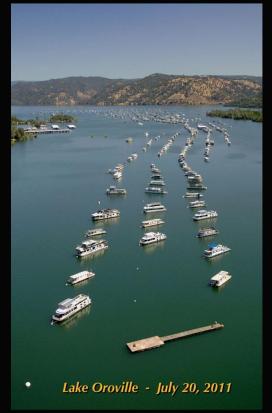


Oroville Dam 2014-2015 River Valve Outlet System





Drought Emergency Operations presented at NWHA, February 17, 2015



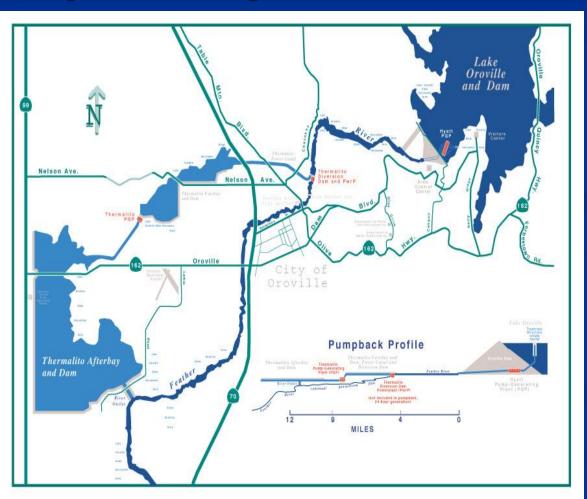






SWP Beneficial Uses of the Feather River

Superior Water Rights, Environment, and Flood Protection Govern Operations

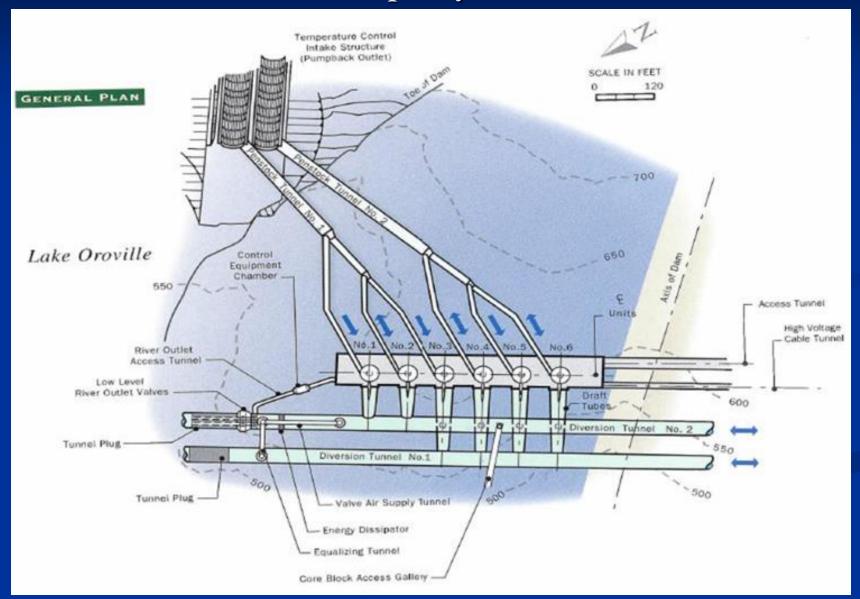


- 1. Flood control (900-825')
- 2. Meet instream requirements for flow/temp (FERC license req.)
- 3. Meet downstream requirements (Delta WQ/ESA)
- 4. Meet local water supply demands (senior water rights)
- 5. Specifically to support SWP water supply deliveries

