the wire ropes. The inspectors found no evidence of advanced wear on the ropes and found the gates suitable for continued operations. Recommendations focused on continued maintenance and monitoring.

In October 2025 (Meeting 21), Mr. Sarkisian reported that, while not a safety issue, the inflatable side seals on the gate, which are pressurized via a water line, are not exerting adequate pressure to counter the reservoir water’s pressure when water levels are high, resulting in the leakage that is sometimes observable from the gates. To improve storage retention, the seals will be addressed via a seal rehabilitation project starting in 2026 to investigate ways to improve the system’s pressure.

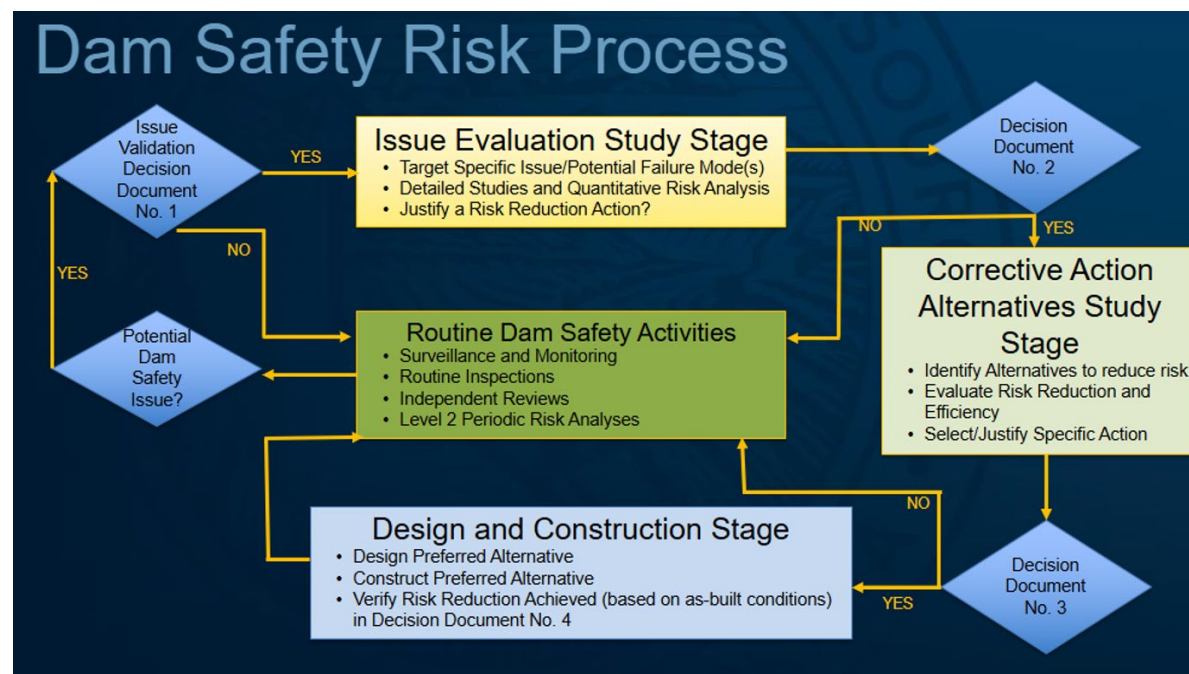
Periodically, DWR retains the USACE to conduct guided wave testing that can detect any breaks or cracks at depth along the rods. In October 2025, Mr. Sarkisian said that, while the test methods have not found any significant anomalies and DWR is confident that

the number of rods provides significant redundancy, DWR recognizes that the gate structure does have a finite service life, so will be evaluating alternatives for structural support or redundant gates in upcoming flood control outlet studies (see [Section 2.2](#)).

Flood Control Outlet – Pier 10 Crack

In October 2025 (Meeting 21), Mr. Sarkisian gave an update on continued monitoring of cracks in the flood control outlet. Prior to 2017, DWR identified a crack originating at the corner of a notch in the pier wall for the roadway bridge deck. DWR monitored the crack for potential growth over time, but growth has not been observed. Ultimately, the crack was determined to be non-structural in nature

Figure 5. Flowchart for dam safety risk process.



and caused by tensile stress at that corner as a result of concrete shrinkage following construction. It was injected and sealed with epoxy in 2019 and continues to be monitored. All other cracks in the flood control outlet are non-structural and fine.

Flood Control Outlet - Monolith 25 and 26 Seismic Retrofit Alternatives Analysis

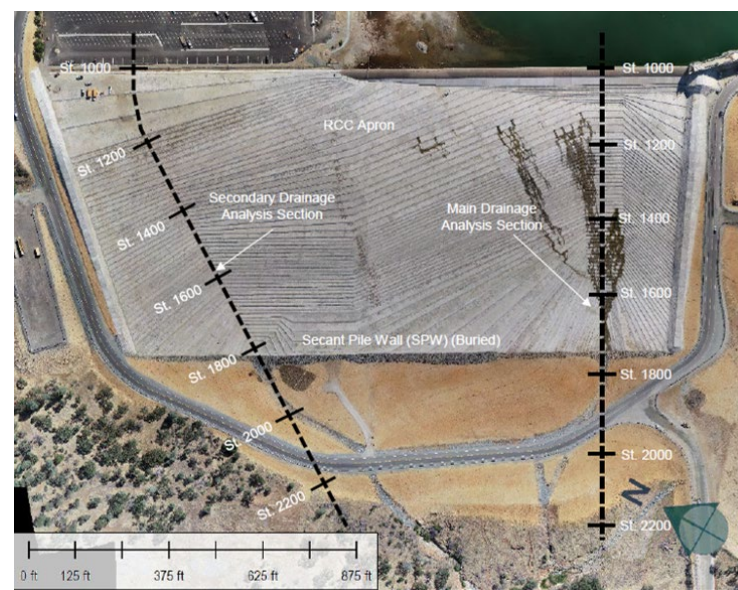
As part of its investigation into measures recommended for consideration in the Comprehensive Needs Assessment, between 2018 and 2021, DWR conducted modeling for the flood control outlet monoliths 25 and 26 under different seismic scenarios and submitted results to DSOD and FERC. More recently, Mr. Sarkisian reported that DWR has made updates to the modeling in response to specific feedback received from DSOD and to incorporate pore pressures recorded from the piezometers. In October 2025 (Meeting 21), he described plans to conduct a quantitative risk analysis on the topic by 2027 and thereafter identify the most effective combination of risk treatments, consistent with the Dam Safety Risk Process. Next steps are outlined in [Section 2.2](#).

Oroville Dam Emergency Spillway Erodibility Analysis

Between 2017 and 2019, DWR made significant improvements to the emergency spillway, including a roller-compacted concrete buttress in front of the monoliths, the roller-compacted splash pad or apron, and an underground cutoff wall, which engineers refer to as a secant pile wall (see Figure 6). In 2022, FERC requested further study of both the main and emergency spillway performance. As Mr. Sarkisian described in February 2023 (Meeting 13), DWR had performed and submitted studies to address FERC's questions, except for whether the emergency spillway could pass the Probable Maximum Flood without experiencing erosion that would compromise the stability of the emergency spillway monoliths, resulting in an uncontrolled release.

DWR's Emergency Spillway Erodibility Analysis, which Mr. Sarkisian first described in 2023 and provided a final presentation on in October 2025, was designed to answer that question with a series of studies and modeling. The risk of erosion downstream of the secant pile wall was assessed on the emergency spillway, specifically within the main and secondary drainages of the spillway apron. Components of the effort included: updates to the geologic model with data collected from 2017 to 2019, hydraulic modeling of the splitting of flows between the main and emergency spillways, emergency spillway capacity analysis, back-analysis of erosion during the 2017 incident to establish erodibility parameters, 3D hydraulic modeling, erosion/scour model development, and

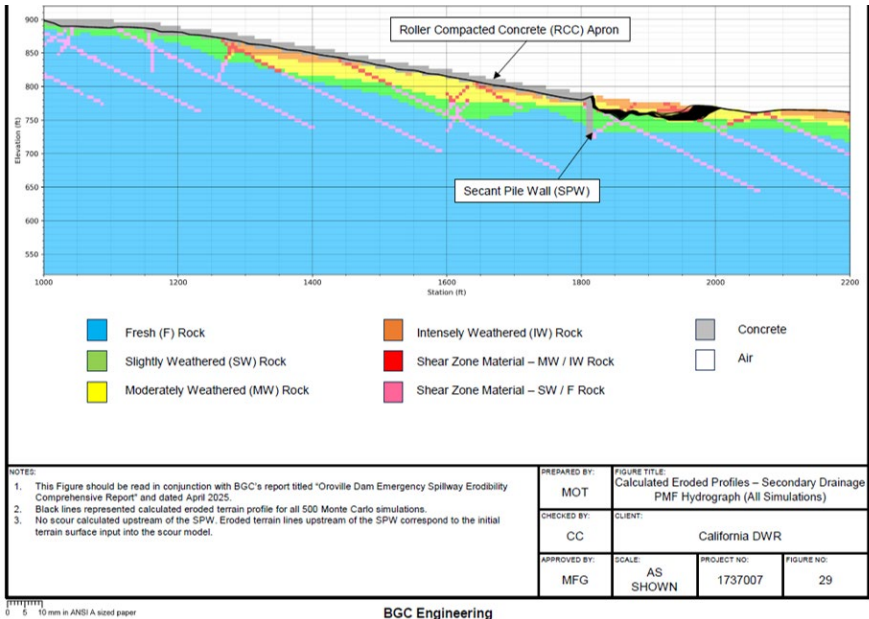
Figure 6. Oroville Dam's emergency spillway, illustrating profiles utilized in erodibility analysis, showing the RCC Apron extent, buried secant pile wall alignment, and main and secondary drainage analysis section locations from St. 1000 to St. 2200.



completion of the erodibility study. The study analyzed six different hydrographs, which included peak discharge rates up to those anticipated in the Probable Maximum Flood as well as ARkStorm 30-day events, which simulate performance in a longer storm scenario (see Figure 7).

Mr. Sarkisian stated that the study results indicate the likelihood of spillway discharges undermining the secant pile wall/roller-compacted concrete apron and causing erosion towards the spillway crest is improbable. No modeled hydrograph scenarios, up to and including the Probable Maximum Flood, resulted in erosion propagating upstream of the secant pile wall. Next steps are discussed in [Section 2.2.1](#).

Figure 7. Oroville Dam’s emergency spillway, illustrating profiles utilized in erodibility analysis. Geological cross-section depicting calculated eroded terrain profiles from all 500 Monte Carlo simulations for the secondary drainage Probable Maximum Flood hydrograph, from st. 1000 to st. 2200



The open question about the risk of erosion on the emergency spillway also motivated the continued DSOD and FERC Condition Assessment rating of Oroville Dam as "fair." Mr. Sarkisian said he hopes that the study results will justify the rating being upgraded to "satisfactory," the highest rating, although he cautioned that the regulators' review and decision could take years.

Paleoflood Analysis

Mr. Sarkisian reported on the Paleoflood Analysis at the February 2023 meeting (Meeting 13). Led by the USACE, this analysis utilized a combination of historical data, hydraulic modeling, and geologic investigation to "reconstruct" and estimate the magnitude and frequency of past floods on the Feather River. The study was completed in 2023 and will inform future dam safety studies, such as the Stochastic Flood Event Analysis (see [Section 2.2.1](#)). These studies are key inputs to future quantitative risk analyses to assess the overtopping of Oroville, Bidwell Bar Canyon Saddle, and Parish Camp Saddle Dams.

Reservoir Debris Maintenance Studies

Debris management on Lake Oroville was identified as a growing concern in the aftermath of fires in the Feather River watershed. DWR reported that greater understanding of where material congregates and builds up has helped crews improve planned maintenance across the lake. Debris in the far regions of the reservoir is trapped with log booms and buoy lines, and the pods of debris are moved across the lake and disposed of after beaching.

In February 2023 (Meeting 13), Mr. Sarkisian reported on DWR's woody debris modeling pilot study, which aimed to help predict the quantity of woody debris coming off the burned watershed in the future under various hydrologic scenarios. The study examined 18

of 480 square miles of burned watershed and results were extrapolated to determine large woody debris volume estimates for all burned watersheds. Analyses found almost 10 times the volume of debris would be generated in a five-year event than a one-year event and would then be doubled from that in a 25-year event. The study, supported by observations in other burned watersheds, suggests that a burned watershed is likely to generate 50% more debris than it might have previously. The results of this pilot study are consistent with the results of similar research studies.

Mr. Sarkisian stated that DWR is prepared to deal with a doubling of debris given the logistical and coordination improvements made since 2017.

Section 1.2.2.2 Project Implementation

Piezometer Installation and Monitoring

At the July 2023, August 2024, and October 2025 meetings (Meetings 14, 17, and 21), Mr. Sarkisian provided updates on the dam's piezometers, which are instruments that measure pore water pressure and are used to assess conditions within and under a dam. The measurement of pore pressures helps engineers understand and assess seepage through the dam or its foundation. Elevated pore pressures and excess seepage can have destabilizing effects on a dam and its appurtenant structures. The Commission has regularly discussed DWR's installation of additional piezometers at the Oroville Facilities and DWR's interpretation of the piezometer readings.

