

Request for clarification to Y-F FIRO Viability Questions (August 1st 2025)

Please reference the FIRO Viability Report tables and graphs cited in the questions to ensure CW3E responses and questioners are on the same page.

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CW3E Responses To Questions Submitted By Robert Bateman on June 16th

Ralph Question - R1a) - Discuss how ID4 Interactive could be more adaptable than ID3 Prescriptive to changing variables and objectives such as; additional release capacity, infrastructure and climate change, by simply changing the rule stack and priority assigned to them?

ID4 is “iterative”, not “interactive.” Differences in adaptability between ID4 and ID3 were not evaluated as a part of the FVA.

Follow up Question R1a) Disregard the comparison with ID3 Prescriptive and please explain how ID4 Iterative could adapt, should dam operators agree to increase the size of the FIRO Space after future infrastructure improvements?

R1b) - How has it performed at Lake Mendocino?

FIRO strategies (iterative and prescriptive) have been very successful at Lake Mendocino, as demonstrated through the outcomes of planned deviations over the past 5+ years.

Follow up Question R1b) Could Oroville’s FIRO Space increase in the future through USACE’s deviation process and avoid another lengthy WCM update process?

USACE Required Level of Flood Protection

Ralph Questions R2a) - In analysing the 1997 event, scaled to 120% (SPF equivalent) found on pages 117-119 in the FVA Appendix,

With significant scalings, the local side inflows joining the Feather and Yuba rivers below ORO and NBB (and their predictability) become a limiting factor.

The level of damage from this SPF equivalent event is what one would expect from a Probable Maximum Flood (PMF) where saving the dam is the only priority. Oroville's outflows were about 300,000 cfs, nearly twice their constraints level with six feet of water flowing over the Auxiliary Spillway.

These exceedances occurred at Oroville Dam, upstream from any local tributaries, and were therefore a result of Oroville not passing its own share of the SPF equivalent event - 1997 event scaled to 120%. (1970 SPF 440,000 cfs peak flow)

Yuba-Feather FIRO Work Plan. Section 9.3.4 Metrics for Evaluating Viability and Efficiency of Alternatives

M4) - Pass the Standard Project Flood without exceeding 150,000 cfs releases.
(a USACE WCM requirement at Oroville for the last 55 years)

Follow up Question R2a.1) During the multiyear FIRO Viability Study did protecting the downstream communities from a SPF, a USACE WCM requirement at Oroville for the last 55 years become just a tentative consideration for evaluating viability?

Was there an objective to satisfy the 1970 WCM requirement and determine what FIRO Space was needed, or was the objective to mitigate some flood damage with what FIRO Space dam owners were willing to create?

Evaluation Results

Table 9-16. Tasks of the Yuba_Feather FIRO Final Work Plan to be completed for the hydrologics engineering studies of FIRO strategies

Task 6) Refine strategies if evaluation and comparison expose opportunities for "quick gains" through minor adjustments to strategies.

Prepare a final technical memo on simulation, evaluation, and comparison.
Submit for Steering Committee review and comments.

Follow Question R2a.2) Please provide the Oroville Citizen Advisory Commissioners the final technical memo on simulation, evaluation, and comparison submitted to the Steering Committee with a general summary of the comments regarding Oroville's inability to pass their own SPF inflows.

Follow up Question R2a.3) Were the independent members of the FIRO Viability Team given a chance to offer suggestions to the dam owners and regulators how the SPF equivalent event could be passed successfully?

R2b) - Was it the "hard constraint" to minimize the use of the Auxiliary Spillway in its current condition?

Use of the emergency spillway at ORO was not a constraint, but rather a performance metric. The modeling was completed with the ORO spillway and emergency spillway

in its current condition. For NBB, modeling was completed with the assumption of the new ARC spillway.

Sizing of Oroville Dam's FIRO Space

R3a) - In analysing the 1997 event, scaled to 120% (SPF equivalent) found on pages 117-119 in the FVA Appendix, why were Oroville's outflows held between only 50,000 cfs for ID4, and 90,000cfs for ID3 until just 24 hours before these peak inflows arrived.

The internal decision logic for both ID3 and ID4 are conditioned on the forecasts (and associated uncertainty) available at the time release decisions are simulated. Diagnostics for how model decisions are simulated at each timestep for each simulation are not addressed in the FVA.

Follow up Question R3a) Not thinking diagnostically, but looking at the hydrographs, indicates the early releases of ID4) smoothly evacuated most of the proposed FIRO Space about 4 days before peak flow occurred, but the size of Oroville's FIRO Space itself was not adequate for the 440,000 cfs inflows (SPF equivalent) that followed. Would you generally agree?

R3b)

If the FIRO Space could be temporarily lowered to elevation 813', (FCO-Gate level) during extreme events, an additional 300,000 af of water could have been pre released before peak inflows, thus minimizing the downstream damage.

That configuration of FIRO Space was not evaluated in the FVA.