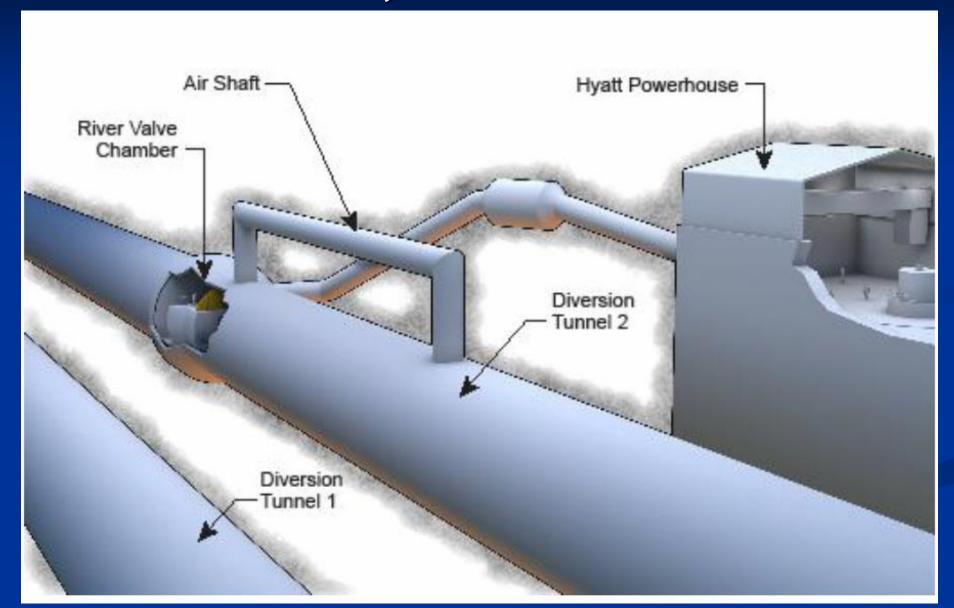
If Lake Oroville falls below elevation 640', the RVOS is the only means to release the remaining 850,000 acre-feet

Hyatt Powerplant Plan View

RVOS – 2 6' conduits with 72" spherical valve and 54" fixed cone valve – 4000 cfs capacity at elevation 640'

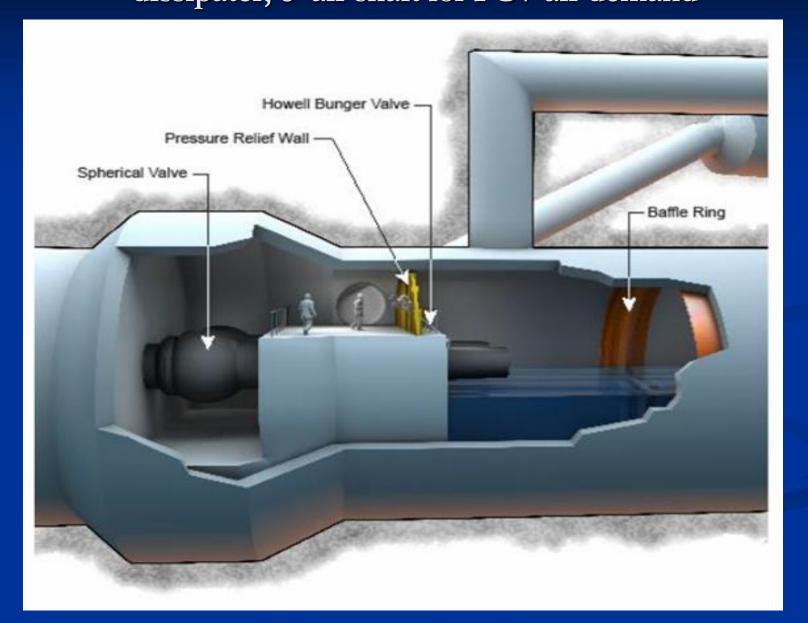


River Valve Outlet System Location Tunnel 2 CL at 225', Main Floor of HPGP at 252'



River Valve Outlet System

PRW designed to fail at 15' of head, 6' baffle ring is an energy dissipater, 8' air shaft for FCV air demand

