Attachment 2: Description and Condition Assessment Framework for Dams

This document describes the major components of District dams and provides a generalized assessment of their condition.

Dam Components

Each dam has three major components; embankment, outlet, and spillway. The embankment is the physical barrier across a stream or river that impounds water behind it to create the reservoir. The embankment is composed of compacted earth or rock and is the structural component of the dam. The outlet is the pipeline that runs either under or around the dam and is used to control the withdrawal of water for beneficial use. The outlet includes an intake structure in the reservoir with shutoff valves or gates, and control valves on the downstream end. The spillway is a concrete channel used to safely route excess runoff around the dam to prevent overtopping and a catastrophic failure of the dam. If the runoff were allowed to flow over the dam, it would erode the dam and cause a failure.

Standards Related to Each Component

This section describes standards or other issues for each dam component that could require some type of retrofit. It is not intended to be comprehensive on all standards for the dams. It will describe the standard, its purpose, and the condition of the dams in relation to the standard. Table 2 summarizes the condition of the District's dams in relation to the standards.

1. Dam Embankment

The most significant issue for the embankment is its performance during the Maximum Credible Earthquake (MCE). The MCE is the largest possible earthquake that could reasonably be expected to occur in a given area on a given fault. The MCE is based on historic quakes, location of faults in the vicinity, and the general tectonic framework of the region. The District is currently required to complete studies for 9 dams. Six are complete (Anderson, Calero, Almaden, Guadalupe, Lenihan, and Stevens Creek), and (Coyote, Uvas and Chesbro) three have been initiated by FY15. The results show that Anderson, Calero, and Guadalupe dams will need to be remediated. Stevens Creek, Almaden and Lenihan dams will experience only minor deformation during MCE and do not have to be retrofitted.

Fault rupture is movement of an active fault in the foundation of the dam that could cause the dam embankment to rupture. Coyote Dam, which was constructed knowing the Calaveras Fault runs under it, is the only District dam with fault rupture as a concern.

2. Outlet Works and Hydraulic Systems

There are several issues regarding the outlets – potential fault rupture, withdrawal capacity structural or potential damage to the intake structures due to deformation of the embankment during the MCE, and valve and hydraulic line replacement due to aging. The seismic stability evaluations include potential fault rupture and its impact on the outlet pipe. Based on the seismic evaluation study, Anderson dam outlet is known to have this issue. DSOD has general standards regarding the withdrawal capacity of the outlet. For reservoirs that impound 5,000 acre-fee of water or less, the outlet system should be capable of draining half of the reservoir capacity in 7 days. For reservoirs greater than 5,000 acre-fee, the outlet system should be capable of lower the maximum storage depth by 10 percent within 10

days. The outlets should also be able to drawdown the reservoir to dead-pool in 90-120 days. Any new or modified outlet would need to meet these requirements. Currently, the outlet at Anderson Dam is the only outlet that cannot meet the requirements.

The intake structure for Almaden dam has been extended several times due to siltation in the reservoir without additional structural components for seismic shaking. This now needs to be corrected. Also, movement of the embankment during an earthquake can affect the outlet if it is in the path of movement. Currently, Guadalupe Dam is the only one with this concern. For structural purposes, a berm was constructed on the upstream slope of the dam in the 1970's and the original intake for the outlet was not moved laterally, but extended vertically through the berm. Movement of the berm during the MCE could fail and clog the outlet, potentially rendering it unusable. Finally, the gates and valves on the intake structure, and their hydraulic controls, are reaching the end of their useful life for many of the dams and need to be replaced. Since it is difficult to replace them under water, staff is first completing the seismic studies before developing a replacement schedule for them.

