MEETING SUMMARY

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Oroville Dam Safety Comprehensive Needs Assessment Ad Hoc Group Meeting #2

October 30, 2018
8:00 a.m. to 11:45 a.m.
Oroville Field Division Conference Room
460 Glen Drive, Oroville

This meeting summary provides an overview of the October 30, 2018 Ad Hoc Group meeting and focuses primarily on capturing the questions posed by Ad Hoc Group members about the Oroville Dam Safety Comprehensive Needs Assessment (CNA) and the Independent Review Board (IRB) Memorandum Number 2; it also summarizes responses to these questions provided by California Department of Water Resources (DWR) staff or IRB members. This document is not intended to serve as minutes of the meeting or a transcript of the discussion. A video of and materials from the October 30, 2018 meeting are available on the CNA website: https://water.ca.gov/Programs/State-Water-Project/Oroville-Dam-Safety-Comprehensive-Needs-Assessment.

MEETING AGENDA

- Introductions and Opening Remarks
- Summary and description of information presented at the second IRB meeting
    - Further description and clarification of the CNA
    - Project integration and evaluation
    - Task 2 status update – CNA and the Water Control Manual
    - Task 3 status update – Flood control headworks
    - Task 5 status update – Embankment
- DWR responses to meeting 1 comments
- IRB summary of their second report
- Ad Hoc Group questions and discussion
- Meeting procedures: timing of material preparation
- Open Item

ATTENDEES

Co-chairs & Ad Hoc Group Members	IRB Members	DWR Staff	Meeting Support Staff & Others
• Assemblyman James Gallagher, Co-Chair • Senator Jim Nielsen, Co-Chair • John Yarbrough, DWR, Co-Chair • Supervisor Bill Connelly • Sean Earley	• Betty Andrews, Environmental Sciences Associates • Bruce Muller Jr., Independent Consultant • Paul Schweiger, Gannett Fleming, Inc.	• Ted Craddock • Sergio Escobar • Joel Ledesma • Dave Sarkisian • Eric See • Liza Whitmore • John Leahigh	• Terra Alpaugh, Kearns & West • Derek Bell, Butte County Sheriff's Lieutenant • Les Harder, HDR • Linda Manning, Council Oaks

- Curtis Grima
- Larry Grundmann
- Sheriff Kory Honea
- Matt Mentink
- Rob Olmstead
- Laura Page
- Rune Storesund
- Ron Stork
- Congressman Doug LaMalfa
- Daniel Wade, San Francisco Public Utilities Commission
- Lelio Mejia, Geosyntec Consultants
- Eric Poncelet, Kearns & West
- Steve Verigin, GEI

ACTION ITEMS

- The Ad Hoc Group will provide a list of written questions and comments for DWR and IRB response by November 27.
- Kearns & West (meeting coordinators) will produce a draft meeting summary for review by the co-chairs, and distribute the revised version to the Ad Hoc Group by November 16 as well as posting it online.
- John Leahigh and Sheriff Honea will meet to discuss the 2018-2019 Winter Operations plan and how DWR calculates a safe flood pool capacity.
- DWR will provide documentation of the geologic mapping of the footprint of the dam done during construction as well as photographs of the trench from that period.
- DWR will establish a method for updating their log of Ad Hoc Group/IRB questions and DWR responses and providing to the Ad Hoc Group on a regular schedule..

QUESTIONS FOR DWR and IRB

Overview of Information Presented

At the start of the meeting, the Ad Hoc Group co-chairs reviewed the meeting purpose. DWR explained that the presentations would be very similar to those at the October 10-11, 2018 IRB meeting but also incorporated some of DWR's initial responses to IRB feedback from that meeting. DWR staff clarified the CNA scope, introduced their new integration team and its work to refine a project-level management plan, and provided updates on Task 2, 3, and 5 work. DWR staff also introduced the draft winter 2018-2019 operations plan and described the status of U.S. Army Corps of Engineers (USACE) Water Control Manual discussions. IRB members presented an overview of the recommendations they made to DWR in their second memo.

