

Attachment 1: Dam Safety Program Description

The District owns 14 regulated dam structures that are operated under licenses granted by the State of California Department of Water Resources, Division of Safety of Dams (DSOD). The regulated structures include 10 major reservoir dams, Coyote Percolation Pond Flashboard dam, Rinconada Water Treatment Plant reservoir, Fellows Dike and Calero Auxiliary Dam. The sizes of the District's reservoirs vary from 495 Acre-Feet (AF) to 90,323 AF. The combined storage capacity of the District's 10 major reservoirs is 169,009 AF. Anderson Dam, because of its power generating capability, is also under the Federal Energy Regulatory Commission (FERC). As part of these license requirements, the District must provide assurances that its dams and other water retention facilities are inspected for safety on a regular basis, and that the reservoirs are operated safely. The Dam Safety Program directly supports this goal. The major operational elements of the Program are:

1. Dam safety surveillance and monitoring
2. Dam inspections and maintenance
3. Emergency preparedness and response
4. Special engineering studies such as seismic evaluations

The following is a description and update of these elements.

1. Dam Safety Surveillance and Monitoring (FY2016 Budget - \$700,773):

Background:

The District performs dam safety surveillance and monitoring to ensure that the condition of dam assets are adequately monitored, analyzed for safety, and documented. The District monitors the movement of the dams and the flow (and pressure) of the water moving through the dams. This is achieved by regularly monitoring an array of instruments consisting of piezometers, inclinometers and survey monuments installed within the dam. The instrument data from the dams is reviewed monthly or immediately after a significant event such as an earthquake. The Dam Safety Program also prepares and submits annual surveillance reports for each of our dams to DSOD (and FERC in the case of Anderson Dam) as required by these regulators. These reports present our interpretations of surveillance data (i.e. geotechnical monitoring instruments, seepage weirs, survey monuments, etc) gathered for the period of the report, to evaluate the performance of the dam.

Current Conditions Assessment:

The data collected from the instruments at each dam is analyzed and evaluated at least once a month. Additionally, the staff performs informal inspections of each dam bi-annually during maintenance and formally annually with DSOD and FERC. Our review of the surveillance data and our periodic safety inspections indicate that the dams and appurtenant structures show response to their environment, aging process, and external events as intended. Based on their review of the District's surveillance and monitoring data and annual inspection, DSOD and FERC have also concluded similarly.

2. 2015-2016 Dam Inspections and Maintenance (FY2016 Budget - \$1,787,743) :

Background:

Dams are the District's oldest assets. Dam appurtenances such as intake structures, control valves, and outlet pipes are reaching the end of their useful life and require regular preventive and/or corrective maintenance. The condition assessment and plans to address marginal conditions of these appurtenant structures is presented in Attachment 2. Additionally, as responsible dam owners, the District is required by DSOD and FERC to regularly maintain their dams to ensure public safety. Regular maintenance activities at the dams include mechanical equipment such as valves, burrowing animal control, vegetation management, erosion control, and cleaning weep holes in the spillways. The hydraulic systems for the intake gates in the reservoirs are also maintained under this program to prevent hydraulic fluid leaks in the reservoir. Besides the regular preventative maintenance, a number of corrective maintenance tasks are also performed on the systems to replace worn-out parts. The FY 2016 budget includes funds for the scheduled planned and preventive maintenance tasks.

Current Conditions:

The District inspects the dams annually with FERC and DSOD to ensure that the dams are in safe condition. District staff inspected all of its dams with DSOD in 2015 and 2016. The inspections held from December 2015 to April 2016 showed the dams are performing as intended. Dam maintenance was executed as planned in our 2015-16 annual maintenance work plan.

3. Emergency Preparedness and Response (FY2016 Budget – \$240,902):

Background:

Emergency Action Plans (EAPs) have been prepared for all the District's dams. They were updated in 2015. The EAPs for each dam contain a summary of emergency conditions that may develop a plan for addressing them, and an inundation map. The District works with various agencies on emergency action planning and training exercises each year. The EAP reports for all the dams were submitted to the OES and all downstream Emergency Management Agencies.

The emergency response and preparedness also includes the Post Earthquake Dam Evaluation Program (PEDAP) team. After significant earthquakes, trained district personnel who self-deploy and immediately inspect the dams for any signs of damage or potential failure so that appropriate actions may be taken in a timely fashion.

Current Conditions:

The inundation maps in the EAPs estimate what areas could flood in the highly unlikely event of a dam failure. The inundation map for Guadalupe Dam was updated in 2014. The inundation maps for Lenihan Dam, and the Anderson Dam and Coyote Dam system, were updated in July 2016. It is budgeted to update the inundation maps of at least one dam per year thereafter.

As required by FERC, District performs table-top and functional exercises for Anderson Dam once every five years. The last table-top and functional exercises for Anderson Dam were performed by the District in August 2010. Staff conducted these exercises again in June 2016.

