

STATE OF CALIFORNIA  
DEPARTMENT OF WATER RESOURCES  
**OROVILLE DAM SAFETY**  
**COMPREHENSIVE NEEDS ASSESSMENT**

# Independent Review Board Memorandum #5

Oroville Independent Review Board Meeting No. 5  
July 11-12, 2019





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# IRB Members

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# IRB Members

- (Elizabeth) Betty Andrews, Environmental Science Associates
- Dr. Lelio Mejia, Geosyntec Consultants
- Bruce Muller, US Bureau of Reclamation (Retired)
- Paul Schweiger, Gannett Fleming, Inc.
- Daniel Wade, San Francisco Public Utilities Commission





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# Past Recommendations

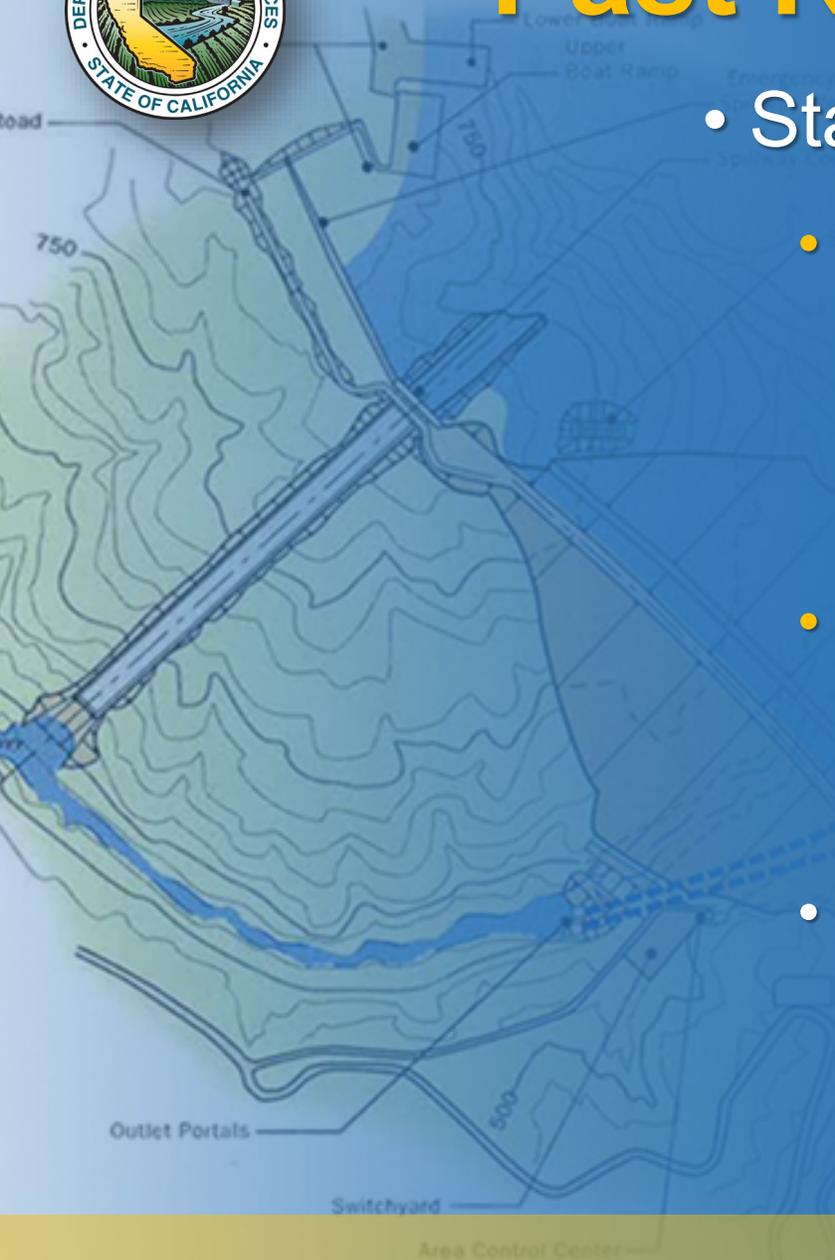
## Comment Log

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# Past Recommendations (Comment Log)

- Status Descriptions
  - **Under Consideration** – Project team is considering the recommendation, but hasn't committed to if or how the recommendation will be addressed.
  - **Planned** – The IRB has accepted the Project Team's response and an appropriate action is planned.
  - **In Progress** – The IRB sees evidence of the planned actions being underway.