Throughout and following these presentations, Ad Hoc Group members posed a suite of questions to DWR staff and IRB members; these are catalogued below and organized by agenda topic. The respondent (i.e. DWR or IRB) is indicated in parentheses before the response.

Questions on Project integration and evaluation

- Question (Q): Will the criteria for evaluating plans coming out of the CNA take into account new dam inspection legislation?

    - Response (R) (DWR): Yes.
- Q: Will any proposed measures or plans take into account the delivery ability of the whole State Water Project (e.g. its levees, bypasses)?
    - R (DWR): Oroville operations are governed by the USACE Flood Control Manual, as are downstream operations. DWR recognizes that the infrastructural changes proposed by the CNA will have operational implications; Task 2 of the CNA will assess and rank each measure based on operational metrics. Any infrastructural changes adopted out of the CNA process will be taken into account in the USACE Water Control Manual update process.
- Q: The Part 12D/ Level 2 Risk Analysis required by Congress will push the anticipated CNA schedule out by five months, moving the completion date to May 2020. How will that impact the CNA Ad Hoc Group's schedule?
    - R (DWR): DWR anticipates scheduling two additional meetings to address the additional content and extended timeline – for a total of eight Ad Hoc Group meetings.
- Q: The 12D analysis is a regularly occurring process. What caused the schedule extension?
    - R (DWR): The recent legislation required a specific risk analysis (Level 2) to be added to the Part 12D PFMA process. This additional risk analysis is not routinely done and required additional time to organize, resource, and prepare. Since the CNA was already underway, DWR decided to integrate the processes.
- Q: The proposed CNA schedule is very aggressive. Is that realistic? How confident is DWR that it can deliver on that timeline and maintain the high quality of its assessment?
    - R (DWR): The modifications to the timeline reflect two changes. First, DWR had to integrate the Level 2 Risk Analysis work into the schedule; this work is outside the CNA scope but will help inform the assessment. Second, in creating the Integration Team, DWR restructured its project management approach; as a result, sequencing and timing of deliverables has shifted. DWR staff emphasized that they are dedicated to producing a high quality assessment and are willing to adjust the schedule if needed to maintain that quality.
- Q: Ad Hoc Group members want to provide input during Phase 2 and Phase 3 of the CNA process, but those phases are scheduled over a relatively short several month span. With Ad Hoc Group Meetings scheduled quarterly, there may not be enough time to provide feedback to DWR, receive DWR responses, and provide additional input accordingly. Can DWR schedule additional Ad Hoc Group meetings during this period?
    - R (DWR): DWR needs to consider this request and asked that the Ad Hoc Group include this request along with their written comments so that the request would be captured.

<u>Questions on Task 2 and Other Flood Operations Activities</u>

- Q: The current flood curve failed to be protective enough in 1986, 1997, and 2017. The full update of the Water Control Manual will take multiple years. DWR has been able to develop and implement plans to make operations safer for the past two years. Can those modifications be made permanent via a process that would be less burdensome than the full update process?

- R (DWR): DWR has worked with USACE on all of its interim operations plans and will continue to do so going forward.
- R (Ad Hoc Group Member): It is under DWR's authority to operate more conservatively than the manual dictates in order to maintain public safety; however, DWR cannot conditionally store water in the USACE flood pool area without USACE approval. To hold and release water as needed and to be fully coordinated with downstream operations, DWR needs USACE involvement.
- R (DWR): The Governor has asked USACE to expedite the Water Control Manual update; the first step is to request Congress to allocate funding for the process. Then hydrologists will need to re-evaluate the watershed and establish a flood control curve reflective of current conditions. DWR anticipates that the Corps' Water Control Manual update will be a multi-year process. DWR will continue to issue interim plans until new Water Control Manual standards are established but also recognizes that USACE ultimately needs to lead the update process.
- C (IRB): It is wise to have interim operations plans for the reservoir. However, to the extent that those plans focus primarily on the objective of safely operating at Oroville to provide downstream flood protection, they may be limited in their focus. The USACE Water Control Manual must take the needs for the entire river into account and is a much larger endeavor that must balance multiple objectives.