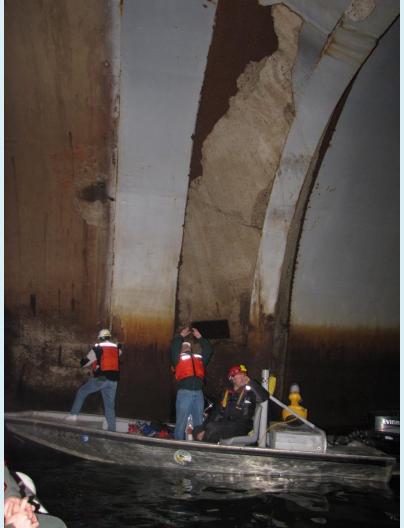






Baffle Ring energy dissipater removed in 2009 due to deteriorated condition







2009 accident lead to USU Physical Model testing and incident investigation



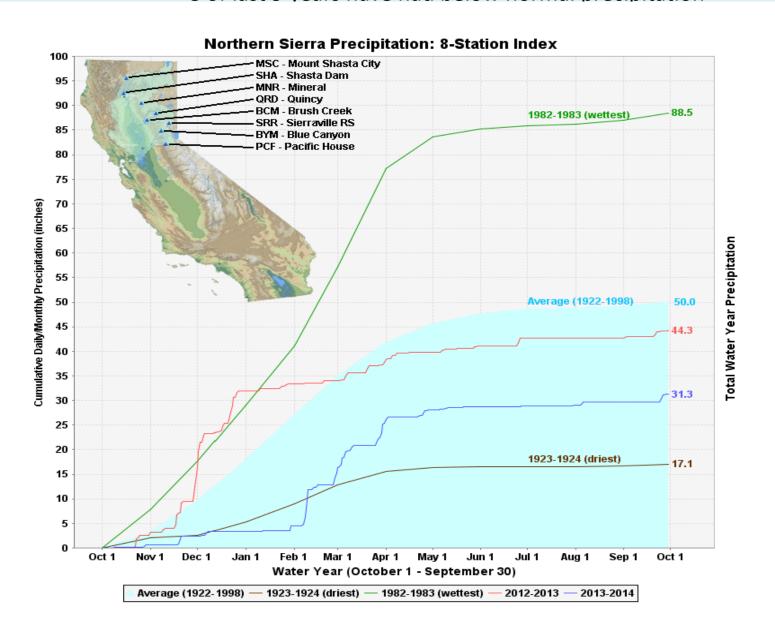


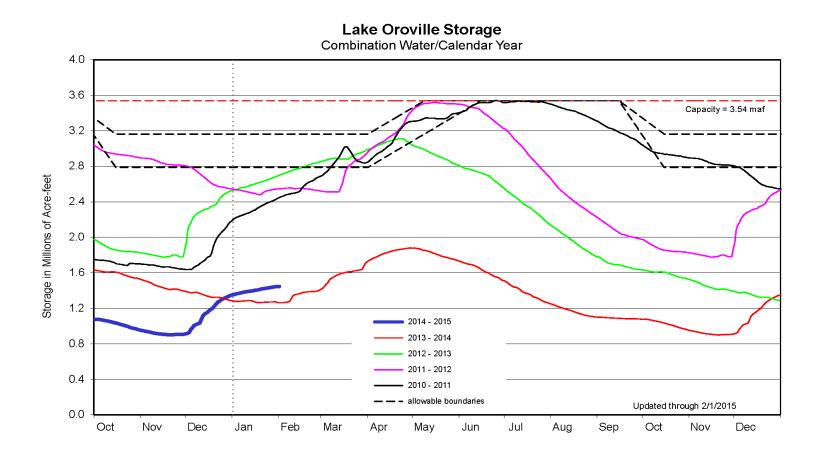
CalOSHA/DWR/IUOE Settlement Agreement

March 2012

- A Settlement Agreement between CalOSHA, DWR & the Local 39 Representative was signed on 3/6/2012 in response to the River Valve Outlet Chamber Pressure Relief Wall failure that occurred July 22, 2009.
- DWR cannot operate existing RVOS until refurbished or replaced (including baffle ring).
- Agreement requires 3rd party, licensed PE, experienced in the design & repair of hydroelectric plants and dams to abate hazards created by operation of River Valve Outlet System. (MWH)
- No DWR/other personnel permitted in the RV Chamber during future operations of the RVOS.