Depending on their specific location, piezometer readings can indicate different things. For example, piezometers installed in the toe of the dam respond to winter precipitation because runoff falls on the face of the dam and runs down to the toe. However, Mr. Sarkisian explained, those readings dissipate under dry conditions

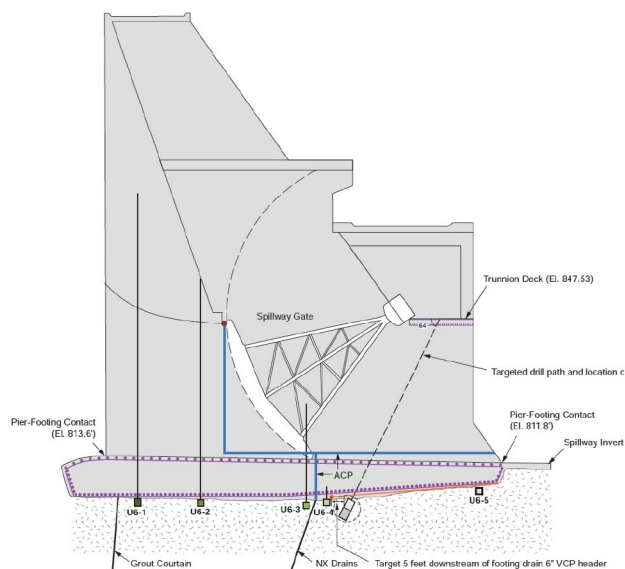
and therefore do not cause concern. If the toe piezometers responded with excessively high readings later in the season when lake levels were high but precipitation was not occurring, then that could indicate rising groundwater and some kind of undesirable seepage through the dam.

DWR's Comprehensive Needs Assessment recommended installation of piezometers in the flood control outlet, the dam toe, the core block, and the grout gallery. In 2020, four piezometers were installed at the flood control outlet headworks, which houses the eight radial gates. Also in 2020, DWR installed eight piezometers in the dam toe area. Installation of eight additional core block and grout gallery piezometers has been deferred due to other construction and high lake levels. Mr. Sarkisian stated that thus far the piezometer readings indicate that the spillway and the dam are performing well, with no indication of leaks due to spillway releases or high reservoir conditions.

Spillway Maintenance Repairs

The spillway is inspected every year. In 2022, spillway inspections indicated the need for specialized maintenance work through a contractor, including joint sealant replacement, minor concrete repairs, and underdrain inspections. At the March 2024 meeting (Meeting 16), Mr. Sarkisian explained that these spillway repairs were an A rated project (i.e., the highest priority) for several reasons: the amount of water passed through the spillway annually (e.g., 2.3 million acre-feet in 2023), its role as the primary release mechanism while the Hyatt Powerplant has been periodically taken offline for the River Valve Outlet System Rehabilitation Project (see below), and the limited times of the year when work can be done on the spillway due to high water levels. DWR issued a three-year contract, with repairs being performed in 2023, 2024, and 2025, including new maintenance items identified in each year's inspection.

Figure 8. Spillway gate cross-section showing subsurface drainage features, NX drain locations, targeted drill path, and key structural elevations.



River Valve Outlet System Rehabilitation Project

Mr. Sarkisian announced the approvals to start construction on the River Valve Outlet System Rehabilitation Project at the July 2023 meeting (Meeting 14). The project involves installation of two new 72-inch diameter spherical valves to improve system reliability and allow for safe, long-term operation and maintenance of the dam's low-level outlet. In October 2025 (Meeting 21), Mr. Sarkisian shared that the project was anticipated to be completed in Spring 2026.

Palermo Canal Lining Improvements

Lining the Palermo Canal was a risk reduction measure identified in the Comprehensive Needs Assessment and is intended to reduce seepage into the rock slope above Hyatt Powerplant and switchyard and reduce the potential for landslides/instability. Mr. Sarkisian

announced at the July 2023 meeting (Meeting 13) that final drawings had been submitted to FERC in March. Construction proceeded after FERC approval was received and the project was completed in January 2025.

Section 1.3 Ongoing Winter Operations

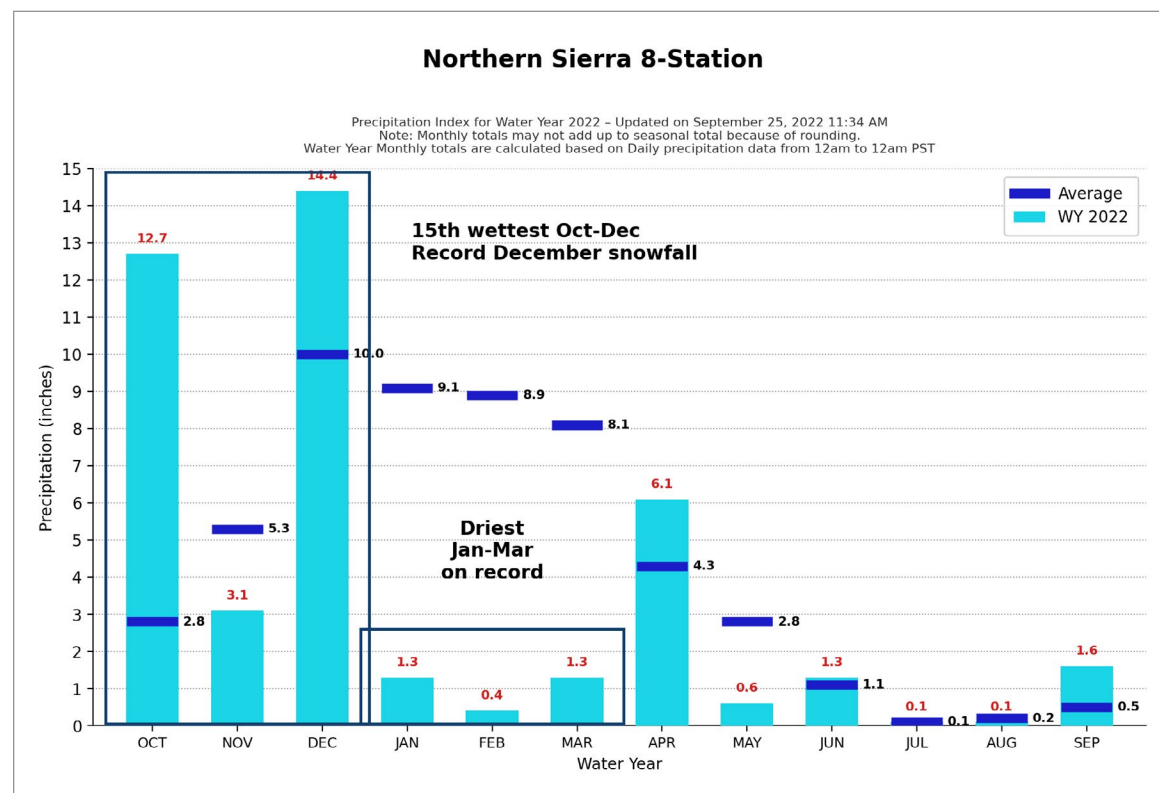
The Commission regularly reviewed winter preparedness and storm response procedures, tracking reservoir operations during significant weather events.

These updates demonstrate how DWR plans conservatively to ensure it can accommodate flood water in the reservoir, use improved forecasting to balance flood control requirements with water supply needs during California's highly variable precipitation patterns, and adjust its approach based on past learning.

Section 1.3.1 Start of Water Year 2023 (Meeting 12)

In October 2022, John Leahigh, SWP Water Operations Manager, reflected on the challenging conditions during Water Year 2022 (Oct 2021 to Sep 2022) and the planning underway for Water Year 2023 (Oct 2022 to Sep 2023). While Water Year 2022 started with record precipitation from October through December 2021, it was followed by the driest January through March on record (see Figure 9). As a result, Oroville's end-of-season storage levels were higher than the previous water year, but still just two-thirds of average. DWR staff were focused on planning for the potential of a fourth consecutive dry year, i.e., aiming to maximize the end of winter reservoir storage while maintaining readiness for extreme weather events.

Figure 9. Northern Sierra 8-Station Precipitation Index for Water Year 2022 (through September 25, 2022). Cyan bars show observed monthly precipitation; blue markers show the long-term monthly average. A record-wet start, the 15th-wettest October–December on record, including record December snowfall, was followed by the driest January–March on record.



Mr. Leahigh highlighted operational strategies, including maintaining storage for flood control purposes using an enhanced flood pool (in which DWR commits to maintaining more space for potential flood inflows than is required by USACE regulations), working with rice growers to balance water conservation needs with Pacific Flyway migratory bird requirements, and funding additional Airborne Snow Observatory flights for snowpack data to improve their forecasting ability.

Section 1.3.2 January 2023 Storms Update (Meeting 13)

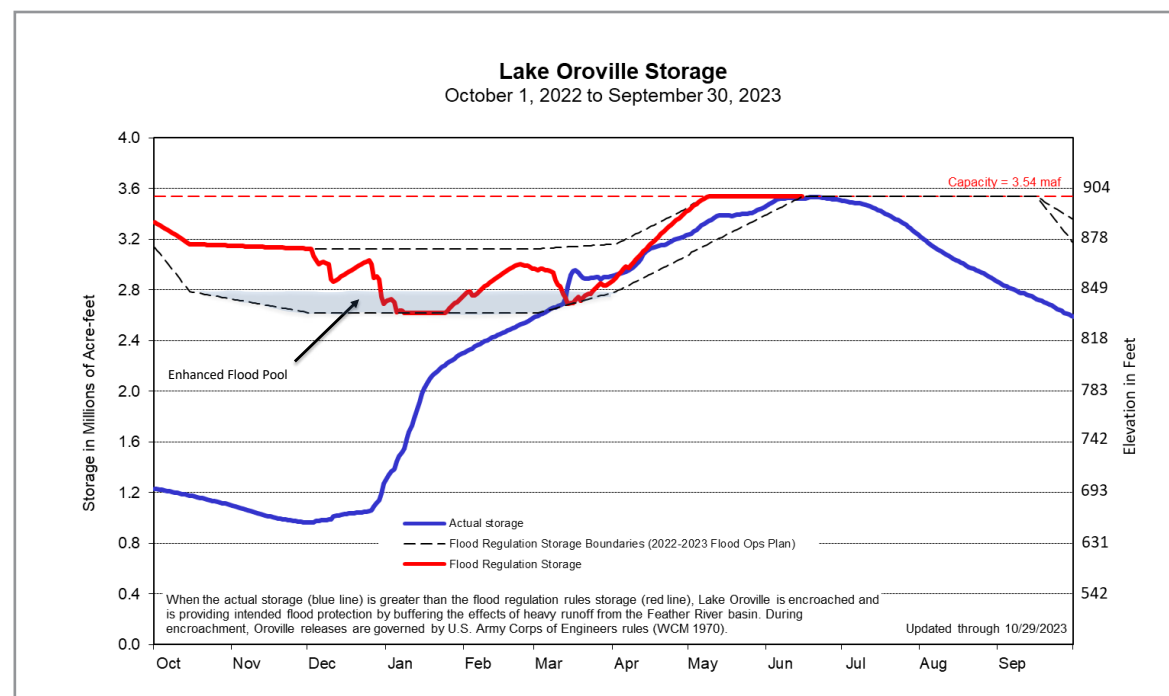
At the next meeting in February 2023, John Yarbrough, then Assistant Deputy Director of SWP, presented on the major winter storm impacts experienced that winter: nine atmospheric rivers occurred over three weeks from December 2022 through January 2023 with one categorized as “exceptional,” four as “strong,” and four as “moderate” storms. This compared to only three strong atmospheric rivers combined in water years 2020 and 2021. The statewide snowpack as of the February meeting was approximately 140% of average levels.

Mr. Yarbrough explained that while the lake’s elevation had risen notably since mid-December, there was still room to capture more inflow in the reservoir before they must make flood control releases. In January, a sizeable portion of the rainy season was still to come, and therefore, the seasonal forecast remained uncertain enough that DWR was unsure whether flood control releases would be necessary that year.

Section 1.3.3 Start of Water Year 2024 (Meeting 15)

John Leahigh, SWP Water Operations Manager, reflected on Water Year 2023, which brought relief after three severely dry years with over 20 atmospheric rivers ranging from moderate to exceptional intensity. Central California received record-breaking precipitation levels, and as of the end of the water year, California was no longer

Figure 10. Lake Oroville storage from October 1, 2022 to September 30, 2023, showing actual storage relative to Flood Regulation Storage boundaries and reservoir capacity of 3.54 million acre-feet. The Enhanced Flood Pool encroachment period is highlighted, during which releases were governed by USACE rules (WCM 1970). Updated October 29, 2023.



classified as being in drought. Lake Oroville storage levels recovered completely by late spring 2023 (see Figure 10).