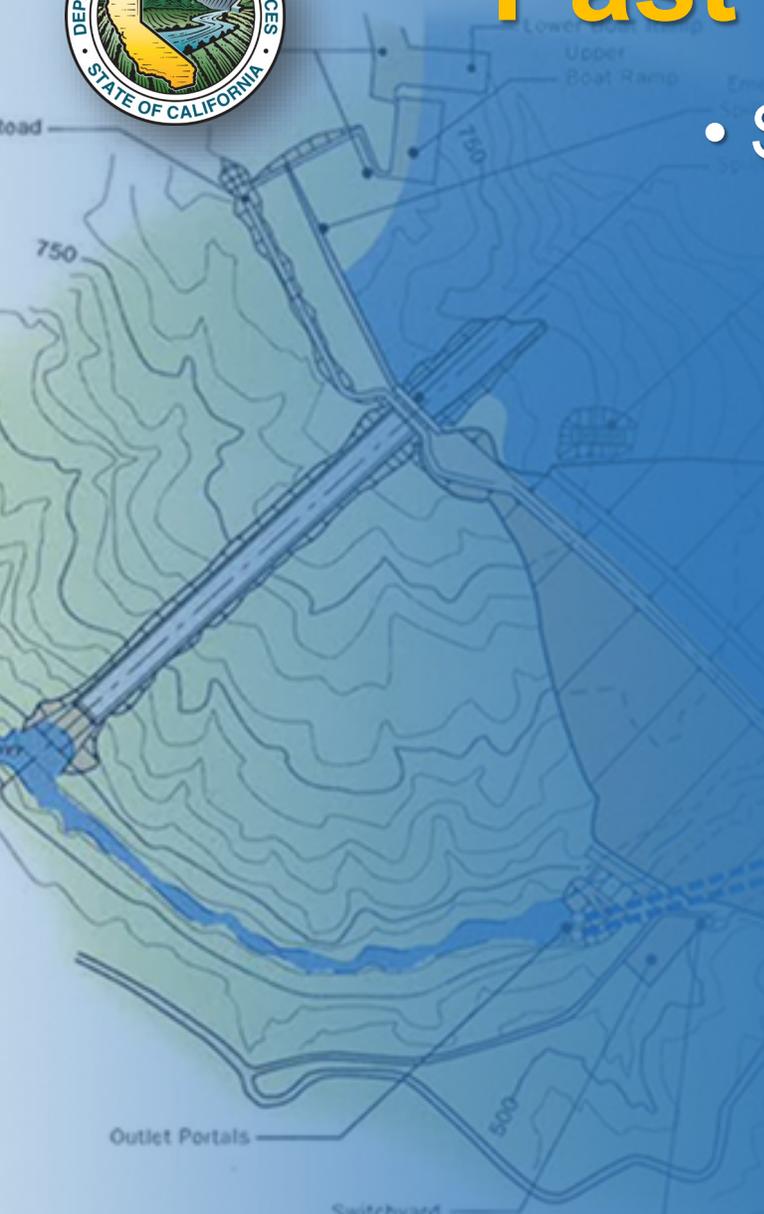




# Past Recommendations (Comment Log)

- Status Descriptions

- **Closed** – The IRB has reviewed and confirmed that the Project Team’s planned action has been completed and adequately addressed.
- **Not Adopted** – The Project Team didn’t adopt the recommendation. An explanation has been or will be provided.
- **Superseded** – The IRB has revised a prior recommendation to provide additional clarity.