- Q: The Federal Energy Regulatory Commission (FERC) recently sent DWR a letter noting that the probable maximum flood is larger than the main spillway capacity and advising that DWR should reclassify the emergency spillway as an auxiliary spillway. The standard project flood, to which DWR manages, is generally scaled to the probable maximum flood. If the standard project flood is bigger, does DWR still intend to manage to it?
  - R (DWR): The current standard project flood was not scaled from the probable maximum flood. The original probable maximum flood from 1968 was scaled up from the standard project flood, which was independently developed. The recently updated 2017 probable maximum flood was developed using a completely different methodology from the original. DWR anticipates that the standard project flood will change during the USACE Water Control Manual update process; it will likely be bigger given changing precipitation patterns due to climate change. These reevaluated flood flows, and any additional facilities that will be proposed as part of the CNA process will be two of many important considerations informing the development of an updated water control manual.
- Q: The recent FERC memo called for standard project flood and probable maximum flood projections using NOAA's Atlas 14 Method (which uses data up through 2004). DWR is basing its flood curves off older storm data (1997 and earlier). How would the proposed flood pools be able to manage the probable maximum flood? What would this look like on the graph of reservoir elevations?
  - R (DWR): DWR needs to consider this question and asked that the Ad Hoc Group include this request in along with its written comments so that the question would be captured.

Questions on Task 3 re: Flood Control Outlet/Headworks (FCO)

- Q: After the incident, we saw evidence of the degradation of rock underneath the spillway. Going forward, will any boring be done to monitor conditions? What are your monitoring plans?
    - R (DWR): During construction, DWR installed piezometers under the chute. In 2019, DWR plans to install piezometers under the FCO to monitor pressure. Engineering efforts are still underway to determine how to install that instrumentation without damaging the infrastructure. When DWR installs those piezometers, they plan to use that as an opportunity to bore down to the bedrock and check conditions. In actuality, the vast majority of intensely weathered rock on the chute was scoured away during the Spillway Incident. The remaining bedrock immediately downhill of the FCO (which was exposed during reconstruction of the chute) is of relatively high quality. Localized areas of weathered rock were over-excavated up to 7 feet below the structural slabs and replaced with concrete. Over the past year and a half, DWR has also done boring and other exploration of geologic features around the emergency spillway.
- Q: Are you also considering vegetation management?
    - R (DWR): Yes, DWR is examining the newest research out of UC Davis on vegetation management around dams.
- Q: Did the testing of drains and anchors show anything significant?
    - R (DWR): The drains examined looked good and gave us a high level of confidence in their overall condition. As the team completes the analysis, they will do sensitivity analyses to help us better understand what the impact of impaired drainage among some or all of the drains would be on the stability of the FCO.
    - R (DWR): Kiewit, at DWR's request, also tested the foundation anchors for the old chute that were exposed during demolition, just downstream of the FCO structure. Five of the six met the design load; the sixth test was done incorrectly so they had to disregard the results. DWR is having sensitivity analyses performed to better understand the risk of partial failures of the anchors that underlie the FCO and enhance its stability.
    - R (DWR): There are three methods of testing the radial gate anchor rods – ultrasonic for near surface flaws, dispersive waves that give an estimate of the tension in the rod, and another USACE ultrasonic method that identifies breaks in rods at depth. Thus far, DWR has results from the first two methods: the tension looks good, and we have not seen near surface flaws. USACE testing results are still pending. There have been two rods that cracked and failed, but there is a lot of redundancy. This is a topic the CNA is delving into given the age of the structure.