Mr. Leahigh presented the Lake Oroville 2023-2024 Winter Operations Plan. Current conditions showed Lake Oroville at two-thirds full, representing 134% of average levels for the time period, with an additional 1.2 million acre-feet of storage compared to the previous year's start. However, fall 2023 precipitation had reached only 30% of average levels and an El Niño winter forecast could

bring either very wet or very dry winters to Northern California. With this in mind, DWR was releasing at minimum required levels to conserve storage and employing an enhanced flood pool strategy for the winter.

Section 1.3.4 Start of Water Year 2025 (Meeting 18)

In December 2024, Dr. Mike Anderson, DWR's State Climatologist, and Molly White, SWP Operations and Maintenance Assistant Division Manager over the Water Management Office, provided current conditions and outlook for the upcoming season. Water Year 2024 ended near average although with notable extreme weather events. For Water Year 2025, dry La Niña conditions were expected but had not fully materialized yet. Limited snowpack development due to high freezing elevations was concerning, given its implications for both water supply and fire risk.

Current reservoir status showed Oroville storage at approximately 1.9 million acre-feet, representing 108% of historical average levels. November storms had boosted both storage and soil moisture. Northern Sierra precipitation and snowpack levels were currently at average, with the enhanced flood pool remaining in effect for the coming season. DWR continued to implement the enhanced flood pool strategy for winter operations.

Section 2. Notice of Upcoming Plans for the Dam and its Site

This section focuses on plans for future operations and infrastructural improvements at the Oroville Facilities as reported over the past three years to the Commission. Section 2.1 summarizes presentations on improvements in weather, river, and reservoir modeling and forecasting; how that information is used in Forecast-Informed Reservoir Operations (FIRO); and the ongoing USACE process to update the Oroville Water Control Manual (WCM). Section 2.2 summarizes presentations on planned dam safety studies and capital improvement projects.



Aerial view of the Oroville Dam main spillway. During an active water release, high-velocity water flows through the concrete-lined chute into the diversion pool below.

Section 2.1 Forecasting and Operations Planning

Section 2.1.1 Forecasting and Modeling (Meetings 12, 15, 17, 18, 19, 20, 21)

DWR relies on forecasting and modeling of weather and water conditions to safely and effectively operate Oroville and the broader SWP. Accurate forecasts enable operators to balance multiple project purposes (e.g., flood management, water supply, recreation) in daily and seasonal operational decisions, and exploratory models allow them to plan for potential future extreme scenarios. DWR is engaged in multiple research partnerships on these topics with local and federal agencies, as well as academic institutions, with the goal of improving operational decision-making and ultimately, public safety.

In the late 2022 to 2025 period, the Commission heard presentations on DWR's study of extreme storm scenarios ([Section 2.1.1.1](#)), improvements in forecasting of atmospheric rivers and its application in operations to decrease flooding and potentially increase water supply ([Section 2.1.1.2](#)), and the tools California uses for snow melt and reservoir inflow forecasting ([Section 2.1.1.3](#)).

Section 2.1.1.1 Atmospheric River Research, aka ARkStorm 2.0

In October 2022 (Meeting 12), Jeremy Hill, Manager of DWR's Hydrology and Flood Operations Branch, gave a presentation on atmospheric river research to the Commission. He focused on the ARkStorm 2.0 scenario, how DWR uses it as a tool, and its relationship with other DWR programs.

Mr. Hill explained that ARkStorm is an extreme but plausible scenario that models a statewide series of storms occurring over a month-long period. The “AR” in ARkStorm stands for atmospheric river, which refers to narrow bands of moisture that can span thousands of miles across the Pacific Ocean. When these atmospheric rivers align with the West Coast, they produce phenomenal precipitation rates throughout California.

Mr. Hill noted that ARkStorm 2.0 is an update of the U.S. Geological Survey’s 2011 ARkStorm analysis of approximately a 500 to 1,000-year event. The update used improved modeling tools and techniques, current climate change projections, and contributions from additional collaborators including the University of California, Los Angeles and the Oak Ridge National Laboratory. As part of the ARkStorm 2.0 effort, DWR is conducting extensive research on rain-on-snow events. New data from Airborne Snow Observatories will provide unprecedented information about snowpack conditions throughout winter and spring, enabling a much better understanding of potential melt-off scenarios if atmospheric rivers arrive.

The ARkStorm 2.0 scenario includes events that overwhelm existing flood infrastructure, including dams. It aims to model and assess the consequences of such events to support better informed emergency planning and response. Mr. Hill explained that for Oroville Dam specifically, the modeling will eventually show what would happen at the Oroville Facilities under an ARkStorm scenario and will directly inform emergency response planning. Future presentations are planned to share these regional implications with local partners and decision-makers.

Mr. Hill explained that the first phase of ARkStorm 2.0 research, published in August 2022, produced 30-day rainfall maps comparing historic conditions with future conditions under climate

change, which present unprecedented future challenges for California’s flood management infrastructure. The future condition maps indicate significantly higher precipitation over California’s mountainous terrain. He highlighted the “double whammy effect” of climate change on flood risk, in which a warmer atmosphere holds more moisture, resulting in higher precipitation rates across the state, and more precipitation falls as rain instead of snow, resulting in immediate runoff rather than storage as snowpack.

Mr. Hill stressed the importance of the ARkStorm 2.0 modeling to several other DWR programs and initiatives, including:

- **Flood Risk Analysis and Infrastructure Planning:** ARkStorm scenarios are being compared against those used in the Central Valley Flood Protection Plan, which serves as the blueprint for prioritizing long-term flood infrastructure improvements.
- **Operational Planning:** ARkStorm 2.0 results will be integrated into existing programs such as FIRO. As the ARkStorm study progresses and additional information becomes available, findings will be shared with dam operators to inform discussions about operational implications.
- **Emergency Preparedness and Planning:** ARkStorm 2.0 results are shared with Cal OES, which coordinates with county-level emergency response services. DWR’s tabletop exercises and emergency planning activities, conducted jointly with the Cal OES, use updated inundation maps to focus on strategies for moving people out of harm’s way in a progressing extreme event. The maps also have potential applications for identifying where Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps need to be updated and where advanced warning systems should be installed.

The statewide nature of ARkStorm 2.0 is particularly valuable as it brings together partners across the entire state and improves

coordination among agencies to strengthen overall flood management capabilities.

Section 2.1.1.2 Forecast-Informed Reservoir Operations

The Commission received presentations on advanced weather forecasting and reservoir management technologies, focusing on atmospheric river research and its use in FIRO during Commission meetings 15 and 20. FIRO is a reservoir operation strategy that integrates enhanced monitoring and improved weather forecasts to better inform decisions about retaining or releasing water, enabling additional operational flexibility. These presentations highlighted FIRO's use of improved weather prediction capabilities to enhance flood safety, while potentially also increasing water storage capacity through more precise operational decision-making.

Introduction to the FIRO Study Process

In November 2023 (Meeting 15), Dr. Marty Ralph, Director of Scripps Center for Western Weather and Water Extremes, provided foundational information on atmospheric rivers and FIRO viability assessments and how they relate to the Oroville Water Control Manual (WCM) updates.

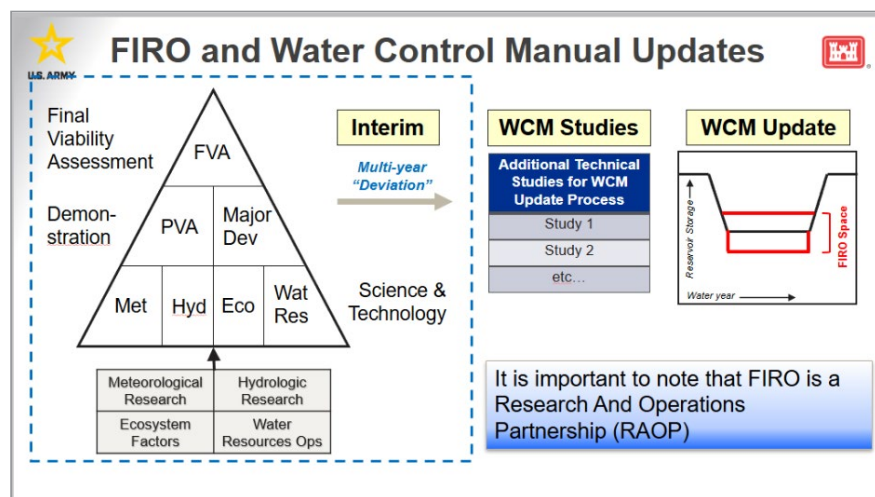
Dr. Ralph explained that California experiences the nation's greatest annual precipitation variability, largely driven by atmospheric rivers that can result in either droughts or floods. He explained that FIRO is a research and operations partnership between USACE, Scripps, DWR, and local water agencies. A FIRO viability assessment is a research process that evaluates whether the streamflow forecast skill in a region is adequate for use at specific reservoirs to achieve desired outcomes for flood risk management, water availability enhancement, and environmental goals. Viability assessments are underway for numerous dams in California, including for the Yuba-Feather System.

The research team starts the process focused on gathering all relevant meteorological research, hydrologic research, ecosystem factors, and water resource engineering. Together, these inform a demonstration of the FIRO theory for the dam through a Preliminary Viability Assessment. If merited, the team makes a request to USACE for a "major deviation" or "minor deviation" to test the ideas outlined in the Preliminary Viability Assessment. This then leads to a Final Viability Assessment, which documents lessons learned. Dr. Ralph noted that if the Final Viability Assessment demonstrates effectiveness of the FIRO approach, a multi-year deviation from standard operating procedures can be proposed (referred to as "interim" operations). He stated that such interim deviations are currently in place at Lake Mendocino and Prado Dam, but not yet in the Yuba-Feather system.

In a subsequent June 2025 presentation (Meeting 20), Dr. Ralph described the relationship between the FIRO viability assessment and WCM updates, emphasizing that these are two distinct processes (see Figure 11). He emphasized that the Final Viability Assessment, overseen by an interagency steering committee, is a research pilot project documented in a comprehensive report with conclusions about whether forecast skill is adequate for FIRO use at specific dams. It is not a decisional document. The update to USACE's WCM can be informed by the Final Viability Assessment but is not bound by it.

A WCM update, conducted by USACE, pursues a broader array of analysis needed for specific manual updates, though it ideally considers the FIRO concept in its calculations and evaluations. For example, Dr. Ralph shared that the Final Viability Assessment only analyzes extreme events; the WCM update would include a more robust period of record analysis.

Figure 11. FIRO and Water Control Manual Update process diagram showing the FIRO viability assessment framework, interim study pathway, and FIRO space allocation within reservoir storage.



Atmospheric River Type Storms are Key for FIRO

In his November 2023 Commission presentation (Meeting 15), Dr. Ralph described meteorology as the key determinant of whether FIRO is viable. He cited a 2019 publication by Corringham and colleagues showing that the vast majority of flood damages in the West are caused by atmospheric river storms, with nearly 100% of flood damages in Northern California resulting from atmospheric rivers. The key is being able to predict atmospheric rivers well enough to be able to anticipate when and how much water to release from a dam ahead of a storm. Dr. Ralph shared several improvements that have increased the average ability to identify an atmospheric river prior to landfall to five days and increased the

accuracy of the forecasted atmospheric river precipitation location and intensity. These improvements include:

- Through a partnership with the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Air Force, Atmospheric River Reconnaissance flights use the nation's hurricane hunter aircraft during winter months over the Pacific Ocean to collect measurements of the atmospheric rivers (e.g., temperature, pressure, wind, and moisture), while also measuring ocean surface and subsurface conditions that influence storm development. These measurements are then provided as inputs to the forecast models that predict the landfall timing and intensity of the atmospheric river, improving outcomes from the model by 10%, the equivalent of approximately 10 years of normal forecast improvement in a single storm event (see Figure 12).
- DWR and Scripps have also developed an atmospheric river scale showing when atmospheric rivers will be strongest and have the greatest impact, as well as a new weather model called WEST-WRF (see Figure 14).
- New forecast tools from Scripps show atmospheric river forecasts for specific coastal locations and indicate whether all forecast models agree that an atmospheric river will hit that location. These tools have quantified the ability to detect atmospheric rivers five to seven days in advance, and while not perfect in predicting exact landfall locations, the forecasts are adequate to determine whether a storm could potentially hit nearby, which is adequate for use of FIRO (see Figure 13).
- Dr. Ralph also noted they are using artificial intelligence and machine learning to enhance forecasting capabilities.

Figure 12. ECMWF EPS 15-day IVT probability forecast (00Z January 3, 2023) showing elevated atmospheric river probability along the California coast, with corresponding geographic projection of the forecast corridor.