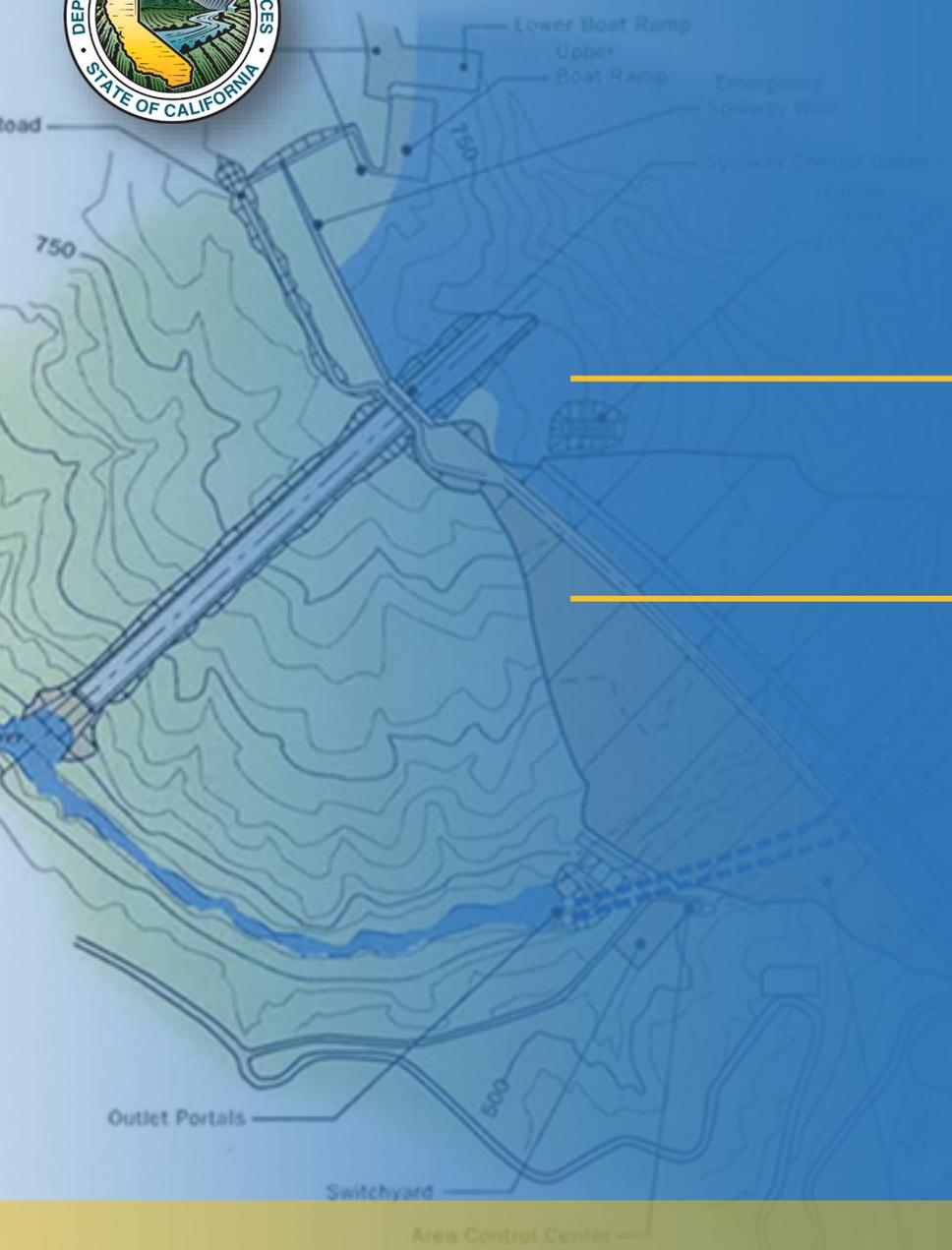




# Past Recommendations (Comment Log)

| Recommendation Status | IRB #1 | IRB #2 | IRB #3 | IRB #4 |
|-----------------------|--------|--------|--------|--------|
| Under Consideration   | 0      | 1      | 0      | 0      |
| Planned               | 3      | 3      | 2      | 1      |
| In Progress           | 9      | 5      | 3      | 2      |
| Closed                | 9      | 5      | 7      | 1      |
| Not Adopted           | 0      | 0      | 0      | 0      |
| Superseded            | 1      | 0      | 0      | 0      |
|                       | 22     | 14     | 12     | 4      |

Status as of 7/12/2019



# Report #5



# 1. Does the IRB have any recommendations or comments on the Task Team's Existing Conditions Assessment presentations?

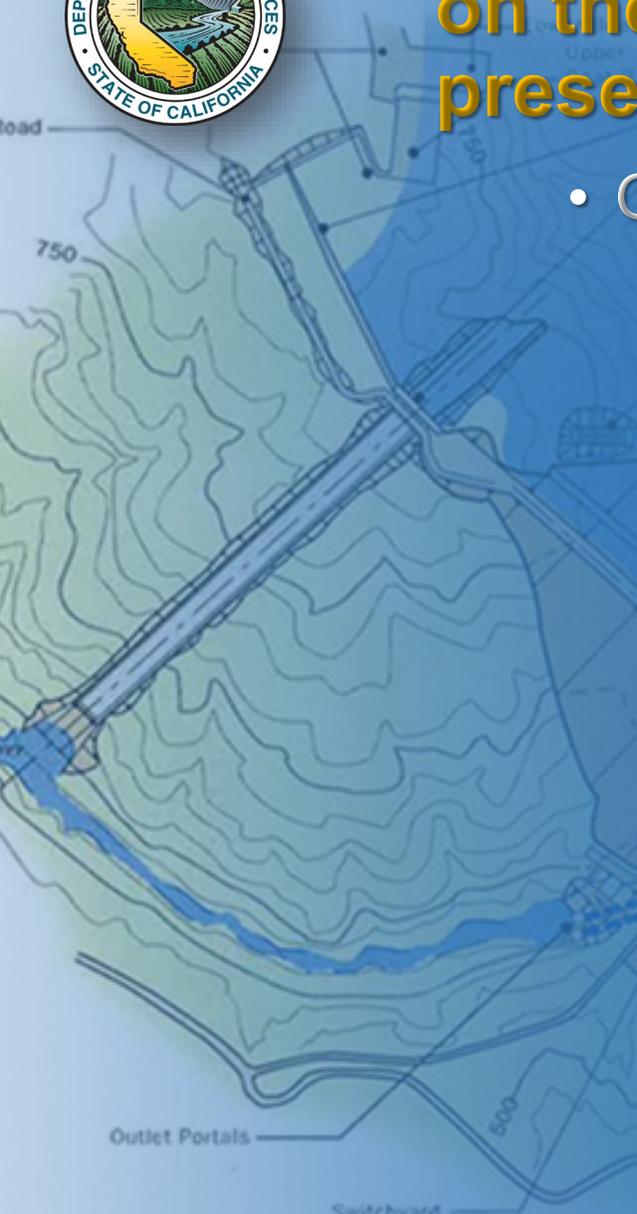
- Remarkable progress on the existing conditions assessment
- On track to successfully complete the study