4. Special Engineering Studies - Seismic Stability Evaluation of Dams (FY2016 Budget - \$697,347):

Background:

As part of their seismic re-evaluation program in the early 2000's, the Division of Safety of Dams (DSOD) performed independent, preliminary seismic stability evaluations of Calero, Almaden, Guadalupe, Lenihan, Stevens Creek, Chesbro and Uvas Dams. Based on their results, DSOD notified the District of their concerns regarding seismic stability of these dams and directed the District to update the seismic stability analyses for them. In 2003, the Federal Energy Regulatory Commission (FERC) reviewed a required safety inspection report for Anderson Dam (GEI, 2001). Based on their review, FERC also concluded that a seismic stability evaluation of Anderson dam was required.

In 2012, during planning study of Anderson Dam Seismic Retrofit Project, it was concluded that the spillway at Anderson reservoir as well as spillway at Coyote Reservoir which is located upstream of Anderson reservoir do not meet the current Probable Maximum Flood (PMF) standards. In May, 2013, DSOD requested the District to perform a comprehensive evaluation of the spillway at Coyote Dam. The spillway at Anderson dam will be modified to meet the PMF standards as a part of the Anderson Dam Seismic Retrofit Project.

Current Conditions:

As of June 2016, the District has completed seismic evaluations for Anderson, Calero, Guadalupe, Almaden, Lenihan, and Stevens Creek dams. The seismic evaluations for Chesbro, Uvas and Coyote dams were initiated in FY2015. The status and conclusion of seismic stability evaluations is as follows:

Dam	Evaluation	Planning	Design	Construction
Anderson	Completed in June 2011	Completed in August 2013	On-going, planned completion in March 2018	Planned completion in July 2021
Almaden	Completed in May 2012- Only intake retrofit required	On-going, planned completion in March 2017	Planned completion in December 2022	Planned completion in December 2024
Calero	Completed in May 2012	Completed in April 2015	On-going, planned completion in March 2018	Planned completion in December 2020

Chesbro	On-going, planned completion in December 2020	To be determined based on safety evaluation to be completed I 2020	To be determined based on safety evaluation to be completed I 2020	To be determined based on safety evaluation to be completed I 2020
Coyote	On-going, planned completion in December 2020	To be determined based on safety evaluation to be completed I 2020	To be determined based on safety evaluation to be completed I 2020	To be determined based on safety evaluation to be completed I 2020
Guadalupe	Completed in May 2012	Completed in September 2015	On-going, planned completion in March 2019	Planned completion in March 2022
Lenihan	Completed in December 2012	No retrofit required	No retrofit required	No retrofit required
Stevens Creek	Completed in January 2013	No retrofit required	No retrofit required	No retrofit required
Uvas	On-going, planned completion in December 2020	To be determined based on safety evaluation to be completed I 2020	To be determined based on safety evaluation to be completed I 2020	To be determined based on safety evaluation to be completed I 2020

Based on the seismic evaluation results, Almaden, Lenihan and Stevens Creek dams do not have to be retrofitted, whereas, Anderson, Calero and Guadalupe dams showed seismic deficiencies, and capital projects are underway to retrofit the dams. Even though seismic studies indicated adequate seismic stability for the Almaden dam embankment, its intake structure (which may fail during a large earthquake) and spillway (which does not meet current standards) have to be retrofitted. A brief status of these retrofit projects is provided as follows:

i. Anderson Dam Seismic Evaluation

AMEC Geomatrix, Inc. performed the Anderson Dam Seismic Stability Evaluation. The study results indicated that material at the base and foundation of the dam embankment would weaken due to liquefaction in a large earthquake. Such an event could significantly deform the dam embankment, risking an uncontrolled release from Anderson Reservoir. The reservoir is being operated under a restricted reservoir level (Table 1, Attachment 1) imposed by FERC and DSOD to ensure public safety. In response to these findings, staff initiated the seismic stability retrofit project in Fiscal Year 2011-2012. The retrofit project has been incorporated in the Fiscal Year 2017-2021 Capital Improvement Plan and the Fiscal Year 2016 and Fiscal Year FY 2017 budgets. A budget of \$200,958,000 is allocated to this project in the Fiscal Year 2017-2021 Capital Improvement Plan. The scope of this

project includes seismic retrofit of the dam embankment and replacing the outlet works to address the potential fault rupture risk. The spillway structure will also be modified based on the 2011 FERC Five Year Safety Inspection and Report reevaluation of the Anderson Dam Probable Maximum Flood. The planning phase of the project was completed in 2013.

Current status:

The project is currently in the design phase. The design phase is planned to be completed in March 2018. The construction phase is planned to be completed in July 2021.

ii. Almaden, Calero and Guadalupe Dam Seismic Evaluations

In 2011, URS Corporation performed seismic stability evaluations for Almaden, Calero and Guadalupe dams. The study concluded that Calero Main Dam and Guadalupe Dam have inadequate seismic stability and will require retrofits. Almaden Dam and the Calero Auxiliary Dam were found to have adequate seismic stability. All three reservoirs are currently being operated at restricted reservoir levels (Table 1, Attachment 1) as directed by DSOD. Staff initiated a seismic retrofit project for Calero and Guadalupe dams in July 2012. The retrofit project has been incorporated in the Fiscal Year 2017-2021 Capital Improvement Plan and the Fiscal Year 2016 and Fiscal Year FY 2017 budgets. A total of \$154,116,000 is allocated to this project in the Fiscal Year 2017-2021 Capital Improvement Plan. The goal of this project is to remediate seismic deficiencies identified in the seismic stability evaluation of the dams. The project assumes a full seismic retrofit will be required for Calero Dam due to its size and importance in water supply operations; however, Guadalupe Dam is relatively small and other alternatives to remediate it will be studied including full and partial removal of the dam.