Questions on Task 5 re: Embankment

- Q: Was there any degradation of the bedrock over time?
    - R (DWR): During construction, the foundation for the core was excavated down to the highest quality rock (slightly weathered to fresh, and up to 80 feet below original ground). Much of this core foundation was then treated with cement. The core sits in a

trench that stretches across the bottom and into the sides of the canyon down to the bedrock. This treatment and the covering of the rock by the core material prevents any further deterioration.
    - R (DWR): For the rest of the dam, DWR excavated down to moderately weathered rock during construction. The bulk of the dam is made out of the old dredge tailings from the Feather River. Those are pervious.
- Q: Are there good documents that show how the dam core was constructed and that its foundation is indeed bedrock (as opposed to weathered rock)?
    - R (DWR): Yes, the footprint of the dam was mapped in detail during construction by geologists, and there are photographs of the trench which DWR can provide..
- Q: Do you have a budget figure on what it would cost to replace the piezometers?
    - R (DWR): There were 56 piezometers in the dam originally but not all need to be replaced, since some were intended only to monitor construction. We would like to put replacement piezometers in the foundation, but not in the core since placement could damage the core. It is not a matter of having adequate budget; DWR is figuring out how many are necessary and can be placed without damage to the structure.
- Q: Could DWR plug the non-functional tubes from the instrumentation areas to prevent any potential for leakage?
    - R (DWR): DWR considered grouting them up, but some tubes are up to 1,000 feet long, have multiple breaks in different zones, and it is unclear where the breaks are. Instead, DWR chose to cut the tubes near their ends in the instrument monitoring terminals to reduce pressures within the tubing bundles and to direct tubing flows out to points where the small drips can be monitored.
- Q: What is the significance of the dashed black line on the "variability of material properties dam materials" slide?
    - This graph shows testing data from construction illustrating the percent of sand/finer material present in the downstream Zone 3 shell material of the dam and is plotted as a function of elevation. The original design intent was to have 25% or less fine material, but there are areas of the dam where materials are dirtier than that. This 25% designation is marked on the graph by the vertical dashed black line. The vegetated area is one of the regions with dirtier materials, which helps explain why plants can establish there. As a result of this material being dirtier than originally anticipated, the designers revised the design and added a vertical chimney drain (Zone 5B) and a horizontal blanket drain (Zone 5A) to ensure proper drainage and to compensate for areas with fine materials.
- Q: Is DWR confident that none of the water measured on the non-reservoir side of the dam is coming from the reservoir side?
    - R (DWR): The core is almost impervious; a few gallons per minute weep through the core and drop down immediately through the pervious materials on the other side to the measurement chamber at the foot of the dam. There are no piezometers that are currently functional, but many were functional from 1965 to 2000, and all the ones

adjacent to the core never measured water above the low internal seepage collection pool that is used to collect and measure seepage.

Questions on IRB Memo #2

- Q: In its response to DWR's third question, the IRB recommended "consideration of measures to eliminate grid demand or grid failure as limiting factors for power plant capacity." Is the IRB saying DWR needs to explore operational or physical changes to ensure DWR has enough demand and can therefore use the powerhouse?
    - R (IRB): Yes, the recommendation is to assess whether powerhouse capacity being used could be an issue during an emergency – and to establish whether there are potential measures or redundancies that could be used to mitigate for this.

Questions on the DWR responses to AHG questions from meeting #1 log

- Q: The Ad Hoc Group found the comment log very helpful. The IRB agreed to add an item to the IRB Meeting agenda to establish whether DWR has sufficiently addressed/implemented or refuted items, so that the log is continually updated. Can the log could be updated and posted online on a monthly basis?
    - R (DWR): The IRB comment log will be updated after each IRB meeting as the IRB closes previous comments and adds new comments. Updated comment logs can be provided to the Ad Hoc Group shortly after each IRB meeting following the updates..
- Q: Given the speed of DWR work, should the IRB be meeting more frequently?
    - R (IRB): The current quarterly meetings seem reasonable in that they allow meaningful progress between meetings.