# 1. Does the IRB have any recommendations or comments on the Task Team's Existing Conditions Assessment presentations?

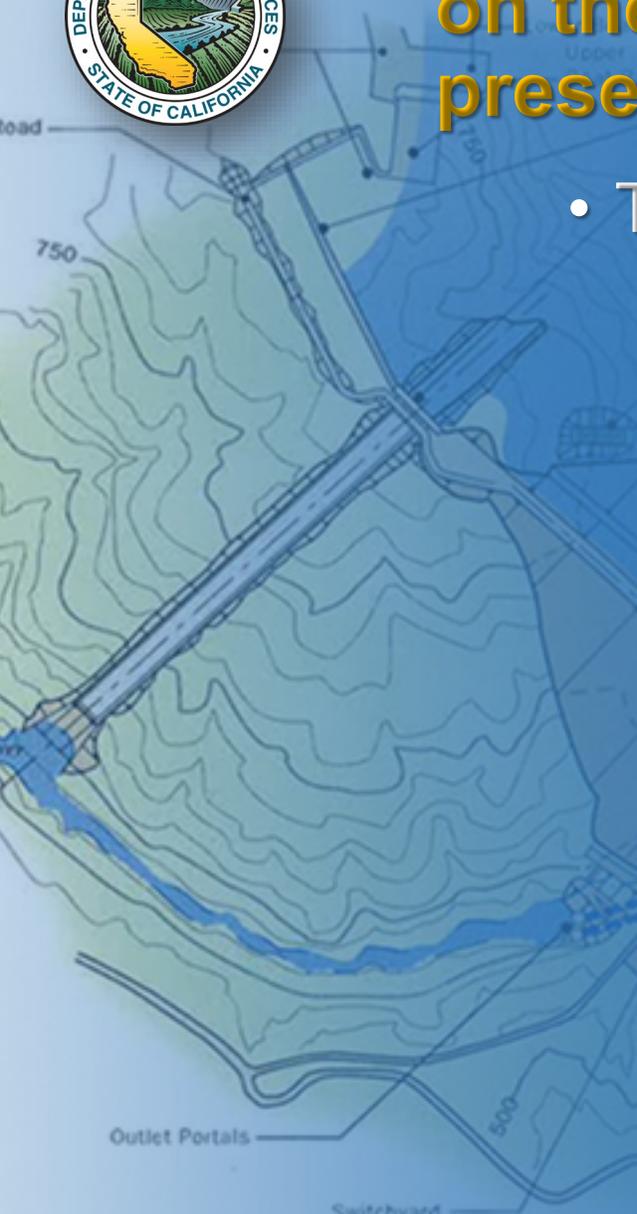
- General (applies to all tasks)
  - IRB Concurs with extension of Asset Management risk matrix
  - 372 Potential failure modes considered:
    - 127 Unique/credible that are deserving of additional effort
    - 407 Scenarios (to account for lesser loading conditions)
    - 2035 Consequences estimates (to account for different types of consequences)
  - IRB Agrees with screening approach (didn't review every failure mode).
  - Recommend keeping a record of PFM's screened out and why.
  - Recommend developing a process to incorporate consideration of uncertainty in the selection of risk reduction measures.
  - Agree with the use of incremental consequences but suggest also presenting and discussing total consequences (flood related).





# 1. Does the IRB have any recommendations or comments on the Task Team's Existing Conditions Assessment presentations?

- Task 1 – Emergency Spillway
  - Relying on operation of Flood Control Outlet (FCO) headworks and spillway as planned in assessing risk of emergency spillway operation. Several FCO potential failure modes could raise the likelihood of the emergency spillway operating.
  - The primary residual risk following 2017/2018 modifications - deposition of eroded material into the diversion pool – impacts on Hyatt PP and ability to evacuate the reservoir.
  - Suggest calibration/validation of the erosion model with observed behavior during 2017.
  - Consider simulation of plausible concentrated flow scenarios.