Northern California 8 Station Precipitation Gage Network and Current Drought 8 of last 9 years have had below normal precipitation





Oroville RVOS Drought Emergency Operations

- Governor Brown Declared CA Drought Emergency in Jan 2014
- At the end of January 2014, 13 consecutive driest months in over 100 year of Feather River hydrologic record
- If 99% hydrology continued, Lake Oroville would be below the Hyatt Powerplant intake by June 2014
- While DWR had contracted with MWH pursuant to SA and was examining total replacement options for the RVOS, refurbishment of existing RVOS was not the leading alternative
- If Lake Oroville falls below approximately elevation 640, the RVOS is the only means to access 850,000 A-F remaining in Lake Oroville
 - No flow in the Feather River simply not something that could be allowed to occur
 - No releases to the Delta also severely problematic and to be avoided at all cost

RVOS Emergency Operational Readiness – Steps Needed

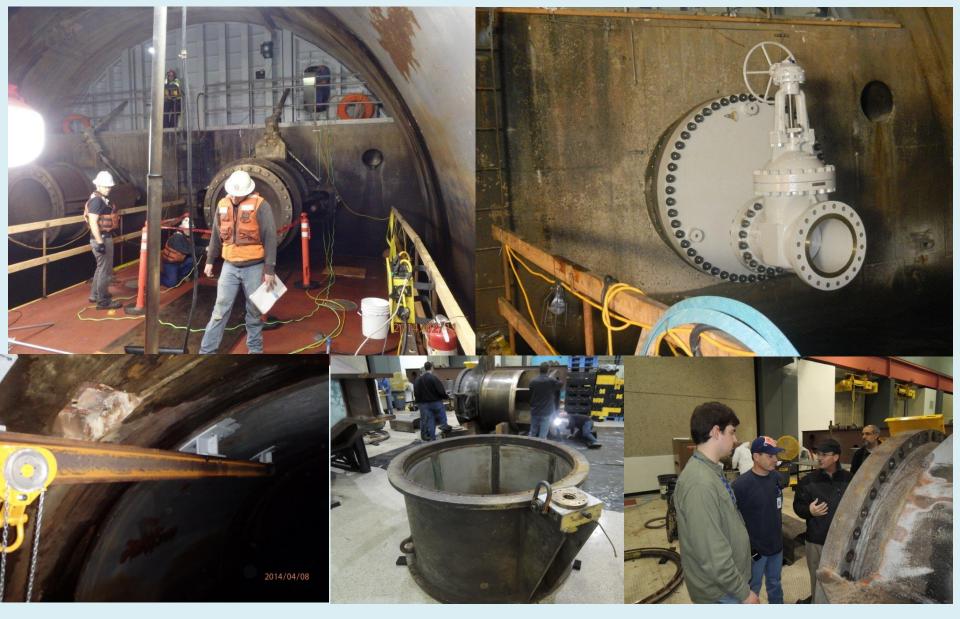




DWR/Partners accomplished in 4 months:

- Inspected and assessed all accessible components of the RVOS – confined space
- FCV's removed and completely refurbished
- RSV seats converted to water pressure actuation and refurbished hydraulic system for trunnion
- New controls and monitoring equipment console relocated to Hyatt elev. 252 and ACC
- PRW assessed and new fasteners installed
- Discussions with OSHA and IUOE to Amend the SA, DSOD and FERC approval needed
- Over 2 dozen PWSPs developed and used
- USU Physical Model of the RVOS used to evaluate safe discharge limits of the RVOS with no Baffle Ring
- DWR contracted with MWH for USU analysis and Technical Memorandum No. 9 which provides MWH/USU recommendations for safe RVOS emergency operations and a test plan

Removal and Inspection of the Fixed Cone Valves



After a preliminary boroscope and visual inspection while still installed, the two Fixed Cone Valves were removed using the newly installed monorail and the newly manufactured blind flanges with 16-inch gate drainage valves were installed.

