

FRRA OpEd Article

While others are preparing for the historic El Nino winter and potential flooding, Oroville Dam is busy notifying us how they plan to protect water storage over public safety.

A group of downstream stakeholders has been engaged with DWR and USACE for over three years on an update to Oroville Dam's water control manual. The following overview is our view and current understanding of how DWR wishes to conduct flood operations.

The updated operating rules will be based on Forecast Informed Reservoir Operations (FIRO) where enough water is released ahead of the storm so when the storm's peak inflows arrives, the size of the flood pool can absorb it so the outflows don't exceed downstream constraint limits.

Oroville has the spillway capacity to pass a 1/500 yr storm but will not use it

A study showed that with early reservoir releases to the bottom of the FCO-Gates, elevation 813 ft. Oroville could pass a 1/500 yr event without surcharging the auxiliary spillway or over topping downstream levees.

Other dam owners such as Folsom and Yuba Water are investing millions to construct secondary spillways to conduct early releases deeper into their reservoir. Oroville already has the spillway capacity, but has indicated they will not use it to protect downstream communities.

Since Oroville is a multi-purpose dam and shares water storage and flood protection responsibility they don't plan to lower the reservoir beyond what their regulators can enforce. They stated they don't have a goal to achieve a specific return interval for flood protection, and with climate change they expect that the return interval that Oroville is able to provide, will decrease further.

DWR claims they doesn't trust the forecasting skill coming out of the FIRO study but haven't offered any specific study to substantiate those concerns and doesn't want to risk ending an extreme event without all the water storage they are entitled to,

A FIRO study demonstrates that when releases stop at elevation 835ft. Oroville's ability to limit their outflows to the 150,000 cfs limit is; 1/248yr (for the 1997 storm scaled by 108%) and 1/154yr protection (for the 1986 storm scaled by 118%). This equates to about 30 - 50% of the level of the flood protection in the original 1970 Water Control Manual agreement

How was the size of the current flood pool created?

The original 1970 Water Control Manual agreement between DWR and USACE was to select enough flood control space required to protect urban and agriculture areas against the 1/500yr (standard project flood), with releases limited to 150,000cfs. The USACE paid for 20% of the construction cost and received 750 thousand acre feet (TAF) of flood pool space.

When it became apparent that Marysville dam with about 250TAF of flood storage wasn't going to be built, USACE required that missing storage needed to pass a 1/500 yr storm, would need to be shared between New Bullards Bar and Oroville Dam. DWR needed to account for 150TAF, so instead of lowering the flood pool to 900TAF, they agreed to surcharge the auxiliary spillway by 10 feet during certain events.

During the structural failure of the main spillway in 2017, the auxiliary spillway surcharged by 2 feet creating massive erosion into the river channel, threatening to backup water into Hyatt Power Plant. The Independent Forensic Team reported that detailed borehole logs containing the accurate descriptions of the moderately to highly weathered bedrock are given in the 1962 geological reports, but are omitted from the final report. ... appearing that DWR geologists developed and promulgated an incorrect understanding of non-erodible rock.

Following this study DWR reversed its decision and agreed to temporarily extend the flood pool 150TAF to 900TAF verse having to surcharge. Hopefully the organizational behavior that altered the geology report isn't continuing such practice in order to put water storage over public safety.

What could happen when early releases stopping at 900TAF, the minimal protection regulators could enforce?

A hydrograph in the FIRO report showed a 1/420yr event (1997 x 120%) would surcharge the auxiliary spillway by 5-7 feet. And downstream flow twice their permissible limit could overtop river levels all the way down to Sacramento. Where Oroville has the ability to absorb more peak flows and help protect all downstream communities that's not their current policy. But maybe DWR can find some comfort in knowing they are probably legally protected from liability by simply following the regulatory minimum requirements.

Has DWR trusted any science enough to adjust the Flood pool?

Where they do want to trust the forecast skill is the current Wetness Index that allows them to store about 400TAF of additional water in the winter flood pool during drought years. This is based on the assumption that dry soil conditions can absorb most of the initial rainfall. But what the wetness index doesn't account for is the snowpack sitting on top of that soil.

During the 2017 spillway incident the snowmelt was under forecasted and the auxiliary spillway overtopped exposing its fragile geological structure. A study later estimated that the heavy snowpack contributed 30% more inflows than rainfall alone. Any future wetness index that allows water to be stored in the winter flood pool must account for the current conditions in the watershed and not just some mathematical formula based on the last day it rained.

Did the FIRO subject matter experts attempt to pass a 1/500 yr storm and also recover water storage?

The FIRO study was led by the Center for Western Weather and Water Extremes, Scripps Institution. But the guidance from DWR and the steering committee directed these leading experts to only study how much incremental flood protection could be achieved if Oroville's flood pool stayed at the regulatory minimum of 900TAF. Otherwise the leading experts could have studied how to lower the reservoir to absorb the peak inflow of 1/500 yr storm, then allow those inflows to recover the permissible water storage.