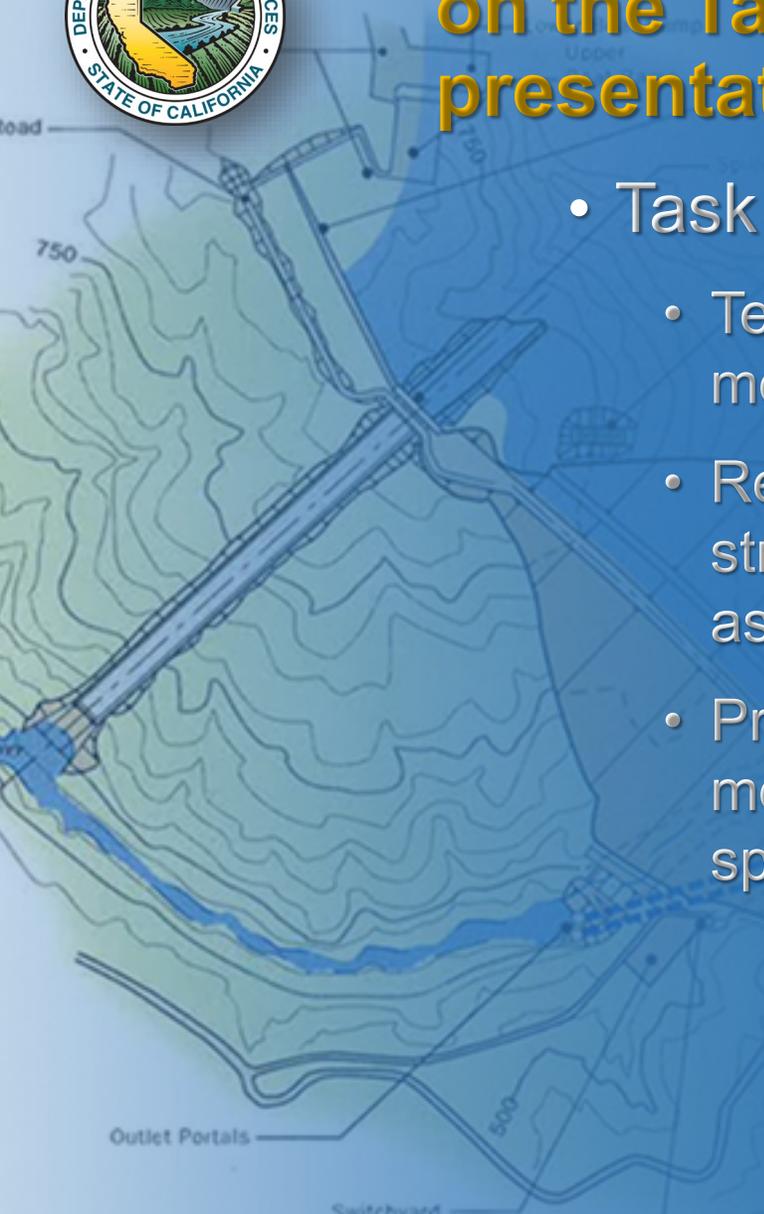




# 1. Does the IRB have any recommendations or comments on the Task Team's Existing Conditions Assessment presentations?

## • Task 3 – FCO Headworks and Spillway

- Tested CNA team's knowledge of dismissed potential failure modes by quizzing them on the backup power PFM.
- Recommend using the non-linear model to understand the stress/strain conditions for the headworks due to the loads associated with the revised probable maximum flood.
- Project Integration Team will consider FCO potential failure modes that could raise the probabilities used for emergency spillway operation.





# 1. Does the IRB have any recommendations or comments on the Task Team's Existing Conditions Assessment presentations?

## • Task 4 – Low-Level Outlets

- Significant diversity of team necessary to address the complexities of the outlets
- IRB agrees with the three levels of failure considered (uncontrolled release of reservoir, inability to deliver water, and systems not functioning as designed).
- IRB agrees with division of outlets into 4 systems:
  - Hyatt intake and conveyance
  - Hyatt power plant
  - River valve outlet system
  - Palermo tunnel
- Comparison to Level 2 risk analysis showed reasonably similar results.





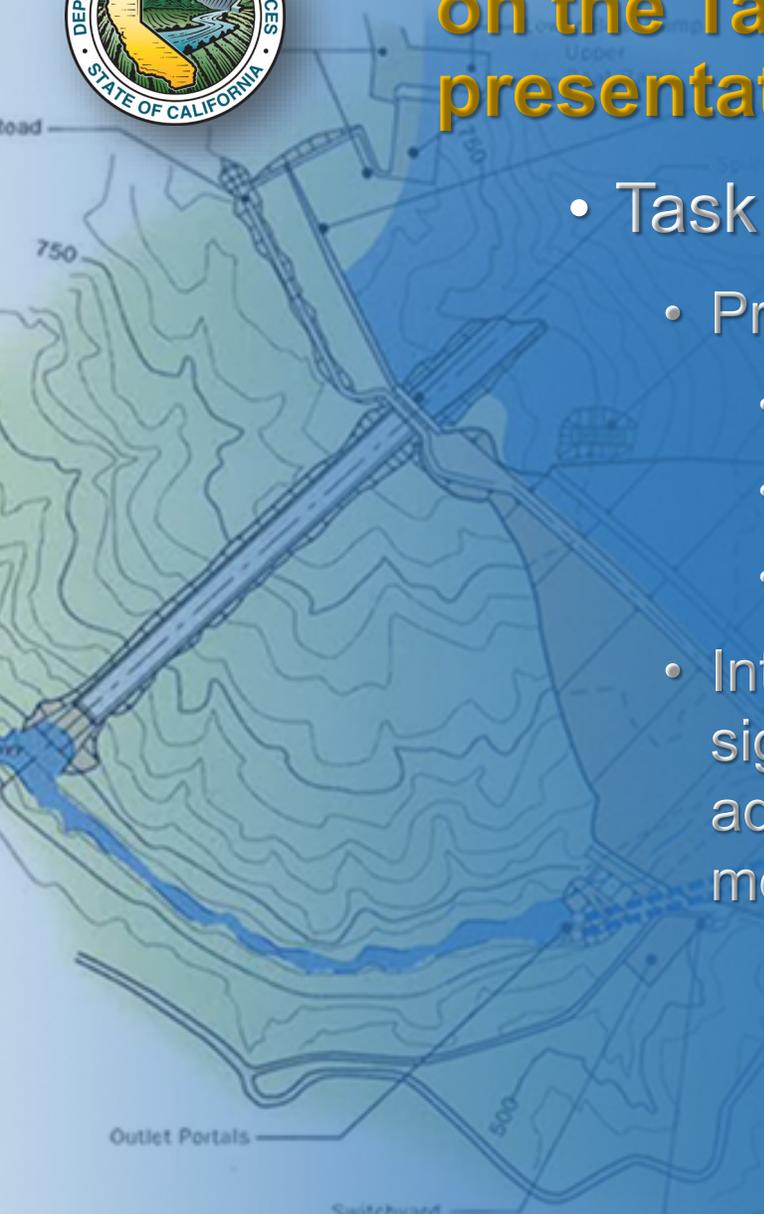
# 1. Does the IRB have any recommendations or comments on the Task Team's Existing Conditions Assessment presentations?