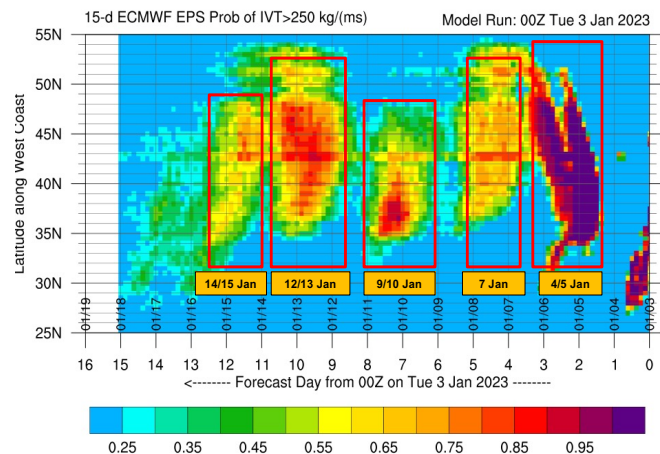
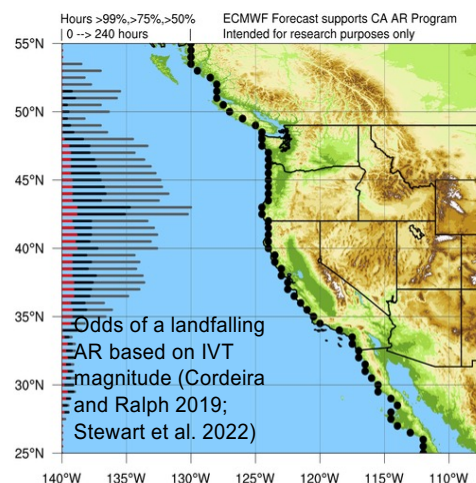
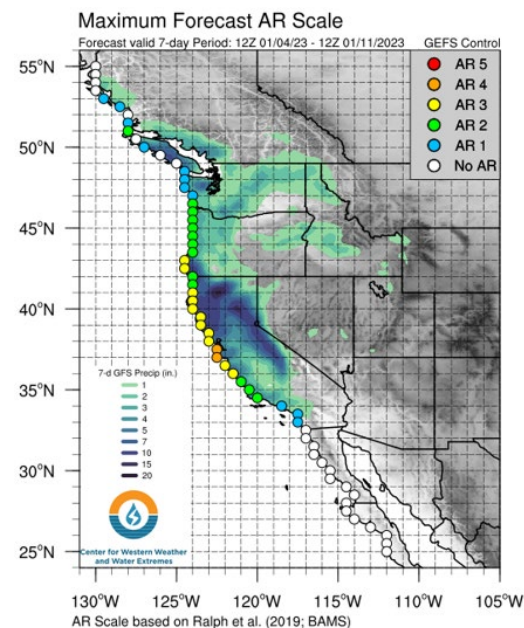


Figure 13. ECMWF EPS probability of an atmospheric river landfall along the California coast. Example for January 3, 2023.



Dr. Ralph then shared how forecast lead times are relevant for FIRO in the Yuba-Feather watersheds. Technical studies of Oroville Dam show that if Oroville storage is kept higher for potential future additional summer releases, it would take four days to release that storage before a storm, with an additional 24-48 hours for that water to pass major downstream control points. A reliable and accurate five-day forecast capability provides sufficient lead time for these operations.

Figure 14. GEFS Control maximum forecast atmospheric river scale for the 7-day period from 12Z January 4 to 12Z January 11, 2023, showing AR categories 1 through 5 along the West Coast and associated 7-day accumulated precipitation forecast. AR Scale based on Ralph et al. (2019, BAMS); produced by the Center for Western Weather and Water Extremes.



Key Findings from the Yuba-Feather FIRO Final Viability Assessment

In June 2025 (Meeting 20), Dr. Ralph presented findings from the recently completed FIRO viability assessment for the Yuba-Feather River system. He explained that a primary Yuba-Feather viability assessment goal was to test the possibility of reducing flood risk, particularly given major flooding events that have occurred in the region. Dr. Ralph presented several conclusions from the study:

- FIRO is viable at both Oroville and New Bullards Bar, and operating the two reservoirs together provides a combination of 90,000 acre-feet of additional FIRO space at New Bullards Bar and 170,000 acre-feet at Oroville, totaling 260,000 acre-feet of additional capacity for flood risk management.
- The strategy produces reductions in downstream flood flows and peak reservoir elevations across all scale factors. These result from using forecasts to access FIRO space that extends into the water conservation pool and the presence of the planned atmospheric river control spillway at New Bullards Bar. Dr. Ralph noted that even without the new spillway, there were benefits.

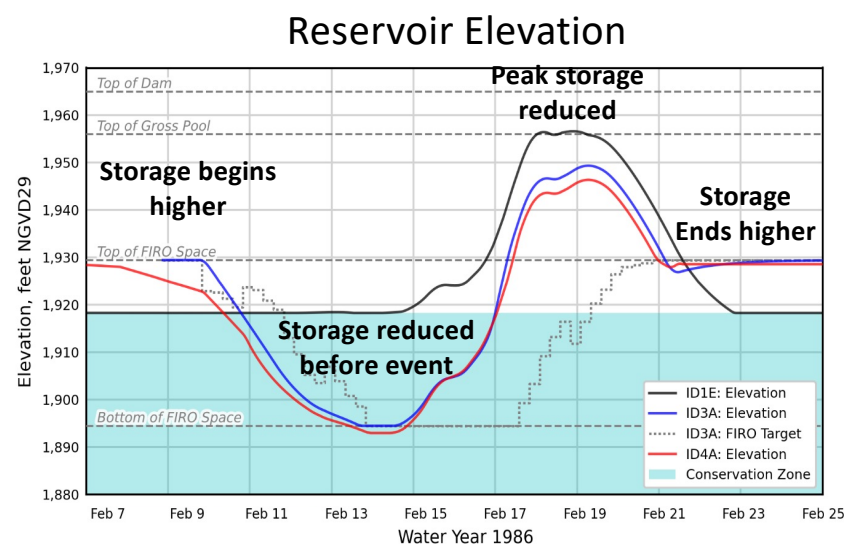
Dr. Ralph emphasized the main recommendation that forecasts be incorporated into WCM updates. He stated that the viability assessment demonstrated that atmospheric river forecast accuracy is now sufficient to enable the FIRO operational approach at both New Bullards Bar and Oroville. The assessment tested FIRO at both reservoirs using major historical storms with different technical options for FIRO operations.

Dr. Ralph walked through analysis of how New Bullards Bar could have been operated during the 1986 storm using FIRO (see Figure 15); they saw similar results in their analysis of storm scenarios at Oroville. He explained that the event was scaled up by 16% to

represent the risk of larger storms. The analysis covered approximately 18 days (x-axis), examining hypothetical operations and the impact on reservoir elevations (y-axis). The black curve represents traditional operations at the dam, which had a lower starting water elevation level but a higher peak elevation during the storm.

The two FIRO scenarios (in red and blue) began with water levels at the top of the FIRO space. When forecasts predicted the storm, both FIRO scenarios dropped water levels to the bottom of the FIRO space. As the storm hit, water levels under both FIRO scenarios rose but were well below the top of the dam and the

Figure 15. Simulated reservoir elevation at New Bullards Bar Dam during a hypothetical scenario applying 116% scaling of the 1986 Flood Event, showing modeled outcomes under operational scenarios ID1E, ID3A, and ID4A relative to key reference elevations including Top of Dam, Top of Gross Pool, Top and Bottom of FIRO Space, and the Conservation Zone. ID3A FIRO Target shown as dashed line for reference



traditional operations scenario, showing substantial extra capacity. After the storm ended, water was released down to the top of the FIRO pool.

Dr. Ralph emphasized that an important operational advantage of FIRO is that increased releases before storm events, although still relatively low, allow for lower peak releases during the storm itself because operators use a longer time period to release the water that the storm will produce. Additionally, FIRO enables faster reductions of high releases after the storm, meaning that levees experience less time exposed to high levels of water.

Section 2.1.1.3 Inflow Forecasting for California Reservoirs

At the June 2025 Commission meeting (Meeting 20), Bibek Joshi, an engineer for DWR, presented an overview of river and reservoir inflow forecasting in California, explaining the processes behind forecast products from the California Nevada River Forecast Center (CNRFC). Mr. Joshi first covered the different forecasting products and then addressed more technical aspects of snow melt modeling and rain-on-snow events.

Mr. Joshi explained that river and reservoir forecasting in California operates through a joint state-federal partnership. On the federal side, the CNRFC operates as part of the National Weather Service under NOAA. On the state side, DWR conducts river forecasting through its Division of Flood Operations.

CNRFC is one of 13 River Forecast Centers in the country, covering a modeling domain of 245,000 square miles that includes California, most of Nevada, and the lower portion of Oregon. Mr. Joshi explained that CNRFC provides both short-range flood forecasting and long-range water supply forecasting. Within this extensive domain, the CNRFC models 350 basins, maintains 102 official

forecast points with flood and monitor stages, forecasts 102 reservoir inflows daily, and monitors 173 additional unofficial forecast points requested by interested parties for purposes such as levee monitoring during high water events or environmental flow monitoring.

Mr. Joshi explained that river forecasting is a year-round operation with at least one forecast issued daily. During summer operations from mid-April to October, one forecast is issued by 9 a.m. During winter operations from November 1st to mid-April, two forecasts are issued on weekdays at 9 a.m. and 3 p.m., plus one weekend forecast. When atmospheric events or extreme precipitation occur during winter, operations switch to flood mode. During flood mode operations, the forecast frequency increases based on watershed response, with an evening forecast added at 9 p.m. During extreme events, CNRFC operates 24 hours and issues additional forecasts at midnight or 3 a.m., with forecasters continuously monitoring hydrologic and meteorological conditions and updating forecasts as necessary.

Forecasting Models

Mr. Joshi outlined the two major models used by CNRFC that were developed by the National Weather Service specifically for river forecasting. Snow-17 is the snow accumulation and melt model that simulates snowpack evolution and estimates the timing and magnitude of snowmelt runoff, including rain-on-snow events. The Sacramento Soil Moisture Accounting model is the hydrologic precipitation runoff model that estimates how precipitation transforms into runoff while considering soil moisture, evapotranspiration, and subsurface water movement. Supporting these primary models are additional tools, including a rain-snow elevation analysis that determines whether precipitation falls as rain

or snow, a routing module that transforms the rain and melt output into downstream hydrographs, and a reservoir model that accounts for reservoir regulation and downstream releases in California's predominantly regulated watersheds.

Mr. Joshi described the Snow-17 Model, which computes how snow melt evolves during winter and spring seasons, tracking snowpack accumulation during the fall to early spring months and snow melt during the late spring and early summer months. While actual physical processes involve radiation transfers between surfaces, humidity, wind, vegetation cover, and interaction between snow and the underlying soil, Snow-17 includes all these processes but simplifies them for easier computation. Mr. Joshi explained that the inputs to the Snow-17 model are air temperature, precipitation, and freezing level. This observed data requires an extensive collection network: CNRFC forecasters monitor over 1,200 rain gauges, more than 600 air temperature sensors, over 500 river gauges, more than 120 reservoir stage and release measurements, and freezing level data. Snow-17's primary output is rain plus melt, representing the total amount of precipitation and snow melt excess on the soil surface, which is then input into a different routing model to create a hydrograph for downstream routing. Other outputs include water equivalent, snow depth, and simulation of snow cover within the watershed.

Mr. Joshi described the Snow-17 rain-on-snow mode and non-rain melt mode of the model. The non-rain melt mode simulates sunny day snowmelt without rain. Snow-17 differentiates between these two modes based on precipitation. When precipitation exceeds 1.5 inches in the next six hours, the model switches to rain-on-snow mode, which is a complicated process that must consider warm rain falling on snow, humid conditions that enhance melt, overcast conditions and associated long-wave radiation changes, and wind effects that speed up that process.

One major advantage of Snow-17 is its interactive nature, allowing forecasters to adjust different parameters so the simulation stays close to field data from snow pillows and snow courses. Forecasters adjust the parameters on a monthly basis during the winter. This ease of adjustment is a significant advantage over other models.

Forecasting Products

Mr. Joshi described two major output types from the forecasting system: deterministic and ensemble or probabilistic forecasts. Deterministic forecasts provide a single best estimate prediction representing the most likely outcome based on one weather forecast, one model run, and one set of initial conditions. Mr. Joshi explained that, for example, a deterministic forecast might predict the Cosumnes River at Michigan Bar will reach 12.1 feet at a particular time or specify a total reservoir inflow volume over the next five days.

In contrast, ensemble or probabilistic forecasts provide a range of possible outcomes with associated probabilities for each. Currently, all uncertainty in the CNRFC model derives from meteorological conditions, resulting in 44 different model runs that capture the range of possibilities. Using the same Michigan Bar example, Mr. Joshi explained that an ensemble forecast might indicate a 95% chance of exceeding 7 feet, or a 50% chance of exceeding 12 feet, allowing emergency personnel to make risk-informed decisions about resource deployment based on specific threshold probabilities.

Section 2.1.2 Water Control Manual Process (Meetings 15, 17, 18, 19, 21)

Starting in November 2023, the Commission received regular briefings on the lengthy process of updating the WCMs for Oroville

and New Bullards Bar Dams. These presentations covered the technical requirements and public engagement opportunities, with an emphasis on maintaining flood safety as the top priority while incorporating new scientific advances such as FIRO. Commissioners also provided presentations sharing community priorities for the WCM updates.