Current status:

The project is in the design phase, which is planned to be completed in March 2018, and March 2019, respectively. This will be followed by the construction phases planned to be completed in December 2020 and March 2022, respectively.

iii. Lenihan, and Stevens Creek Seismic Evaluations

Terra/GeoPentech (TGP), performed seismic stability evaluations for Lenihan and Stevens Creek dams. The final reports, presenting the findings of the study for Lenihan and Stevens Creek dams were completed on December 19, 2012 and January 17, 2013, respectively. The Lenihan Dam and Stevens Creek Dam studies indicate that the dam has adequate seismic stability. No remediation of the dam is required and no reservoir level restriction has been imposed by DSOD. However for Stevens Creek Dam, DSOD requested the District install additional piezometers and replace old piezometers to reliably monitor the dam in case of a major seismic event. The staff installed new piezometers at Stevens Creek Dam in September 2013.

iv. Chesbro, Coyote and Uvas Dam Safety Evaluation

Staff initiated a comprehensive safety evaluation of Coyote, Chesbro and Uvas dams in FY2015. The project has been added to the FY2017-2021 Capital Improvement Program with a budget of \$9.7 million. AECOM (formerly URS Corporation) have been retained by the District to perform the study. The consultant agreement was approved by the Board in September 9, 2014.

Unlike seismic stability evaluations of other dams, the seismic stability study for these dams will be performed in two phases due to their age, condition and limited available data. The first phase will include collection of background information to prepare a Supporting Technical Information Document (STID), geologic mapping and surveying the dam sites, preliminary geotechnical field investigation and laboratory testing, and Potential Failure Mode Analyses (PFMA). The final phase of the study will include the final geotechnical field and laboratory testing, fault hazard assessment, seismic stability evaluation of the dams, evaluation of the dam spillway capacities, and condition assessment of outlet works.

Current status:

The project is currently in the evaluation phase. The evaluation phase is planned to be completed in December 2020. Capital improvement projects will be initiated based on the conclusion of the evaluation phase.

v. Almaden Intake Retrofit Project

In October 2000, a capital project was initiated to address seismic issues related to the Almaden Dam outlet works. The planning level work was suspended in September 2005 pending completion of the seismic stability evaluation of Almaden Dam. This seismic stability evaluation is now complete and no remediation of the dam embankment is required; therefore, the Almaden Intake Retrofit Project has been reinitiated.

On February 14, 2012, the Board approved a \$250K budget adjustment to re-initiate the Almaden Dam Outlet Works Project for FY12. The project will include seismic retrofit or replacement of the existing outlet works and modification of the existing spillway to meet the latest Hydro Meteorological Report (HMR) 58 Probable Maximum Flood (PMF) standards. The project has been incorporated in the Fiscal Year 2017-2021 Capital Improvement Plan and the Fiscal Year 2016 and Fiscal Year FY 2017 budgets. A total of \$56,518,000 is allocated to this project in the Fiscal Year 2017-2021 Capital Improvement Plan.

Current status:

A Planning Consultant has been retained to perform Planning and Environmental Services. The planning study for the project is planned to be completed in March 2017. The design and construction phases are planned to be completed in December 2022 and December 2024, respectively.

Table 1 – Santa Clara Valley Water District - Reservoir Sizes and Capacities

Reservoir	Year Built	Dam Height (feet)	Use	Surface Area (Acres)	Reservoir Capacity (AF)	Restricted Capacity (AF)	March 2015 Stored Volume (AF)	Reason for Restriction
Almaden	1935	105	Recharge & treated water	59	1,586	1,472	1,704	Seismic stability concerns
Anderson	1950	240	Recharge & treated water	1,245	90,373	61,810	40,884	Seismic stability concerns
Calero	1935	98	Recharge & treated water	347	9,934	4,585	3,920	Seismic stability concerns
Chesbro	1955	95	Recharge	265	7,945	7,945	3,806	N/A
Coyote	1936	120	Recharge & treated water	648	23,244	12,382	12,382	Active fault under the dam
Guadalupe	1935	129	Recharge	79	3,415	2,218	2,005	Seismic stability concerns
Lexington	1952	195	Recharge	475	19,044	19,044	8,558	N/A
Stevens Creek	1935	120	Recharge	91	3,138	3,138	3,041	N/A
Uvas	1957	118	Recharge	286	9,835	9,835	7,135	N/A
Vasona	1935	30	Recharge	57	495	495	308	N/A
				Total	169,009	122,924	83,113	

AF = acre-feet