- Task 5 – Embankment

- Primary Risk drivers:

- Internal erosion
- Overtopping
- Instability

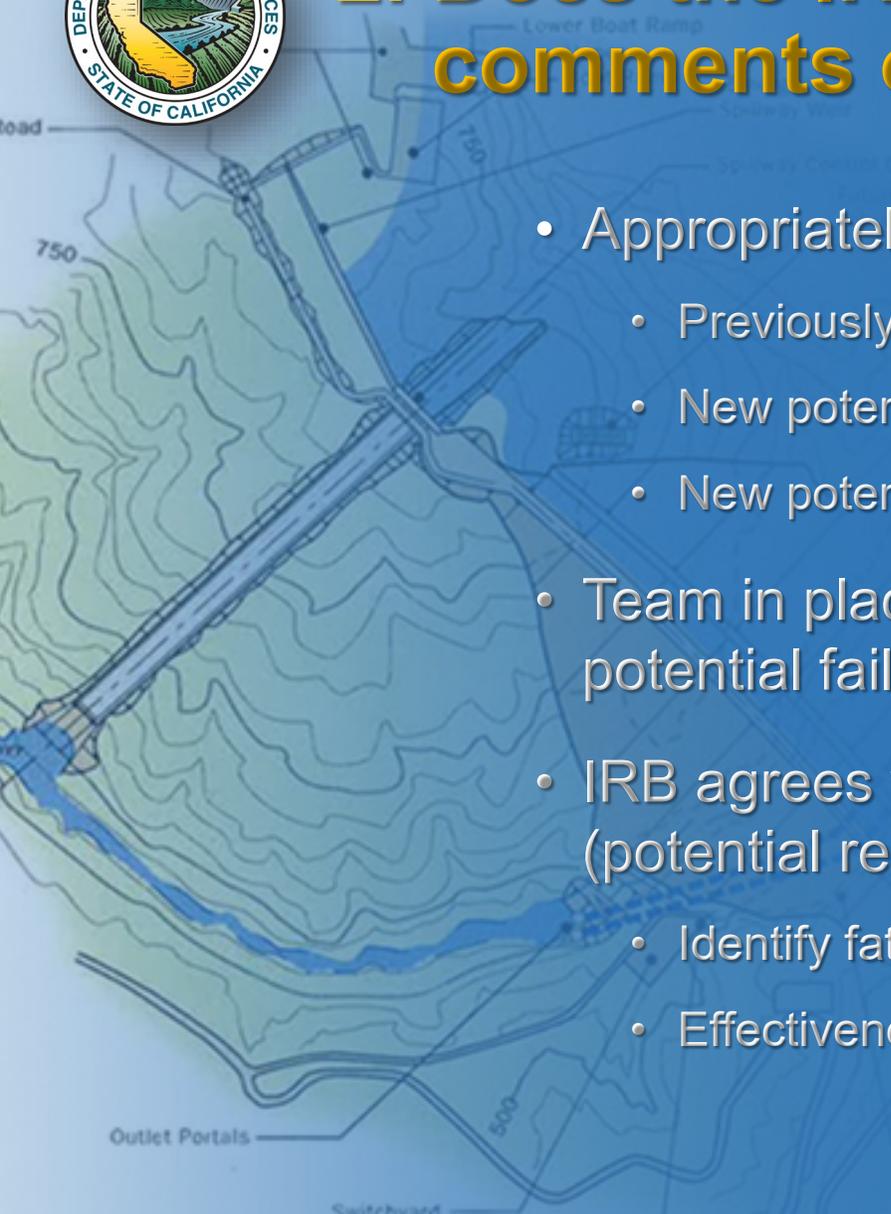
- Internal erosion potential failure modes generally have significant uncertainty. The IRB suggests attention be given to addressing uncertainty in the development of any remedial measures.