Despite having a limited mandate the FIRO experts did conduct numerous studies and made many recommendations that would help both objectives. The following is an overview of some of their work and other ideas.

Decision Support Tools and System - During the three year study NOAA and CW3E developed many new forecast and observational products to predict inflow and target water storage. The team then gathered information from dam operators about the needs/gaps when making real-time flood operations decisions. Dam owners responded that the extensive amount of information provided by these forecast and observational products can be overwhelming to users, highlighting the need to improve how these products are connected to and used within the operational stream. The FIRO team also recommended a manual be developed that would describe the tools and methodologies for coordinated operations.

With new forecast and observational tools the operational objective should be restated as - Reduce the risk to water storage, verse stop releases at the regulatory minimum

If DWR aggressively invests into incorporating the new forecasting and observational products from NOAA and NWS, some of their fears of the forecast uncertainty not recovering their entitled water storage could be greatly reduced. With recovery of the water storage more predictable, setting a hard bottom to the flood pool becomes an irrelevant objective to dam operations if new tools can forecast water storage recovery.

Because using all the new forecast data streams would require a substantial investment and training, It is probably easier for them to simply wait and see which alternative plan would be selected, and maybe that work won't be required?

Alternative ID4 Iterative - was one of two proposed plans. It would run an ensemble of forecasts through a stack of rules that could include; not releasing more than 150,000 cfs, not surcharging the auxiliary spillway or need to recover the water storage at the end of the event. It used situational awareness of adverse outcomes to determine the scheduled reservoir releases. If any of the rules were broken another release schedule would be created until all the objectives in the rule stack were satisfied.

Despite this plan being in effect at Lake Mendocino and showed the best results at Oroville it was thrown out by USACE's Washington DC office without any explanation. They usually don't get involved in the WCM updates. It's the divisional office that oversees the process and the Regional office that signs off.

Are Political influences in play

For the Washington DC office to eliminate the only plan created by the FIRO experts, could appear as if political influences were in play. Or maybe it became apparent to USACE that DWR had not and was not going to invest in the FIRO recommendations to improve the Decision Support Tools needed for Alternative ID4. The dam operator hasn't provided a straight answer if these recommendations were completed.

The Risk Tolerance Curve - was created to not jeopardize the end of event water storage. The curve would disregard the largest 30% ensemble forecasts at 14 days lead times, 15% at 10 days, and 5% at 6 days ahead of peak inflows. Even with this proposed protection to end-of-event water storage, Alternative ID4 was eliminated without explanation.

Alternative ID3 Prescriptive was the only plan left coming out of the FIRO study. It's a plan DWR had paid their consultant to develop 5 years before the FIRO study even started. It does not use an ensemble of forecasts or a rule stack of adverse outcomes to determine the scheduled reservoir releases. It's an easy to follow process that simply prescribes release volumes based on forecasted reservoir inflows.

Period of Record Water Benefits - will be studied by USACE in an attempt to balance long-term water gains versus flood protection. An End of the Season Storage Gain study demonstrated a 200TAF annual benefit from the FIRO alternative plans. If Delta Water is valued at \$1,000 per acre foot, that equates to \$1 billion over five years. Downstream communities are only asking for DWR to take a 200TAF risk to water storage once in 150 years or greater to prevent massive destruction costing billions.

Other Ideas to explore?

The Delta Tunnels - is being sold as creating the ability to capture large reservoir releases into the state aqueduct to fill southern California storage reservoirs. DWR could capture the voluntary early releases of 250TAF needed for 1/500 yr flood protection by transferring that water to south state storage facilities.

Early Release - Water Transfer Credit - When Oroville Dam voluntarily releases more water than required and the post-event water storage level isn't recovered, they get a water transfer credit for the amount of water not recovered. That credit can be used the next time excise water

is flowing to the ocean, by turning on the aqueduct and moving that amount to south state reservoirs.

In both cases concerns over forecast uncertainty causing the conservation pool not to recover during extreme events would be eliminated, communities could be saved, and the south state would still have its permissible water storage just in a different reservoir.

Summary

The Oroville Citizen Advisory Commissioners, members of the Oroville Comprehensive Needs Assessment Ad Hoc group, members of the Feather River Recovery Alliance, previous flood victims and concerned citizens have been asking for a solution-based workshop. Although USACE has been willing, DWR's policy makers haven't, instead they prefer to talk at us, not with us. The opportunity for dam owners and downstream stakeholders to find resolution to competing objectives before the selection of the updated WCM plan never occurred.

They instead are waiting to see USACE's proposed WCM update, and what the minimal requirements will be before conducting their own analysis or forming policy positions. Although USACE will be releasing their recommendations for the updated WCM soon, it will not be until next year before it gets enacted.

Meanwhile downstream communities and their own dam operators are without clear direction from the dam owner policy makers on what to do this winter when the historic El Nino could create massive downstream destruction. Do they save the communities by conducting voluntary releases deeper than what can be regularly enforced or will they choose to protect the water storage because of current forecast uncertainty. Based on our best understanding, from what we have been recently told, they are going to let us flood.