3. Spillway

The spillway for each dam must be capable of passing the Probable Maximum Flood (PMF) without overtopping the dam. The PMF is defined as the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area. It is based on the Probable Maximum Precipitation (PMP) which is the greatest depth (amount) of precipitation, for a given storm duration, that is theoretically possible for a particular area and geographic location. The National Weather Service of the National Oceanic and Atmospheric Association (NOAA) is responsible for establishing PMP standards through Hydro Meteorological Reports (HMRs). The PMP for California is defined in HMR 58 which was released in 1998. It replaced HMR 36 for all dams and for new or modified spillway construction, or where analysis shows that the spillway does not meet HMR 36 standards. Almaden cannot meet HMR 36 and will need to be modified. Recent PMF analysis for Anderson Dam during planning of the Anderson Dam Seismic Retrofit Project showed that its spillway does not meet the HMR 58 standards and will have to be retrofitted. The same analysis also showed that even though Coyote Dam spillway meets HMR 36 standards, it does not meet the new HMR 58 standards and will need to be modified. The DSOD directed the District to address this issue at Coyote Dam. PMP/PMF studies for Calero, Guadalupe and Almaden dams indicate that their spillways do not meet the current standards and have to be modified.

Approach to Capital Project Identification

Most of the dams will require some type of remediation due to their age and changes in design standards. Because the potential impact and cost from the seismic studies is so large, staff has delayed any improvements until they are complete. Each dam will then be reviewed to determine all of the necessary remediation work and develop projects that complete all of it. The status of the District's dam condition assessments is summarized on Table 2.

Table 2 – Condition Assessment of Dams as of March 2015

Reservoir	Dam Embankment		Spillway	Outlet Works		Planned Completion Date
	Seismic Stability	Fault Rupture		Hydraulic System	Outlet pipe, Structure & Intake	
Almaden	Evaluation concluded that no retrofit is required	No fault rupture hazard at the site	Spillway needs modification to meet current standards	System will be replaced as a part of the intake retrofit project	Outllet works will be replaced as a part of the intake retrofit project	Intake Retrofit completion by December 2024
Anderson	Evaluation concluded that embankment retrofit is required	Fault rupture hazard at site will require embankment retrofit	Spillway needs modification to meet current standards	System will be replaced as a part of the retrofit project	Outllet works will be replaced as a part of the retrofit project	Retrofit construction completed by July 2021
Calero	Evaluation concluded that embankment retrofit is required	No fault rupture hazard at the site	Spillway needs modification to meet current standards	System will be replaced as a part of the retrofit project	Outllet works will be replaced as a part of the retrofit project	Retrofit construction completed by December 2020
Chesbro	Safety evaluation study initiated; planned to be completed by 2020	No fault rupture hazard at the site	Safety evaluation study initiated; planned to be completed by 2020	Safety evaluation study initiated; planned to be completed by 2020	Safety evaluation study initiated; planned to be completed by 2020	Evaluation completion by December 2020
Coyote	Safety evaluation study initiated; planned to be completed by 2020	Fault rupture hazard at site. Safety evaluation study initiated; planned to be completed by 2020	Safety evaluation study initiated; planned to be completed by 2020	Hydraulic system replaced in 1992. No modification required	Outlet works replaced in 1992. No modification required	Evaluation completion by December 2020
Guadalupe	Evaluation concluded that embankment retrofit is required	No fault rupture hazard at the site	Spillway needs modification to meet current standards	System will be replaced as a part of the retrofit project	Outllet works will be replaced as a part of the retrofit project	Retrofit construction completed by March 2022
Lexington	Evaluation concluded that no retrofit is required	No fault rupture hazard at the site	Study planned to be initiated in 2020	Hydraulic system replaced in 2010. No modification required	Outlet works replaced in 2010. No modification required	Spillway study planned to be initiated in 2020
Stevens Creek	Evaluation concluded that no retrofit is required	No fault rupture hazard at the site	Study planned to be initiated in 2020	Hydraulic system replaced in 1985. Modification required	Outlet works replaced in 1985. No modification required	Spillway study planned to be initiated in 2020. Hydraulic system planned to be modified by 2018
Uvas	Safety evaluation study initiated; planned to be completed by 2020	No fault rupture hazard at the site	Safety evaluation study initiated; planned to be completed by 2020	Safety evaluation study initiated; planned to be completed by 2020	Safety evaluation study initiated; planned to be completed by 2020	Evaluation completion by December 2020
Vasona	Safety evaluation planned to be initiated in 2020	No fault rupture hazard at the site	Study planned to be initiated in 2020	N/A	N/A	Safety evaluation planned to be initiated in 2020

Note: Items marked “N/A” in the table refer to dam components that are not applicable for the dam because the dam does not have these components.