## 2. Does the IRB have any recommendations or comments on the CNA Screening Processes?

- Appropriately allows for consideration of:
  - Previously identified potential failure modes
  - New potential failure modes identified by the CNA teams
  - New potential failure modes identified by the Level 2 risk assessment team
- Team in place to review decisions not to fully develop any of the potential failure modes.
- IRB agrees with the process for reviewing “initial conceptual measures” (potential remedial actions) to identify “feasible measures”
  - Identify fatal flaws
  - Effectiveness in meeting project objectives (reducing risk)





### 3. Does the IRB have any recommendations or comments on the embankment piezometer installation?

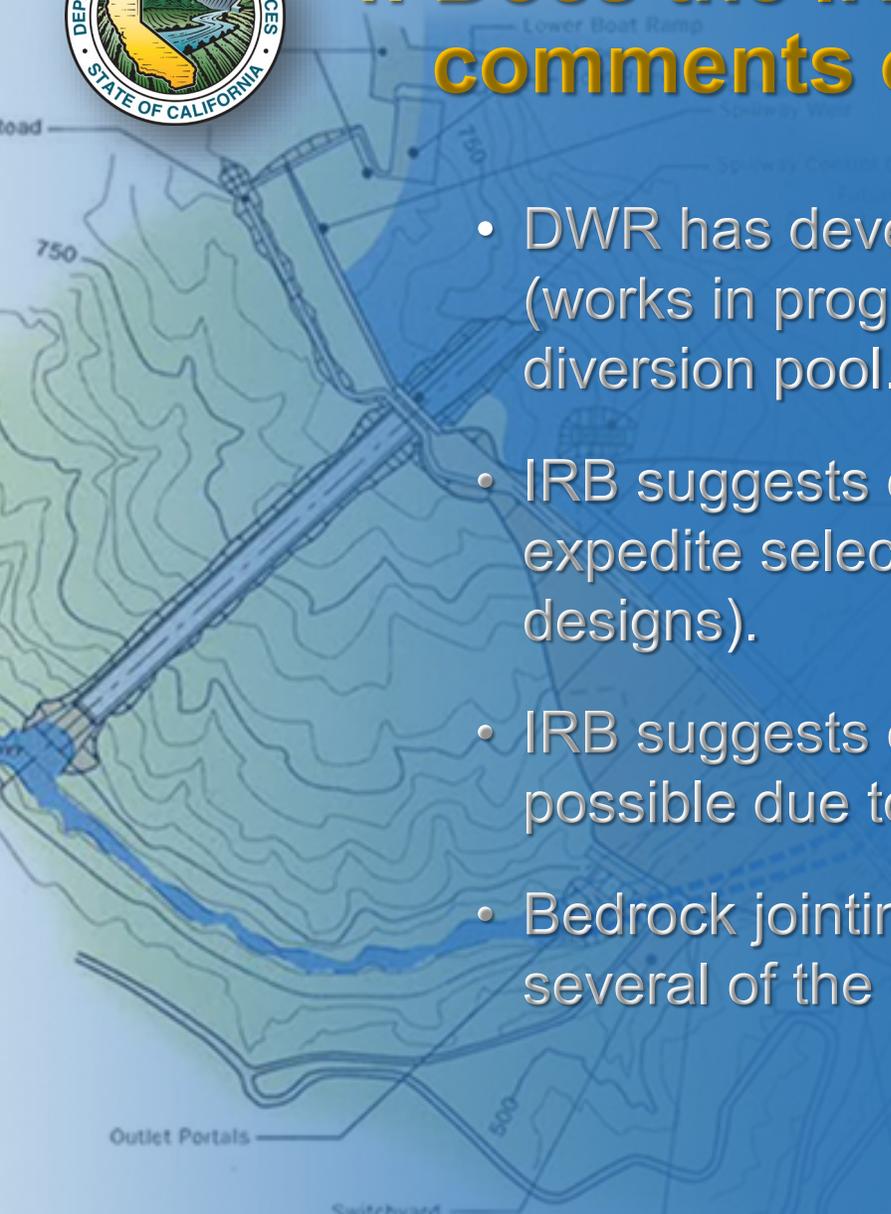
- Achieves the objective of identifying early risk reduction measures that reduce risk.
- IRB agrees in concept with the rationale presented for additional piezometers.
- IRB recommends consideration of two additional piezometers for redundancy in measuring water levels below Zone 5A upstream of the seepage barrier.





## 4. Does the IRB have any recommendations or comments on Task 1 – Preliminary Measures?

- DWR has developed a reasonably wide range of “conceptual measures” (works in progress) to address deposition of eroded material in the diversion pool.
- IRB suggests development of an efficient and consistent process to expedite selection of “candidate measures” (only need feasibility level designs).
- IRB suggests emphasizing channel alignments that are as straight as possible due to supercritical flows (difficult to change direction of flow).
- Bedrock jointing should be an important consideration in evaluating several of the conceptual measures under consideration.





## 5. Does the IRB have any recommendations or comments on the final and task-level report outlines?

- IRB commends the effort to develop a detailed report template for the task teams.
- IRB appreciates the use of text boxes to highlight key information.
- IRB agrees with separating the technical task team reports from the main report to protect critical energy infrastructure information.