Additional Ad Hoc Group Questions

- Q: What is the status of the supplemental probable failure study? Some of the probable failure study reports are available but not the latest supplemental one.
    - R (DWR): This study focused on risks during construction. The analytical work was completed but the report has not yet been finalized. The reports will contain lists of potential failure modes and will require a redaction process before they could be made public. This work will be presented to the FERC part 12 D board.

KEY PERSPECTIVES & COMMENTS SHARED

- Ad Hoc Group members re-emphasized their perspective, as shared in the first Ad Hoc Group meeting, that the Comprehensive Needs Assessment should examine dam safety more broadly than its current scope allows. Rather than limiting itself to physical structures and operations, DWR should also study organizational weaknesses and look for integrated, multi-benefit measures to address the risks identified during the CNA process.

    - DWR staff explained that they appreciate those comments and that they have attempted to respond to them by creating an Integration Team. Rather than creating an additional integration task, they have created a project-management level team to evaluate all the measures produced by the six task teams and formulate potential plans that address the dam safety needs and best meet their evaluation criteria. Efforts to examine and address organizational weaknesses or other multi-benefit projects are being carried out in other arenas. DWR stressed that the Comprehensive Needs Assessment Project is an initiative to examine ways to make the existing facilities more reliable in order to reduce risks to the public. It is not to examine new projects to create either more reservoir storage or a new flood control/risk reduction project.
- DWR would like Ad Hoc Group input on additional or revised evaluation criteria for the measures and plans coming out of the CNA task work.
    - Ad Hoc Group members asked to include a criterion evaluating "impacts to recreation." Many of the measures that could come out of the CNA would impact recreation facilities and/or access. It is understood that the CNA is not planning recreational facilities around the dam, but it will change the existing conditions, and some proposals could require revising the recreation plan in the FERC license. Therefore, impacts to recreation should be one of the ways proposals are compared and evaluated.
    - Ad Hoc Group members asked that "maximizes public safety" and "maximizes worker safety" be treated as separate criteria to emphasize that they are distinct and important issues.
    - The IRB emphasized the importance of establishing these criteria before measures and plans are proposed as part of the CNA process. This eliminates the possibility of creating criteria that bias the choice toward one measure or another and provides credibility for the final recommendations.
- Ad Hoc Group members are concerned about the amount of time a full USACE Water Control Manual Update process may take. They emphasized that the hydrologic evaluation of the watershed that will result in a new flood curve should take into account the impacts of fires, potential State Water Resources Control Board (SWRCB) changes to stream flow standards, and the impacts of climate change on precipitation patterns, snow melt, and vegetation.
- Ad Hoc Group members would like to see that the studies and reports coming out of the CNA have been reviewed and signed by a licensed professional engineer to ensure quality assurance.
    - DWR confirmed that, typically, studies that will feed into the CNA processes have been and will continue to be signed and stamped by licensed professional engineers or engineering geologists, as appropriate.
- An Ad Hoc Group member would eventually like to see the data collected on drains, anchors, etc. to confirm that the headworks are adequate.
    - DWR reminded the group that everything discussed within the Ad Hoc Group is public; therefore, since the studies are focused on identifying areas of risk, not all the details will be made available for security reasons.

- DWR shared their plans to hire an expert in risk communication to translate the CNA engineering work into language the community can clearly understand. The Ad Hoc Group asked DWR to use group members as a resource in developing those risk communications methods, standards, and tools.
- Ad Hoc Group members would like DWR to consider incorporating the recommendations from the October 25, 2018 FERC letter into their winter 2018-2019 operations plan.

IMPORTANT DATES

- Ad Hoc Group Meeting #2 presentations and video published to website – 10/31/18
- Ad Hoc Group questions and comments due to DWR and IRB – 11/27/18
- Ad Hoc Group Meeting #2 summary posted to website – 11/16/18
- IRB Meeting #3 – 12/13/18 - 12/14/18
- Ad Hoc Group Meeting #3 material posted online – 1/3/19
- Ad Hoc Group Meeting #3 – 1/10/19