Section 2.1.2.1 Water Control Manual 101

In March 2025 (Meeting 19), Jennifer Fromm, the USACE Sacramento District's Chief of Water Management, provided commissioners a foundational introduction to WCM's required content and USACE authority. Section 7 of the Flood Control Act of 1944 grants USACE flood release management authority over dams that have received federal investment, such as Oroville and New Bullards Bar. Therefore, while the SWP is responsible for real-time operations as the project owner for Oroville, SWP is bound by USACE's prescriptions with respect to water that encroaches into the dam's flood control space, a buffer space reserved to temporarily hold excessive storm flows so that they can be released more gradually than in a free-flowing river and thereby provide flood protection.

In its WCMs, the USACE provides instruction on how the dam owner should operate the flood control space for flood safety. A central component is the water control diagram or "rule curve," a graphical representation of the flood control space and release requirements, based on the time of year and state of the watershed.

The Oroville WCM establishes a maximum flood control space of 750,000 acre-feet with a "wetness parameter" that adjusts the size of that space based on watershed saturation and anticipated runoff. It also provides a release schedule, instructing the dam operator on how quickly to release water encroached into the flood control

space and maximum flows for different points downstream that should not be exceeded. The existing Oroville WCM sets release limits at 180,000 cubic feet per second (cfs) above the Yuba River and 320,000 cfs for coordinated releases with Yuba Water Agency below the Bear River.

Ms. Fromm walked through a simplified WCM update process, describing each step and the general time frame, which generally takes about five years in total.

- Project Management Plan, in which the USACE establishes schedule, roles, and responsibilities for the update [Year 1]
- Public/Interested party outreach, including interested party workshops [Years 1-4]
- Hydrology analysis includes flow frequency analysis and creation of hypothetical data sets, including synthetic events and hindcasts [Years 1-2]
- Existing conditions analysis includes modeling of baseline/historical reservoir operations and establishing baseline environmental conditions [Years 1-3]
- Project alternatives identification involves modeling various reservoir operations alternatives and evaluating the results on the reservoir and downstream conditions [Years 2-4]
- Environmental effects analysis then models the environmental effects of the reservoir operations alternatives under consideration [Years 2-4]
- Reviews and documentation steps include the engineering report, National Environmental Policy Act (NEPA) documents, Agency Technical Review Report, Independent External Peer Review Report, and ultimately, the WCM itself [Years 2-5]
- Final review and approval at the division level for policy and legal compliance and ultimately, approval by the Division Commander ends the process [Year 5]

Section 2.1.2.2 Ongoing Oroville Water Control Manual Update Process

In November 2023 (Meeting 15), Jennifer Fromm presented the WCM update process for New Bullards Bar and Oroville Dams, which was initiated by USACE in 2022 and is anticipated to take four to five years to complete. She explained that the public NEPA process, which had not started, would provide multiple opportunities for community engagement. Oroville Dam's WCM was last updated in 1970, predating modern hydrologic data and advanced technology. The final WCMs will be signed by the USACE South Pacific Division Commander.

Combined system operations at Oroville and New Bullards Bar are required since both locations share a control point at the confluence of the Yuba and Feather Rivers, necessitating simultaneous updates. Ms. Fromm shared the key safety objectives against which USACE is evaluating alternatives:

- In the section of the Feather River directly below Oroville Dam and down to the Yuba-Feather Confluence, the USACE wants coordinated operations to minimize exceedance of 180,000 cfs in the Feather River upstream of Yuba River, without necessity of Marysville Dam-Lake, without necessity for Lake Oroville emergency spillway use, and without exceeding 150,000 cfs released from Lake Oroville.
- In the section of the Feather River from the confluence with the Yuba River to the confluence with the Bear River, the USACE wants coordinated operations to minimize exceedance of 300,000 cfs in the Feather River below the Yuba River, 320,000 cfs in the Feather River below the Bear River, and without necessity for Marysville Dam-Lake.
- The USACE wants to ensure the passage of the Probable Maximum Flood with a minimum of two feet of freeboard (i.e.,

the vertical safety buffer between the maximum water surface elevation [including waves] and the top of the dam crest) at New Bullards Bar and three feet of freeboard at Oroville.

The first two objectives will focus on evaluation of and potential revisions to the water control diagram, and the last will focus on the emergency spillway release diagram.

The coordination between these WCM updates and the Yuba-Feather FIRO viability assessment process represents the first instance where these processes are proceeding in parallel. Teams developed common task lists while maintaining independent progress and created working groups covering communications, forecast verification, meteorology, hydrology, and economic benefits.

Commissioners at the meeting requested a clear process for community input and emphasized community safety as their priority. Ms. Fromm confirmed that public engagement occurs during the NEPA process, noting that workshops had already been conducted with local flood control districts.

In August 2024 (Meeting 17), DWR relayed that the USACE was planning a pre-NEPA public meeting to provide an opportunity for members of the public to learn about the Oroville Dam WCM update process. DWR Director Karla Nemeth explained that the USACE is responsible for the WCM's public input process (as described in federal statute), so while the Commission will serve as a public forum for updates on the USACE process, it is not the formal venue in which the USACE will receive feedback from the public.

Ms. Fromm provided another WCM update process update in December 2024 (Meeting 18). She reminded the commissioners that WCM objectives include operating for authorized purposes, maintaining structural integrity, and ensuring public safety.

The comprehensive updates under consideration by the USACE will apply to both Oroville and New Bullards Bar and include revisions to the water control plan itself. She also reminded participants that the FIRO pilot program, which aims to demonstrate how enhanced monitoring and forecasting can improve flood risk management and increase water conservation, is running in parallel to the WCM updates and may inform manual content.

Ms. Fromm presented an updated timeline for public input, with public scoping beginning in Spring 2025 and draft WCM and NEPA documents available for review in December 2025, although this was ultimately delayed.

Also at the December 2024 meeting, Commissioner Bateman and Matt Mentink, a member of the former Oroville Dam Comprehensive Needs Assessment Public Ad Hoc Group, presented on behalf of the Feather River Recovery Alliance, emphasizing their concerns with the current WCM's approach to public safety. In their presentation, the Feather River Recovery Alliance representatives emphasized the need for the WCM to prioritize public safety over water delivery and shared their belief that the current WCM failed downstream communities in the past in part because it was designed primarily for water delivery. They voiced concerns about the way the WCM considers snow storage and potential melt in its sizing of the flood pool and asked that downstream levee re-evaluation be part of the WCM revisions, given concerns about the integrity of the Oroville levee (see [Section 3.1.2](#)).

Ms. Fromm again represented the USACE on the WCM update at the Commission in October 2025 (Meeting 21). She explained that the process was preparing to enter the NEPA phase. She was seeking input from commissioners on potential locations for public

meetings, ideally centralized in the Marysville area for accessibility. The USACE's goal is to have draft NEPA documents and WCM formats for both projects completed by mid-2027.

At the same meeting, Supervisor Bill Connelly presented a downstream perspective to inform the WCM update process. He described his understanding that the community of Oroville was promised that the dam would provide 500-year flood protection, but that the current WCM creates conditions that fall short of even 200-year protection. Supervisor Connelly described how climate change is increasing the frequency and intensity of atmospheric river storms, and that current forecasts remain imperfect despite improvements over the years. He referenced citizen Matt Mentink's analysis of maximum reservoir elevations needed to provide 500-year flood protection. Given the relative newness of FIRO, he urged that conservative margins be used in flood control regulations to prioritize public safety, highlighting the significant local costs of evacuations. He emphasized the importance of robust flood protection even in the face of competing political pressures for increased water storage.

Section 2.2 Oroville Facilities Infrastructure Planning

As described in Section 1.2.2, DWR's Dam Safety Services Manager, David Sarkisian, provides an annual update to the Commission on key dam safety projects and supporting studies and analyses. Section 1.2.2 detailed Mr. Sarkisian's reports on progress-to-date at the July 2023, March and August 2024, and October 2025 meetings (Meetings 13, 16, 17, and 21). This section focuses on the aspects of those updates related to future studies and planned project implementation.

Section 2.2.1 Studies and Analyses (Meeting 21)

As outlined in the Dam Safety Risk Process (see [Section 1.2.2](#)), DWR advances studies to inform important questions about whether potential dam safety risks are high enough to justify investing in risk reduction actions. The following section describes upcoming studies and analyses Mr. Sarkisian highlighted as important to answering the dam safety risk questions that DWR has identified.

Radial Gate Reliability Study

While DWR has not found any significant anomalies in the inspections described in Section 1.2.2 and is confident that the number of anchor rods provides significant redundancy, DWR recognizes that the gate structure and operating equipment does have a service life. DWR will thus be evaluating the need to maintain or replace components critical to gate operations. This study will also inform another risk analysis that considers the likelihood of the radial gates operating “on demand” as needed. As of October 2025 (Meeting 21), Mr. Sarkisian anticipated that this study would be completed in December of that year.

Oroville Dam Seismic Stability/Deformation Analysis

Mr. Sarkisian explained that this seismic stability and deformation study is intended to improve risk assessments related to dam performance under a wide range of earthquake loading and reservoir conditions. The work plan is finalized, and the study is anticipated to be completed in 2026.

Oroville Dam Stochastic Flood Event Analysis

This analysis uses computer simulation of flood modeling to consider hydro-meteorological and watershed input parameters as variables rather than fixed values. This study fulfills a past FERC Part

12D Independent Consultant Board recommendation and will help inform and improve future risk analyses, including analysis of whether to raise Parish Camp Saddle Dam to reduce the potential for future overtopping during extreme flood events. Mr. Sarkisian anticipated completion in 2026.

Emergency Spillway Erodibility Study Next Steps

Mr. Sarkisian reported in October 2025 (Meeting 21) on completion of the Emergency Spillway Erodibility Study. He explained that in July of that year DWR submitted the study to FERC and DSOD along with an Issue Evaluation Study that identified the “feeder” studies and team needed to conduct a quantitative risk analysis on the topic of emergency spillway erodibility and the potential for head-cutting to the monoliths. Once the Oroville Dam Stochastic Flood Event Analysis and Radial Gate Reliability Study (see description above) are completed, DWR plans to schedule quantitative risk analysis workshops for summer or fall 2026 and to produce an Issue Evaluation Study Report within the following six months. This approach follows FERC’s Risk Informed Decision-Making guidelines and processes adopted by the SWP Dam Safety Program to reach decisions for significant dam safety actions/projects. Ultimately, DWR’s goal will be to reach consensus with FERC and DSOD on the emergency spillway’s performance and the need for any action/improvements for dam safety.

Monolith 25 and 26 Seismic Retrofit Alternatives Analysis

Mr. Sarkisian has planned more quantitative risk workshops for 2027 to determine whether retrofitting the existing flood control outlet monoliths is sufficient or whether a new headworks structure might be needed. Following those workshops, he explained, DWR will determine which of two potential paths is appropriate: if risk

reduction measures are feasible and sufficient, DWR will initiate retrofit design and permitting for the monoliths. If retrofits are not feasible or do not provide sufficient risk reduction, DWR will consider a new flood control outlet headworks structure. The current modeling results show good performance under seismic loading, so DWR currently considers the first path of retrofits more likely. DWR has included the design and construction phases for seismic retrofits to the monoliths in the SWP Dam Safety Program's 10-year planning and budgeting.

Section 2.2.2 Project Implementation (Meeting 21)

In October 2025 (Meeting 21), Mr. Sarkisian highlighted two upcoming projects advancing to implementation in the next three years.

Radial Gate Standby Generator Project

Approved by FERC for implementation, this project was identified in the Comprehensive Needs Assessment (Measure T3-BH.2) and includes installation of a new standby generator and associated equipment for flood control outlet gate operations, including improvements (quick-connects) for use of a temporary portable generator. Construction is anticipated between 2026 and 2028.

Radial Gate Seismic Retrofits

DWR is advancing a number of retrofits to the radial gates into the design and construction phase, which are intended to address maintenance recommendations from their inspections. DWR will strengthen select gate components (e.g., skinplate, vertical ribs, upper horizontal girder), repair coatings, and inspect trunnion pins. Design will take place between 2025 and 2028, and construction across all eight gates is anticipated to take nine years, through 2037, although scheduling will be highly dependent on water levels and other flood control outlet activities that may be needed.

Section 3. Overview of Flood Management Projects along the Feather River

During this three-year period, in addition to presentations on the dam's infrastructure and operations discussed in report Sections 1 and 2, the Commission also heard presentations focused on flood management topics downstream along the Feather River. These included flood management planning activities such as updates to inundation maps and assessment of the City of Oroville's levee, as well as reports on flood emergency response and coordination activities at the state and local levels.



View of Oroville Dam main spillway during active water release.

Section 3.1 Downstream Flood Preparedness

Section 3.1.1 Inundation Maps (Meeting 12, 14, 17)

In October 2022 (Meeting 12), Michael Bessette, the executive director of the Sutter Butte Flood Control Agency (SBFCA), provided a presentation on his agency's work, in which he discussed how challenging it can be for a downstream interested party to understand available inundation maps.