## 6. Does the IRB have any recommendations or comments on the CNA comparison with the L2RA?

- Processes intersect for extreme events with life safety consequences.
- General agreement for vast majority of potential failure mode cases compared:
  - L2RA – industry experts with significant knowledge of dams throughout the nation and world
  - CNA – staff intimately familiar with details and history of Oroville Dam
- Differences appear to be randomly distributed (no indication of one group being more or less conservative than the other).
- Where differences are significant, CNA task teams are reviewing the bases of their estimates.
- Unique and effective QA opportunity.



## 7. Does the IRB have any recommendations or comments on the IRB Comments Log?

- Reviewed at the beginning of this presentation

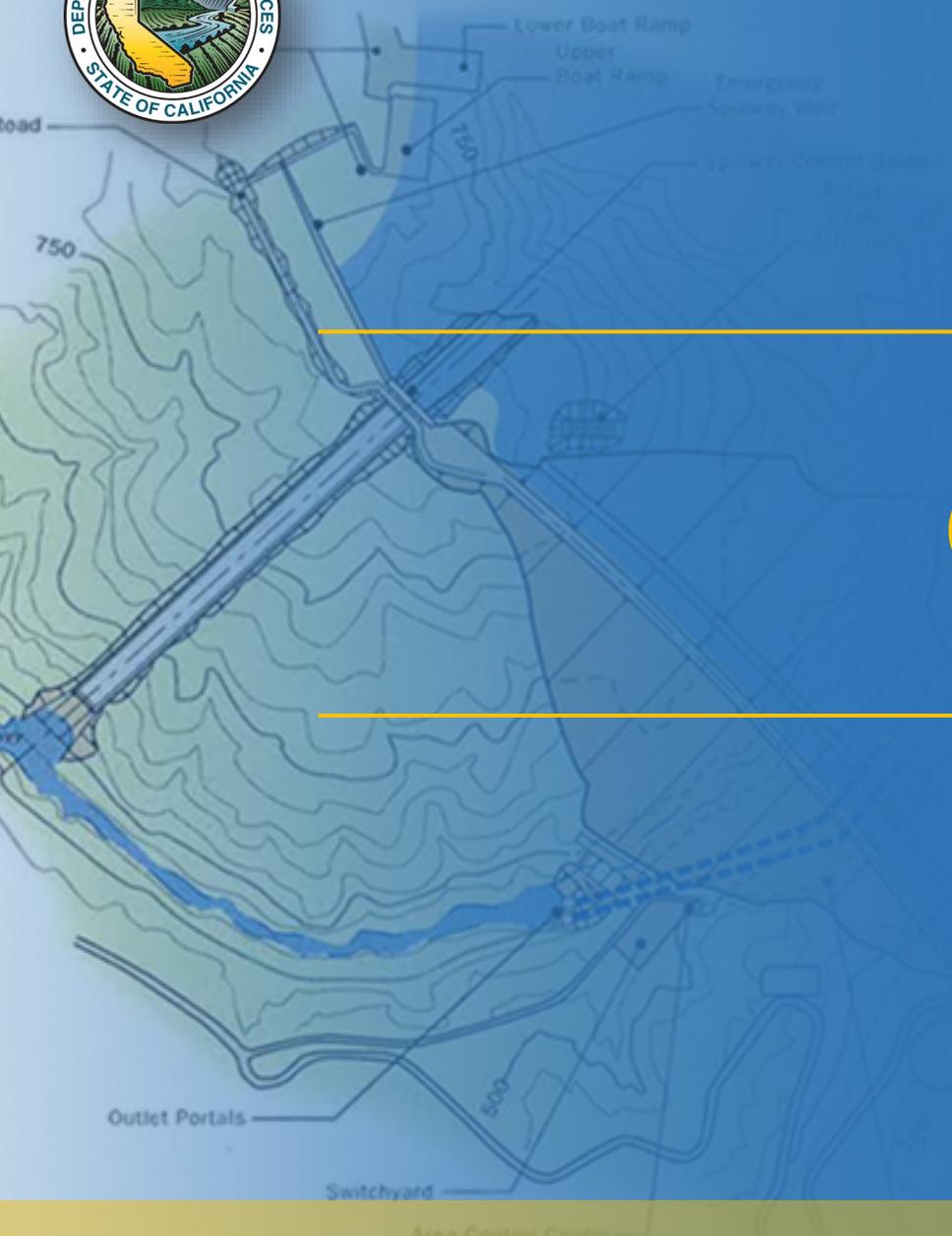




## 8. Does the IRB have any other recommendations or comments?

- Recommend revisiting the definitions for “direct” and “indirect” costs.
- Suggested topics for IRB meeting #6:
  - Results from completed CNA Existing Conditions Assessment and the L2RA
  - Progress reports for CNA tasks
    - Identification of measures for risk reduction
    - Identification of measures screened out from further consideration
    - Progress in completing process and background information in task reports





Questions?