FCVs Disassembly, Assessment, and Refurbishment



All work in Tunnel 2 under confined space rules, limited personnel entry, and the requirement that all HPGP Units be locked and tagged out. This allowed for approximately 8 hours a day to work in/near the RVOS chamber.

FCV Assembly and Hydrotesting

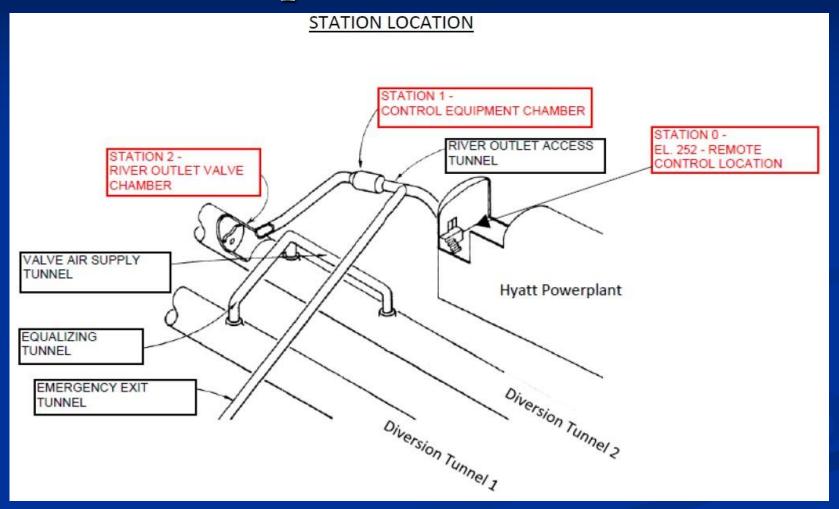


Clean and Refurbish RSV Hydraulic System



RSV trunion hydraulic system cleaned, and new piping and Duplex filter added. RSV seats converted to water pressure actuation due to past experience with oil/water mixing past seat O-rings. New PRW pressure switches for auto-shut down.

All RVOS controls relocated to Hyatt Powerplant Elevation 252'



Station "0" will allow remote operation of Spherical & Fixed Cone Valves as no personnel will be in the RV Chamber during flow testing and operations



New RVOS controls relocated to the turbine deck of the HPGP

- All FCVs and RSVs safely and remotely operable
- 9 new remotely operable cameras
- Oil accumulators allow for RSV operation in the event of total power outage







Reinstalled FCVs, 5 days of Validation Testing w/DWR, MWH, and USU in July 2014 which was also witnessed by IOUE and DSOD – RVOS limited to 2000 cfs WO BR





2014 RVOS Drought Emergency Ops Highlights

- Developed/implemented new Standard Operating Order
- About 225,000 acre-feet safely released through the RVOS (Aug-Dec, 122 days)
- All FERC/BO mandated temperature requirements met
- No lost time injuries or accidents
- Extended Emergency Ops though 2015 with CalOSHA, IOUE, DSOD and FERC through cooperative engagement
- During 2014, no water from Lake Oroville was released for SWP water supply, all deliveries from San Luis/other SWP reservoirs
- Lake Oroville dropped to elevation 647 on Nov 21, 2014
- DWR partnered with MWH, USUWRL, Syblon Reid, NRC, North Valley Rescue, Unico Mechanical, Jeffco, Safety Management Systems, and other specialists and consultants
- Total Cost \$11 million