Mr. Bessette explained that multiple map products (e.g., SB 92 Dam Inundation maps, FEMA floodplain maps, SB 5 DWR 200-Year Floodplain Maps, DWR Best Available Maps) serve different purposes. Each map has its own assumptions, which can make them difficult to interpret. In addition, some standard assumptions do not reflect on-the-ground flooding scenarios very well. For example, many models examine the consequences of levees overtopping without failure, but levees are subject to failure, so this should be considered when performing a hydraulic model. Similarly, many maps reflect "sunny day" scenarios, in which there is no rainfall or other factors bringing additional water into the system or complicating drainage issues.

Ted Craddock, Deputy Director of the SWP at DWR at the time, confirmed that Oroville Dam safety modeling has been done for failure of the structure during sunny day events. He noted that DWR would be interested in considering how those analyses could reflect a greater suite of assumptions; this was an opportunity for DWR to collaborate with SBFCA and other partners in the area.

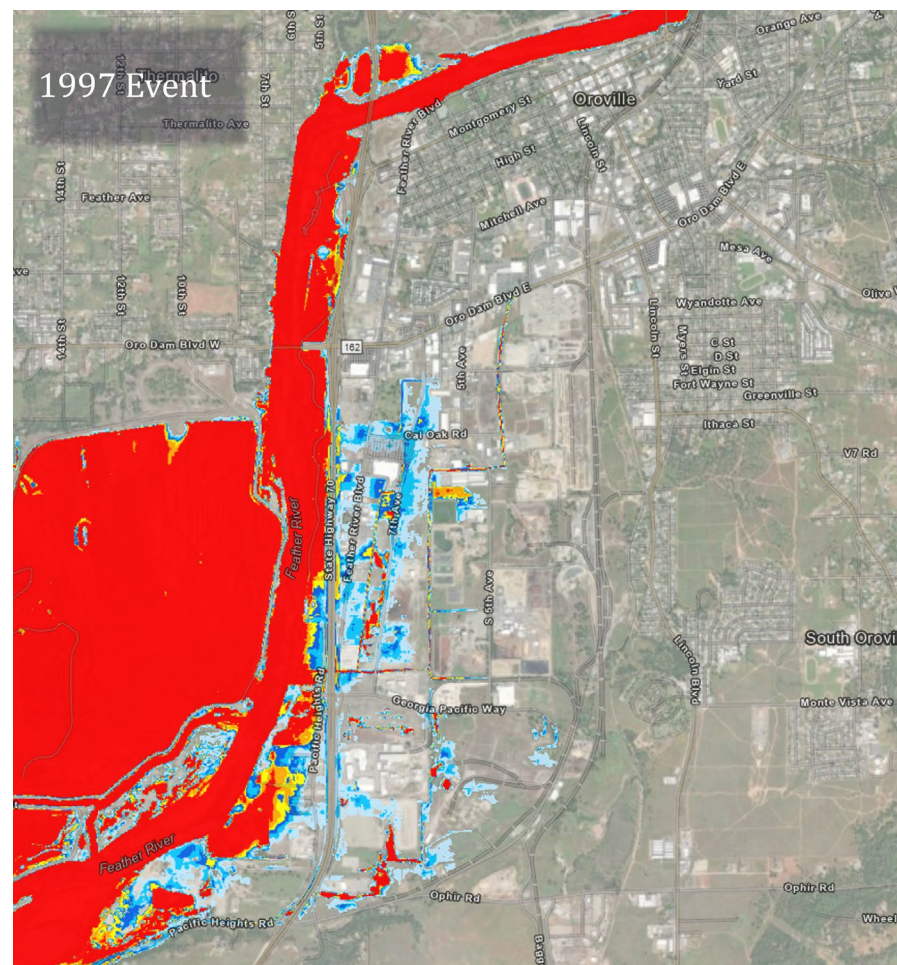
Director Karla Nemeth of DWR shared that legislation sponsored by Senator Nielsen and Assembly Member Gallagher that passed in 2017 and 2018 catalyzed DWR and other dam owners and flood managers to work together directly to update inundation maps. Director Nemeth said that there are annual meetings between these entities, the most recent with Butte and Sutter counties having just occurred earlier that month. At that meeting, staff identified state and local agency coordination as an area of necessary improvement in light of the 2017 Oroville Dam emergency, and Director Nemeth anticipated future conversations on the topic.

In July 2023 (Meeting 14), Mike Mierzwa, State Floodplain Manager, DWR Division of Flood Management, and Mr. Bessette briefed commissioners about the follow-up meeting including SBFCA staff, DWR staff, and several commissioners on inundation mapping and modeling that had occurred in May. Mr. Mierzwa explained that after 2017, new legislation (SB 92, 2017) imposed specific requirements for inundation map creation for dam owners. The SWP has produced maps to meet the requirements of this legislation for the Oroville-Thermalito Complex. They have been approved by the DSOD and are available online.

However, Mr. Mierzwa stressed that the maps required by SB 92 – focused on flooding scenarios associated with the dam – will not answer all the questions about flooding that interested parties might have, and for those questions, there are other kinds of maps. Mr. Mierzwa explained different inundation maps may be designed for land use planning, flood defense system designs, emergency response, and flood recovery.

Mr. Bessette explained that given public dissatisfaction with the existing inundation maps, SBFCA is starting the process of updating them, which is funded by a grant from DWR. As requested, the agency is focusing on high-flow releases from Oroville Dam; it will be evaluating floods of 100,000 cfs to 350,000 cfs and also plans to

Figure 16. Flood inundation map of the 1997 Feather River flood event in the Oroville and Thermalito area, showing the spatial extent and relative depth or velocity of flooding along the Feather River corridor west of State Highway 70.



model the 1997 flood at 161,000 cfs (see Figure 16). The update will also compare research and personal recollections of that flooding event to create an accurate inundation map for such a scenario.

In August 2024 (Meeting 17), Chris Fritz of the SBFCA provided an overview of the results of the City of Oroville inundation mapping effort. The study primarily examined potential flood risk to the south Oroville industrial area, south and east of the river, and included both river channel modeling and interior drainage analyses. He presented visuals that showed the area topography to help attendees understand the flow of water from the foothills through the urban area and then into the river. The interior drainage system uses gravity and is composed of storm drains, culverts, and open ditches. Several key learnings included:

- As Feather River levels rise during times of high releases from Oroville Dam, water will impound against the highway and back up into the interior drainage system. If this occurrence coincides with a precipitation event, there may be insufficient space to contain all the water, and flooding may occur.
- Flooding also occurs from seepage of water through or under Highway 70. There is inundation potential due to seepage under the Highway 70 embankment when river flows exceed 130,000 cfs.
- When Feather River flows are greater than 60,000 cfs, the river starts to backflow through the Highway 70 box culverts into the gravity ditch system, which may impact properties near Highway 70.

Mr. Fritz shared modeled maps that depicted the 1997 flooding event, as well as a hypothetical event where 200,000 cfs is being released from Oroville Dam and combines with a major rainfall event. Large areas of the maps showed inundation that exceeds five feet of water.

Mr. Fritz provided four key recommendations that resulted from the mapping study:

1. Develop a master drainage study and master drainage plan to alleviate potential flood risk.
2. Conduct further hydrogeologic analysis to better understand the linkage for the seepage-induced flooding.
3. Coordinate high-flow releases with forecasted rainfall events. Potentially incorporate related knowledge of rainfall events and water movement into the WCM update.
4. Utilize and share this knowledge and information with emergency response providers to assist them with planning for potential emergency evacuation; e.g., reroute evacuees away from Highway 70 in the case that it becomes unsafe due to flooding.

Section 3.1.2 City of Oroville Levee (Meetings 12, 19)

Concerns over the City of Oroville levee were first raised by the City's then Mayor Chuck Reynolds in October 2022 (Meeting 12). At that time, he explained that the City was unsure about who owned the levee but was interested in assuming maintenance responsibilities to manage trash and contamination issues associated with illegal campers. City officials and local Commission members continued to voice their interest in better understanding the levee's long-term integrity at meetings. State and SBFCA staff began to coordinate with them outside of meetings, during which time the City's existing ownership of the levee was confirmed and the State recommended the City's levee to the USACE as a candidate for the National Levee Safety Program.

In March 2025 (Meeting 19), Michael Bessette from SBFCA presented on the City of Oroville levee, recent activities, and next steps to the Commission with support from Brian Ring, the Oroville City Administrator, and additional context from Oroville's Mayor

David Pittman. Mayor Pittman described the levee as built in 1913 with a four-inch concrete slab, which has since deteriorated due to flooding. Mr. Bessette explained that the levee, approximately 1.1 miles long, lies largely on City-owned land but also runs over some County and privately owned land, which may have caused some of the initial confusion. Mr. Bessette emphasized that the City is responsible for the levee; it is not part of the State Plan of Flood Control or the USACE program, making it an isolated concern within the broader flood management system.

The City of Oroville levee has a history of seepage and boils, especially during high water events. The levee's integrity is of particular concern for the following reasons:

- Public safety due to flooding in areas of Oroville could be compromised, especially given the proximity of Highway 70.
- It could exacerbate the city's already identified interior drainage problems, which increase flooding risks when the river's water level rises and impacts the drainage system. The City is working on an interior drainage study and seeking grant funding for improvements.
- Some of the city's critical infrastructure, like fiber optic cables, runs through the levee.
- FEMA's Flood Insurance Rate Map, which shows areas at risk of inundation during an event exceeding a 100-year return period, will eventually be updated and recent modeling indicates that the physical extent of the floodplain may increase. Properties within the newly designated floodplain would be required to have flood insurance, and any new development would need to be built above the base flood elevation (which is the elevation associated with the 100-year event return period).

Mr. Bessette described efforts over the past two years to address the levee's integrity issues, which have included:

- Identifying local funding sources for advancing improvements, considering cost-share arrangements, and coordinating with DWR for potential funding.
- Identifying a City lead representative, such as an appointed staff member, to work with private consultants or enter a services agreement with entities with expertise in levee improvements (e.g., SBFCA).
- Reviewing recommendations in the 2015 HDR Engineering study, which has been shared with the USACE to inform their upcoming levee inspection.

Mr. Bessette shared that the City of Oroville had been selected to participate in the USACE National Levee Safety Program, in which the USACE conducts a one-time levee safety inspection that helps evaluate a levee's performance under various hydraulic conditions and determines necessary remediation actions. The inspection process, completed in May 2025, included a two-day site review, both physical and in-office, to assess flood loading, hydrology, and the potential consequences of levee breaches or overtopping. The inspection resulted in a report with recommendations and cost estimates, providing essential data to help make informed decisions about improving safety and performance. This report was shared with the City Council at its meeting in February 2026 and is scheduled to be presented to the Commission in April 2026.

In his March 2025 presentation, Mr. Bessette also stated there is a possibility of applying for additional funding through the USACE Section 165 Continuing Authorities Program, which could fund a more comprehensive feasibility study for the levee. However, this depends on the federal budget, and the City will need matching funds.

Erik James, Chief of Levee Safety for the USACE, also contributed to the March 2025 presentation. He explained that the Continuing Authorities Program helps fund feasibility studies and potential construction projects in rural communities and highlighted that USACE can also provide technical assistance through floodplain mapping. Laura Hollander, Deputy Director of Flood Management and Dam Safety at DWR, highlighted the state's active involvement in identifying funding pathways and providing technical assistance and its commitment to continuing to support levee safety efforts.

Section 3.1.3 Downstream Flood Management Projects (Meeting 12)

In his October 2022 presentation (Meeting 12), Michael Bessette, the executive director of SBFCA, described the partnership of DWR, California Department of Fish and Wildlife, and local interested parties on the Flood Stage Reduction and Ecosystem Enhancements project. Located in the Oroville Wildlife Area, this project is a nature-based strategy to reestablish historic floodplains and make the region better prepared for a flood scenario. Mr. Bessette concluded by saying that SBFCA is seeking construction money for the Flood Stage Reduction and Ecosystem Enhancements project and informed the Commission about coordination efforts with staff to secure funds.

Section 3.2 Flood Emergency Response and Coordination

Even as the Commission has prioritized discussions about dam safety risks and mitigation and operational strategies to reduce the impact of storm events on downstream communities, commissioners also recognize the continued importance of

maintaining and improving regional emergency communication, coordination, and response systems. The Commission received updates on emergency response planning at the local and state levels at Meetings 12, 13, 16, and 18.

Section 3.2.1 Evacuation Planning and Communication (Meeting 12)

In his October 2022 presentation (Meeting 12) of SBFCA's work, Michael Bessette discussed lessons learned from the 2017 Spillways Incident with respect to emergency evacuations in the event of floods. He shared that staggering waves of evacuation rather than having everyone leave at once would be safer, allowing those at most imminent risk to get out first. That level of coordination, however, requires advance planning conversations and a detailed understanding of the flood wave time of arrival to properly sequence evacuation zones – and ultimately, clear communication to both emergency responders and the general public. Mr. Bessette stressed the importance of understanding the variability of future scenarios associated with local flooding impacts so that people can be directed to safe evacuation routes within a timely manner.

