



FRIENDS OF THE RIVER

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To: Ad Hoc Team leaders

Dear James and Jim,

DWR made available the spreadsheet with the Independent Review Board's recommendations to DWR with the status of DWR's review and response. As of yesterday, there have been three sets of recommendations.

Important CNA objective: My particular interest in the Comprehensive Needs Assessment (CNA) is that the Oroville Dam complex function competently, reliably, and without drama during the conduct of floodwater management operations up to the reservoir design flood. Also of interest would be its performance in its spillway design flood.

Events subsequent to CNA tasks: The CNA tasks were formulated before the October 25, 2018, letter from FERC's San Francisco office asserting that the reconstructed spillways were inadequately sized to meet the new or perhaps subsequent PMFs (in modern practice, the spillway-design-flood target), the expanded hilltop emergency spillway concrete would likely suffer moderate to severe damage at likely outflows associated with the new PMF, and the redesignation of the emergency spillway as an auxiliary spillway.

It also follows that the CNA tasks predated the recommendations of the November 23, 2018, FERC After Action Panel (FAAP) report to FERC's national Division of Dam Safety and Inspections that the auxiliary spillway be completed to reach the river.

Compliments to the IRB: The Independent Review Board (IRB) has made formal recommendations to DWR to expand, refine, and make more precise the CNA tasks. In general, they have been positive and helpful recommendations. It is impossible in a short memo to offer comments on each of the recommendations made by the IRB, but I can highlight some of particular interest — and highlight some potential CNA deficiencies to the objectives in the second paragraph of this memo. I suspect that the objectives are shared by all the members of the Ad Hoc group.

Some additional background to my primary CNA interest: First let me expand on the meaning of the second paragraph. Floodwater management operations here involve large releases (up to the reservoir design flood) from the dam's outlet works to the downstream river and floodway. In order to conduct these operations, the physical hardware must be in place, it must be reliable, a state-of-the-art operations plan exists, and operations should not be expected to cause significant undesirable damage to project works, the environment, or cause flooding outside of the floodway.

Spillway-design-flood operations are the largest flows that can be accommodated by the dam complex spillways. Hydrologies that exceed the reservoir design flood and up to the spillway design flood can be expected to trigger dam-safety operations.

IRB recommendations: I've noted a number of recommendations from the IRB that will be helpful to the reliability of the powerhouse and river valve outlet system (RVOS) outflows. They have made some recommendations about the main spillway gates. But I've selected some other IRB recommendations to highlight in this memo.

Change recommendations to Task 1: Task 1 is "Alternatives Evaluation to Restore Spillways Design Capacity to Pass the Probably [sic] Maximum Flood." MO1-14 recommends that the title of Task 1 be revised to: "Alternatives Evaluation to Ensure Spillway Integrity to Safely Pass the PMF." The subsequent MO3-7 changed that recommendation to the title to Task1 to be "Evaluating Measures to Enhance Spillway Reliability and Resiliency."

I suspect that the reason for the dropping of the PMF objective is recognition that FERC has yet to decide whether the spillway design flood will be the old, current, or potential future PMFs. This will be FERC's call, but DWR will have to develop in the CNA whatever engineering approaches to meet the need for expanded capacity.

A positive aspect of MO3-7 is that recommendation applies to the reservoir design flood, a modeled hydrologic event that does not assume that operations will cause significant damage to project works and project lands or cause flooding outside of the

floodway. One of the apparent lessons of the 1997 operations was that operators may depart from by-the-book operations, risking project objectives, if they believe that planned operations will cause havoc such as the unraveling of the auxiliary spillway hillside.

In light of the 1997 operations experience and the recent FERC letter and FAAP report, the IRB MO3-7 recommendation could definitely be improved by a slight revision: "Evaluating Measures to Enhance Spillway Competence to Meet Project Objectives, Reliability, and Resiliency." (*Underlined words*)

Presumably, project objectives would at least include reservoir-design-flood operations that don't result in throwing the auxiliary spillway hillside into the river.

I believe that the Ad Hoc group should make that recommendation to the IRB.

Finally, on this subject, it would be helpful to understand how long DWR has known that there was a revised PMF and how long have they known or considered likely that the existing and reconstructed spillway did not have sufficient capacity to meet the revised PMF. Also, what are the implications to FERC's question about the basis for the PMF in its October letter to DWR?

These are appropriate questions for the Ad Hoc group and the IRB to ask.

Evaluation of the Objective Release: The objective release is generally the maximum release from a dam for circumstances up to the reservoir design flood. It is generally not to be exceeded until a full or nearly full reservoir is experiencing inflows that exceed the objective release. In such circumstances, larger dam-safety releases of the emergency spillway release diagram are to be followed. These flows may test downstream levees to their limits and, if inflows are severe or long enough, may require outflows that unambiguously would overwhelm downstream levees.

IRB recommendation M2-05 asks DWR to justify the 150,000 cfs Oroville Dam objective release and to examine a range of objective release flows from 100,000 cfs to 200,000 cfs, presumably to examine more nuanced objective release outflows in varying circumstances against their risks to downstream levees and floodway resources versus the risk of unnecessary use of the emergency spillway release diagram.

This is a sophisticated recommendation that could improve the floodwater management capabilities of the dam complex if they were adopted as part of a Corps-

approved interim or long-term reservoir regulation manual update. (This approach is almost completely beyond the authority of DWR to implement.)

Such recommendations could also result in a more complicated reservoir regulation manual. It would also demand more sophisticated data collection, weather and runoff forecasts, conditions of downstream levees, status of upstream and downstream hydrology, levels of uncertainty, and require more multi-disciplinary staff involvement in making outflow decisions, particularly in floods approaching the size of the reservoir design flood or capacity of the downstream levee system.

Since the Central Valley Flood Protection Plan (CVFPP) is recommending expansion of the capacity of the Yolo Bypass and other nearby bypasses, if implemented this IRB recommendation could also improve Oroville Dam's floodwater management performance with time since the downstream conditions would likely be part of revised reservoir regulation manuals.

That said, the concept of a floating objective release carries elevated risks if not well designed and executed.

I would recommend that the Ad Hoc group have at least a brief discussion with the IRB and DWR highlighting our understandings as I have just discussed above.

Final thoughts: We should continue to press DWR on the implications of the October FERC letter, the FAAP report, and the IRB recommendations.

Obviously, the DWR CNA, FERC, and the Corps of Engineers are going to be shaping the size of the reservoir design and spillway design floods and thus the competence requirements of the floodwater management and dam-safety operations of Oroville Dam. John Lehigh has already suggested that the new reservoir design flood will be the presumably new standard project flood (SPF). This is an important insight into DWR's current thinking. It's a commendably conservative approach as well, since the Corps of Engineers, for purposes of defining the federal interest, moved to a benefit-cost approach nearly four decades ago — something that in the relatively rural Feather River basin might result in less ambitious floodwater management objectives for the Corps National Economic Development alternative than what might be the locally preferred project.

Clearly, the deliberations of the CNA, IRB, and the Ad Hoc group are going to be important to good outcomes.

It would probably be helpful if you circulated this letter to the Ad Hoc group before our upcoming January meeting. I also have no objections to this letter being circulated to the IRB and DWR.

Sincerely

A handwritten signature in blue ink, appearing to read "Ronald M. Stork". The signature is written in a cursive style with a prominent initial "R" and a stylized "S".

Ronald M. Stork