Follow up Question R3b) Since recovery of the conservation pool was not a concern, was there infrastructure concerns regarding releases down to elevation 813 feet? Was there concerns regarding the stability of the FC-O gate intake channel, or increase seepage under the gatehouse with outflows at elevation 813'

R4a) - Was this option explored enough to run hydrographs on the outcome? **No. The FIRO Spaces used in the FVA were selected by the USACE, YWA, and SWP.**

R4b) - If not, why wasn't it considered, infrastructure stability, end of event water recovery? **The USACE has no authority to require a flood release from conservation storage. The fact that FIRO Space included a portion of the conservation storage reflects the interest of the SWP and YWA to help mitigate flooding associated with extreme events.**

R5a) -Table 4-1 Relative performance of FIRO alternatives (FIRO FVA page 63) listed the 1986, and 1997 historic events scaled by only 106% each, as the largest events to meet all the performance metrics, Does this approximately equate to a 90 yr and 200 yr level of flood protection?

The USACE has estimated the return frequencies for inflows to ORO and NBB. It is likely that the uniformly scaled events for the whole YF system have slightly different

return frequencies for the individual reservoirs. This question is better answered by the USACE.

Climate Change Altered Level of Flood Protection

Ralph Question R6a) - What's the current consensus from the scientific community for Oroville's projected climate altered stream flows for 2050 and 2075?

This question is beyond the scope of what was investigated in the FVA

Table 9-17 of Section 9.3.4 Metrics for Evaluating Viability in Y-F Final Work Plan requested frequency analysis with CVFPP climate change projections.

The Central Valley Flood Protection Plan (CVFPP) 2022 Update predicted climate change to increase peak inflows up to five times in the next 50 years, and the peak ARKFuture runoff is as much as 2-4 times higher than ARKHistory. Using these two credible studies lets use the average of three times higher in the next 50 years. By calculating compound interest (increase) that's an annual increase of 2.2%. Using this 2.2% annual increase for streamflows, in 26 years inflows would increase by 176.6%.

Page 85 of the FIRO PVA Appendices has a hydrograph for the 1997 event scaled to 90%. The peak inflow is 250,000 cfs and when multiplied by 176.6% equals 441,500 cfs. or equivalent to the 1970 SPF.

Page 121 of the FIRO FVA Appendices is Table G-3 listing CNRFC scaled events and associated return periods (developed by MBK Engineers). It has the 1997 event scaled to 90% as having a 106 year return period.

Therefore, one might conclude that the 1997 event scaled to 90% with current peak flows of 250,000 cfs could have climate altered inflow of 441,500 (SPF equivalent) in the year 2050 and have a 106 year return period? Oroville's outflows would be 300,000 cfs, twice their constraint level, the flows at Yuba City would peak at 150% their constraint level, levee overtopping would last 3 days, for this 106 year event. Using CVFPP estimate of inflows increasing by five times in next fifty years, this SPF event would be a 106 year event starting in 2040 (16 years)

Follow up Question R6a) - Since Section 9.3.4 Metrics for Evaluating Viability in the Y-F FIRO Work Plan requested frequency analysis using CVFPP climate change estimates, please share the results of those evaluations and methodology used.

Oroville Wetness Index

Ralph Question R7a) - Before including the soil wetness index in the FVA report, was any attempt made to run hydrology models using a starting flood pool of 350,000 acre feet (top of the wetness index pool) instead of 600,000 acre feet models?

The details of the ORO model development should be referred to the SWP.

R7b) - With all the hydrology models in the FVA report using the top of the FIRO space instead of the top of the wetness index, doesn't that skew the evaluations and conclusions in the report now that Oroville's Soil Wetness Index was included to shrink the size of the FIRO Space?

To properly compare ID3 and ID4 for ORO, they needed to start at the same reservoir elevation. The impact of ID4 using the wetness index to define the starting elevation for simulations was not evaluated in the FVA.

Follow up Question R7b.1 Regardless of the reasoning for not running hydrology models with a starting flood pool of 350,000 acre feet, the top of the wetness index, doesn't it skew the evaluations and conclusions in the Final Viability Report now that Oroville's Soil Wetness Index was included to shrink the size of the FIRO Space.

What type of evaluations were done before including a starting elevation of 350,000 acre feet as a recommended flood pool in the Yuba-Feather FIRO Final Viability Report?

Follow up Question R7b.2 What evaluations are recommended during the WCM update process, to evaluating the flood uncertainties associated with:

- 1) Calculating soil absorption, including the effects of fire scared and frozen terrain?

- 2) Not calculating the Snow Water Equivalency (SWE) as a watershed condition that is equally important in the sizing of the flood pool, regardless of Oroville's past practices.
(During the March 2017 spillway event it was estimated that the snowmelt increased water available for runoff by 37% over rain alone - Brian Henn)

- 3) Moving the start of spring refill from April 1st to March 1st, given the recent history of record snowpacks and warm AR storms in the middle of March?

- 4) Duration of river Levee Saturation with 600,000 af of prereleases being evacuated to bring the 350,000af flood pool down to 950,000af ahead of peak inflows,