Section 3.2.2 Local Emergency Response in Butte and Yuba Counties (Meeting 13)

At the February 2023 Commission meeting (Meeting 13), Joshua Jimmerfield, Deputy County Administrative Officer at Butte County Office of Emergency Management (OEM), provided an overview of Butte County's response during emergency events such as the January 2023 storms. He described the locally focused response used by the Butte County OEM, which relies on weather forecasts and outreach to local jurisdictions (Oroville, Chico, etc.) to address impacts such as localized flooding, downed trees, and potential debris flows from recent fires. OEM coordinates with USACE and

BUTTE COUNTY OEM RESPONSE TO JANUARY WINTER STORMS

The County OEM response begins locally and grows based on need, and is influenced by weather forecasts and anticipated impacts.

Public works, law enforcement and fire are the boots on the ground that help identify potential impacts.

As impacts grow, the County initiates an Operational Area Coordination Call that includes:

- Brief outs from the County
- Jurisdictional updates
- State updates
- Reimbursement reminders, and
- Identifying unmet needs to be elevated.

the Flood Operations Center and also works closely with counties downstream of Lake Oroville to gather updates, address concerns, and ensure community safety. Mr. Jimmerfield noted that most monitoring occurs hourly during a big storm event, and that the California Data Exchange Center is a useful resource to get real-time updates on lake levels and downstream river levels.

To mitigate potential local flooding, Mr. Jimmerfield explained that OEM measures include road closures, provision of sandbags to the public, and public service announcements and website updates to keep local community members informed.

As impacts grow, OEM initiates an Operational Area Coordination Call and sends briefs to other agencies and departments as appropriate. These calls and emails provide jurisdictional and state updates while also seeking updates and information on unmet

needs from partners. During the January 2023 storms, although there was not elevated concern about significant water releases from Lake Oroville because of the large amount of storage space left in the reservoir, the Butte County OEM was prepared if anything did occur because of its pre-established lines of communication. Mr. Jimmerfield described how OEM works closely with the sheriff's office to coordinate any potential evacuation notices or warnings downstream.

OEM also relies heavily on the Oroville Dam Emergency Action Plan and its inundation maps for the purpose of evacuations. OEM is looking at other maps that may provide additional relevant information and is working to determine what the impacts of that information might be on evacuation modeling.

Mr. Jimmerfield acknowledged SBFCA's concerns about the Oroville levee (see [Section 3.1.2](#)). He noted that he was in the process of discussing an emergency operations plan for that area with the Oroville City Administrator and SBFCA. This plan will bring awareness to the citizens living in the protection area of the levee and designate an evacuation plan. While there are solutions on the table, he noted that it might take some time to implement them.

Mr. Jimmerfield then presented on behalf of the Yuba County Office of Emergency Services because its representative was unable to attend. Although it is in a different watershed, Yuba County Office of Emergency Services also focuses on strong communication among municipal agencies, reclamation districts, PG&E, and USACE.

The situational reports and briefings conducted by Yuba County also include local agencies outside of the watershed to assess all possible information. During the January 2023 storms, Butte County provided one report per day, and Yuba County provided two reports per day. Both counties have established a "duty officer" who

serves as the person on call during a designated period. Mr. Jimmerfield further reinforced the importance of consistent communication and coordination, assessing internal resources, being proactive before an event happens, and building strong relationships.

Mr. Jimmerfield stressed that it is crucial to ensure that the names and contact information of the appropriate staff are up to date due to high turnover. Lists are updated annually. The County reviews contact lists during the preseason to fill any gaps or to correct information; they also share their contact lists with dam owners so they can update their emergency action plans in turn. The County also proactively reviews annual levee reports from downstream reclamation districts and other partners.

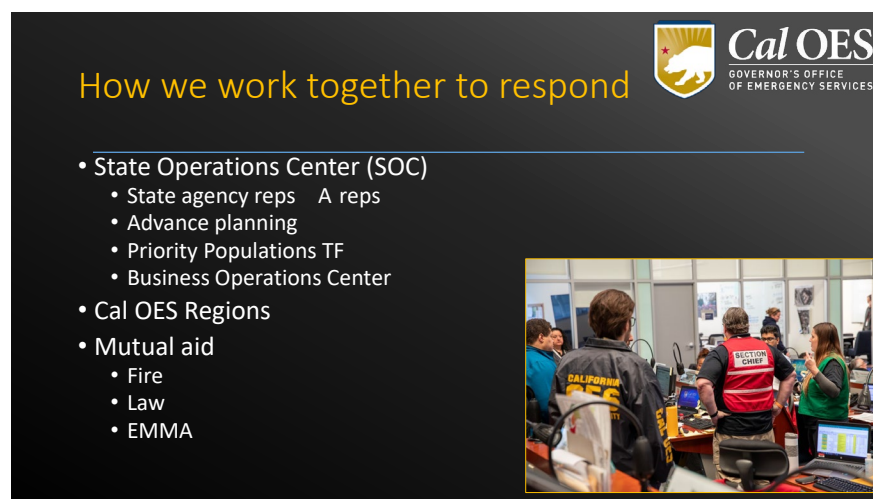
Mr. Jimmerfield recommended that all emergency notification systems provide confirmation that messages were received. Mr. Jimmerfield explained that the Butte County OEM deploys a system called “positive contacts,” which requires getting a response or confirming every mechanism to reach a person is exhausted before contacting the next person on the list.

Section 3.2.3 State Emergency Preparedness Coordination (Meeting 16)

In March 2024 (Meeting 16), Lori Nezhura, Deputy Director at Cal OES, presented on emergency management and coordination in the State of California, specifically State emergency preparedness coordination and use of weather forecasts in emergency response.



Diagram illustrating the five levels of California's Standardized Emergency Management System (SEMS), progressing from Field (Incident Command) through Local Government, Operational Area/County, OES Region, and State. Source: California Governor's Office of Emergency Services (Cal OES).



Overview of California's coordinated emergency response structure, highlighting the roles of the State Operations Center (SOC), Cal OES Regions, and mutual aid partners including fire, law, and Emergency Managers Mutual Aid (EMMA). Source: California Governor's Office of Emergency Services (Cal OES).

She explained that all levels of government, from local to state, use the Standardized Emergency Management System.

This unified framework emphasizes local leadership (“all disasters start and end at the local level”) and ensures coordinated response across all levels. Deputy Director Nezhura explained that a wide array of partners is involved in statewide emergency management, including partners from federal, state, and local governments; special districts; private sector organizations; nongovernmental organizations; community-based organizations; and Tribes. Ms. Nezhura reviewed how Cal OES uses collaboration to prepare for natural disasters statewide.

Cal OES reviews and approves all dam emergency action plans and collaborates with DWR on dam safety. Cal OES also works with counties on emergency operation plans and developing statewide emergency plans. Additionally, Cal OES conducts catastrophic planning for large regional disasters with extensive community partner involvement.

Cal OES offers specialized training for emergency response professionals, law enforcement, firefighters, and volunteers through the California Specialized Training Institute. Cal OES also partners with other agencies to conduct emergency response exercises, including annual notification exercises and local government exercises upon request. Additionally, the office provides technical assistance and training to the more than 450 Community Emergency Response Teams across the state.

To reach the broader population, Ms. Nezhura explained that Cal OES works with community-based organizations to reach vulnerable populations and with private sector/nongovernmental organizations to prepare businesses and organizations. Cal OES also supports ListosCalifornia, a grant program that educates communities on disaster preparedness.

She detailed that when a disaster does occur, Cal OES activates a State Operation Center with representatives from various state agencies. This allows for efficient resource allocation and decision-making during the crisis. The office also deploys specialized units such as the Priority Populations Task Force and Business Operations Center. California is divided into three Cal OES Regions, with Butte County (home to Oroville Dam) falling under the Inland Region.

Each region has assigned emergency services coordinators who act as liaisons, ensuring counties receive the resources they need during disasters. Additionally, Cal OES maintains three mutual aid systems – for fire, law enforcement, and emergency management – to facilitate coordinated response across these critical services.

Finally, after an event, Cal OES supports disaster recovery efforts through various initiatives, including initial damage assessments, training for disaster response personnel, local assistance center setup, safety assessment programs, joint field operations with FEMA, and grant programs to mitigate future disasters (e.g., Hazard Mitigation Grant Program). Deputy Director Nezhura reiterated that Cal OES plays a vital role in keeping California prepared and resilient before, during, and after disasters, with the ongoing goal of helping to keep the state safe in preparation for future disaster scenarios.

Section 3.2.4 Oroville Emergency Response Exercises (Meeting 18)

In December 2024 (Meeting 18), David Gordon, Principal Engineer in DWR’s SWP Executive Office, presented an overview of the SWP emergency preparedness program. He shared that the program was established in 2020 in response to various factors, including the 2017 spillways incident. The program’s vision is to build a resilient SWP with a foundational culture of preparedness to support continuous improvement and a maintained state of readiness.

Overview of Trainings and Exercises



Overview of the exercise and training continuum from seminar through full-scale exercise, highlighting the two Oroville Dam exercises conducted in 2024: a tabletop exercise on August 7 and a functional exercise on August 28.

Mr. Gordon outlined how the program covers all phases of emergency management to enhance the ability to effectively handle emergencies: preparedness, response, recovery, and mitigation.

SWP Emergency Preparedness Program Program Vision

Building a resilient SWP through a culture of preparedness that supports and maintains a state of readiness.

Guiding Principles

Consistency. Sustainability. Proactivity. Coordination.

Mr. Gordon stressed the importance of SWP staff participation in various emergency preparedness exercises, seminars, and trainings,

some of which include external emergency management partners to ensure everyone is familiar with the facilities and emergency response roles.

DWR conducted emergency management exercises in summer 2024 with 129 participants across state and local agencies, including several members of the Commission. Mr. Gordon described the role of tabletop and functional emergency management exercises.

Tabletop exercises are internal meetings designed to test staff responses and internal roles during a simulated emergency whereas a functional exercise serves as a more robust external simulation that involves various agencies working together and testing their roles in incident command, emergency operations, and unified command.

Mr. Gordon shared that the exercises are critical not only for testing readiness but also for fostering relationships and understanding the roles of different organizations involved in emergencies. This includes evacuation coordination where multiple agencies need to collaborate. Increasing the frequency of such exercises and continuing to build strong partnerships between DWR and external agencies will ensure the effectiveness of the emergency preparedness program in the future.

Commissioners said their staff have benefited from tabletop exercises, which helped them feel prepared for local emergency situations like the Park Fire Burn Scar and planning for a potential flood. Mr. Gordon stressed that DWR welcomes participation in these emergency preparedness training exercises from local emergency response partners.

Section 4. Conclusion

Founded by SB 955 as a forum to increase communication and transparency, the Commission has held 21 productive public meetings, 10 in the last three years covered by this report. During this period, commissioners also toured the Oroville Dam and powerhouse facilities and participated in a floating classroom tour of the Feather River to learn about the innovative work at the Feather River Fish Hatchery and improvements to the Feather River habitat which have helped support spring- and fall-run Chinook salmon populations. Meetings have contributed to the ongoing dialogue about the Oroville Facilities and public safety. The Commission tracks ongoing action items and requests that emerge during its meetings and ensures these receive follow-up and/or are addressed in subsequent meetings.

Commissioners, interested parties, and members of the public have asked important questions during each meeting. Public safety remains a primary concern for the Oroville community as well as neighboring communities downstream. Over the past three years, the Commission covered a variety of topics with an ongoing focus on dam and flood safety. Commissioners heard from DWR, external experts, and local partners on DWR's SWP risk assessment process, improvements in weather and river forecasting, local inundation maps, assessment of the Oroville levee, and planned updates to the WCM by the USACE.

Commissioners, expert presenters, DWR staff, interested parties, and the public have consistently approached Commission meetings as an opportunity to tackle difficult and complex topics thoughtfully. This positive, respectful tenor began with Senator Nielsen at the inaugural Commission meeting on September 19, 2019, at which he urged commissioners to come together for a common purpose: "This is a place to problem solve, to be aware, and for the public then to gain comfort that our State Water Project is working well."

In its second three years, the Oroville Dam Citizens Advisory Commission has met the requirements and guidance established in SB 955, and this report serves as the record of this accomplishment. More work remains, and the Commission will continue to meet regularly, learn from experts, discuss complex issues, and provide a public forum to address topics related to the safety, operations, and maintenance of the Oroville Dam and associated facilities.

Section 5. Register of Communications Received from the Department of Water Resources and Other Parties to the Commission

Section 5.1 Communications Received as Part of the Triennial Legislative Report Process

The attached communications have been provided in response to the Triennial Legislative Report process. They provide updates on content discussed in the report, reflections on the work of the Commission as a whole, and feedback received during the public review period on the report itself.

- February 25, 2026, Comment for OCAC 2nd Triennial Report: Unaddressed Concerns and Future Priorities, from Feather River Recovery Alliance Director Dick Thompson, Treasurer Erik Johanson, and Secretary [also OCAC Commissioner] Robert Bateman, Supervisor Bill Connelly, Supervisor Tod Kimellshue, Mayor David Pittman, Oroville Recreation Advisory Committee Chairman Kevin Zeitler, and Butte County Emergency Manager, Angie Mannel
- April 27, 2026, Update letter to OCAC Commissioners on actions DWR staff have taken to address and implement dam safety-related recommendations from its most recent audits and inspections, from David Sarkisian, DWR Manager, Dam Safety Services, Division of Operations and Maintenance
- [others]

Comment for OCAC 2nd Triennial Report
(February 25th 2026)
Unaddressed Concerns and Future Priorities

1. Important future priorities for the Commission

- Advising the DWR and the USACE that the revised Water Control Manual (WCM) should be aimed at achieving 500-year protection which up-to-date science including the FIRO studies suggest that can also result in an increase in water storage over 10 years.
- Providing the Commission with more information about how risk is assessed by the DWR including comparison with other Dams and best industry practice.
- Taking further steps towards having OCAC meeting agendas developed in consultation with downstream Commissioners and involved citizens and having presenters address questions that are submitted either at meetings or afterwards.

2. WCM Update

- Volunteers and Commission members have spent hundreds of hours working to understand the reservoir operations and the role of the WCM. Continuing working with the USACE and the DWR on the completion of the WCM revisions is the top priority for the next year. We have submitted questions over the last 18 months to the USACE and received answers. At the same time there have been a series of meetings with DWR representatives. These interchange of ideas are important for the development of trust in the DWR.
- The FIRO studies explored alternatives for operating the Oroville reservoir. Based on the information we have received it is now possible for the reservoir to be scientifically managed for the provision of 500-year flood protection while increasing the volume of water stored. We had been given the impression that both the USACE and the DWR staff accepted the merit of this approach. But, the USACE presentation at their public meeting on February 4th did not include this alternative.
- 500-year protection will depend on the level of the reservoir to be lowered to 813 ft when an extreme storm is forecast, which is unlikely to be more often than every 15 to 20 years. In the interest of the downstream communities, and that includes Sacramento, if this practice cannot be included in the WCM regulations, it should be adopted by the DWR. Not only would this satisfy any duty of care but also as long as the operation of the reservoir is driven by scientific forecasts both

in refilling the reservoir and in low rainfall years rather than the legally derived flood pool, more water will be stored for summer delivery. The OCAC should advise the DWR that 500-year protection should be sought unless there are compelling reasons why not.

- If the reservoir is operated to achieve 500-year protection, the risk of inundation and evacuations will be greatly reduced and will be caused only by exceptional events such as earthquakes or the failure of an upstream dam.

3. Risk

Flood and inundation risk is the main concern for the downstream communities and managing this risk should be the top priority of the management of the DWR. The two papers which were submitted for the first Triennial report, and were included in the Appendix, made several recommendations about risk; specifically the fundamental causes of risk and the way it is being handled. While David Sakisian has provided good update about safety projects, understanding, analyzing and mitigating known and unknown risks, as discussed in the presentation to the OCAC given by Dr, Rune Storesund four years ago, have largely been ignored.

Unaddressed concerns include:

- The assessment of risk used by the DWR is based on the CNA study which was a subjective assessment by DWR personnel and not based on independent studies. DWR's risk management and investigation is largely in reaction to FERC's mandatory Part 12 inspections by independent subject matter experts (SME). Their findings and recommendations are often quite different from those of DWR's staff as seen in the 2012 and 2018 Part 12/L2RA. To resolve these recent differences of priorities, FERC has simply asked that all studies recommended by the independent SME be completed.

As dams, including Oroville, are exceeding the life expectancy of many infrastructure components, FERC part 12 inspections have moved to once in every 10 years, thus relying on dam owners' due diligence in doing proper self-inspection. Despite improvements in the Oroville Dam safety program, it has not matured to level of design assumption audits or life cycle analysis.

A presentation on how the DWR deals with the assessment of risk in comparison with other similar dams and best industry practices would be appropriate.

- The Oroville dams does not comply with current standards with respect to emptying the reservoir in case of emergency, the ability to handle a standard

project flood and maybe other aspects. There are no firm plans to address these concerns. These failures tend to be overlooked in the DWR publicity and by management. DWR publicity and management tend to assert that safety of the Dam is satisfactory and as good or better than other Dams whereas the DOSD ranks Oroville in a low category for safety. An independent report on how Oroville measures up against other Dams in terms of risk to safety should be included in a future meeting.

- Neither the extent to which recommendations in the Independent Forensic Teams 2018 report nor those in the State Auditors Report have been addressed in an OCAC meeting. They should be.
- The OCAC has not been fully informed about the risks of downstream levy failure when releases from the Dam reach or exceed 150,000 cfs. A presentation of this supported by independent studies is needed.
- The original financing of the Dam led to the State Water Contractors (SWC) having significant influence on maintaining and renovating the Dam. In effect, they have responsibility without accountability while the DWR personnel cannot be held accountable for decisions they do not control. The ambiguity and lack of transparency about the relationship between the DWR and the SWC leads to poor governance and public misunderstandings. This relationship, the specific responsibilities of the SWC and role of the SWC in budget, maintenance, capital expenditure and reservoir operations should be explained at an OCAC meeting.
- The maintenance of the Oroville Levee and how it should be paid for should remain on the agenda for future OCAC meetings. The cost being the responsibility of the City of Oroville rather than the State Water Project (SWP) or the DWR, the agencies which benefit most from its reliability, should be justified.

4. Management of the OCAC

- The agendas of recent meetings have started to reflect the topics of concern to downstream communities and Commissioners. But presentations have tended to ignore the questions that were submitted in advance. The practice of establishing working groups to follow up on presentations should be continued more broadly.
- The 3-minute limit on public comment should not be applied to members of associated committees such as the CNA Ad Hoc Committee and ORAC that are referenced in the Commission Charter.

- The action report does not get systematically reviewed. This is as much the fault of Commissioners as the OCAC management. Consideration should be given to establishing a sub committee of 2 or 3 Commissioners to review the Action Report before and after each meeting.
- An important role for the Commission is to advise the DWR and represent the interests of the river communities. The Commissioners who are employed by government agencies have not shown much enthusiasm for engaging with the DWR. The Commission is not generally a high priority for the representatives who are elected County Supervisors or City Councilors. Concerned volunteers provide most of the information and analysis for the development of advice and comments. Consideration should be given to providing Commissioners and associated concerned citizens with some direct support, perhaps from a member of the Kearns and West staff.
- Comments from concerned citizens and Commissioners such as these should be included in the body of the report not in an Appendix.

5. Future Priorities

The above comments include recommendations for priorities for future meetings. Other priorities should be considered only after the WCM process is concluded. These include:

- Recreation: Use the influence of the OCAC to create a more functional structure for the provision of recreation. This includes:
 - i) Considering what role the OCAC can play in advising the DWR on recreation, particularly if FERC withdraws as is specified in the Alternative Licensing Process (ALP) Relicensing.
 - ii) Including recreation maintenance, expenditure and budgets in the items reviewed at OCAC meetings.
 - iii) Considering the priority of safety in recreation decisions from the point of view of facility owners.
 - iv) Reviewing the extent to which agreed recreation facilities and projects are implemented.
- Relicensing: There should be presentations at an OCAC meeting covering the conflicting views of the appropriateness of the ALP License that was sent to FERC in 2007 without the agreement of the County and other stakeholders and without the normal independent studies associated with the issue of a 50-year license. It

should be noted that the ALP has not been used anywhere other than Oroville. The OCAC may be in a position to advise on what needs to be done to reach terms for relicensing that are appropriate, effective and broadly seen as fair. This should end the antagonism that has clouded relationships and adversely affected economical development and recreation in the past.

The Feather River recovery Alliance is a public service charitable organization formed by Oroville Businesses after the Spillway Incident and the evacuations in 2017. It was instrumental in submitting a petition 'Hold the DWR Responsible' to FERC signed by 6,500 local residents. It continues to support the adoption of measures aimed at mitigating the risk from the Dam and eliminating the recurrence of the uncontrolled releases and disastrous floods such as those in 1986, 1997 and 2017. We seek regulations, maintenance and renovation based on today's science not historic rights. We believe that, if the Dam is going to be an overall benefit to the local communities, trust in the DWR must be established.

Supporters and contributors to this paper are:

FRRA Directors:

Dick Thompson, Chairman

Erik Johanson, Treasurer, formally President of Oroville Economic Development Corp.

Robert Bateman, Secretary and OCAC Commissioner

Bill Connelly, Butte County Supervisor and OCAC Commissioner

Tod Kimellshue, Butte County Supervisor and OCAC Commissioner

David Pittman, Mayor of the City of Oroville and OCAC Commissioner

Kevin Zeitler, Chairman of ORAC

*Angie Mannel, Emergency Manager, Butte County,
and other allies of the FRRA*

DEPARTMENT OF WATER RESOURCES

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April 27, 2026

Dear Oroville Dam Citizens Advisory Commissioners and members of the public,

As an update to material presented in August 2024 Oroville Dam Citizens Advisory Commission (OCAC) Meeting 17, DWR would like to share the actions DWR staff have taken to address and implement dam safety-related recommendations from its most recent audits and inspections since that time. The recommendations, shared at Meeting 17 and documented in Sections 1.1.2 and 1.1.3 of the OCAC October 2022-2025 Triannual Legislative Report, were developed as part of the 2023 independent external audit of the owner's dam safety program at the State Water Project (SWP), the Federal Energy Regulatory Commission's 2024 Part 12D Safety Inspections, and California Division of Safety of Dams' 2024 5-Year Director's Safety Review Boards.

In August 2024, Joel Wortley, principal and geotechnical engineer at HDR, presented findings and recommendations from the audit of the SWP owner's dam safety program on behalf of the independent external audit team. The following improvements, made by DWR in response, are organized by category, and the numbers correspond to the order in which the recommendations were listed in Section 1.1.2 of the OCAC Legislative Report, so that they can be cross-referenced.

1. ***Dam Safety, Policy, Objectives, and Expectations:*** DWR's leadership now issues an annual statement to DWR employees highlighting the importance of Dam Safety to the State Water Project (SWP) and Department as a whole. The annual statement has been coordinated with National Dam Safety Awareness Day.
2. ***Dam Safety Organization and Responsibilities:*** The SWP Dam Safety Program developed a RACI matrix (i.e., defining who is (R)esponsible, (A)ccountable, (C)onsulted and (I)nformed for each activity) to ensure SWP managers understand their respective roles.
3. ***Dam Safety Training Program:*** Training Plans have been updated to reflect required training, and annual reviews of training accomplished are performed by the DWR Dam Safety Services Manager.
4. ***Communications, Coordination, Reporting, and Reports:*** The SWP Dam Safety Program continues to address recommendations in this area through updates to internal procedures, collaboration and engagement with Field Divisions, and reviews of threshold levels and dam safety instrumentation to align with potential failure modes.
5. ***Records-keeping and Databases:*** The SWP has deployed field tablets for dam safety instrumentation data collection which provides efficiencies and minimizes potential errors associated with data collection and handling.
6. ***Continuous Improvements:*** SWP continues to revise and refine policies that provide expectations and requirements with respect to deliverable quality, risk processes, and reporting to SWP management. The SWP Dam Safety Program has completed semi-quantitative (FERC Level 2) risk analyses for 22 of 26 SWP dams, providing a nearly complete portfolio view. The risk information has informed prioritization of resources and investments for SWP dams to address the highest risks first.

Also at the August 2024 Commission Meeting 17, in my role as Dam Safety Services Manager for DWR, I reported out the dam safety recommendations for Oroville that DWR received from

the Part 12D Safety Inspections and 5-Year Director's Safety Review Boards. The improvements DWR has made in response to those recommendations thus far are listed below in the same order as the corresponding recommendations in Section 1.1.3 of the OCAC Legislative Report, so that they can be cross-referenced.

- DWR is developing internal procedures that will adopt universal standards and best practices to be implemented by various survey groups throughout the SWP.
- DWR now documents methods within LiDAR reports and establishes the frequency of LiDAR surveys within Dam Safety Surveillance and Monitoring Plans.
- DWR has already performed extensive landslide mapping and plans to complete a wave run-up analysis for Oroville and Bidwell Bar Canyon Saddle Dam prior to the next Part 12 Comprehensive Assessment in 2028 and 2029.

DWR is committed to ensuring its facilities and programs meet the highest dam safety standards. We appreciate the thoughtful recommendations provided by third party technical experts in these inspections and make addressing them as expeditiously as possible a priority.

Sincerely,

David Sarkisian

David Sarkisian, PE, CEG
Manager, Dam Safety Services
Division of Operations and Maintenance
California Department of Water Resources

Section 5.2 Communications Received on Normal Commission Business from October 2022 through 2025

The attached communications document the robust communications between the Commissioners and interested parties and the commission organizer, the California Natural Resources Agency, over the past three-year period. The table of contents provided within the attachment summarizes the topic of each item of correspondence and links to the relevant individual email or document.



