ROLL CALL

- Lieutenant Collins
- Supervisor Connelly
- Supervisor Conant
- Secretary Crowfoot
- Chief Deputy Director Curry
- Supervisor Flores
- Supervisor Fuhrer
- Assemblyman Gallagher
- Supervisor Kimmelshue
- Deputy Licon
- Captain Million
- Director Nemeth
- Senator Nielsen
- Councilmember Pittman
- Mayor Reynolds
- Lieutenant Stokes
- Superintendent Teague
- Supervisor Vasquez
- Commissioner Widener
ITEM 1
WELCOME AND INTRODUCTIONS
ITEM 2
ACTION ITEMS, ROADMAP, 2022 REPORT
# Commission Action Items Tracker

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MEETING</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Report out how instrumentation performed and was managed during winter operations.</td>
<td>Mtg 2</td>
<td>Ongoing.</td>
</tr>
<tr>
<td>5. Discussion to help state agencies and local partners address homeless encampment concerns around Feather River.</td>
<td>Mtg 3</td>
<td>For future Commission consideration.</td>
</tr>
<tr>
<td>6. DWR updates on debris and storm inflows.</td>
<td>Mtg 5</td>
<td>DWR monitoring, will notify Commission as needed.</td>
</tr>
<tr>
<td>ITEM</td>
<td>MEETING</td>
<td>STATUS</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>8</td>
<td>Mtg 7</td>
<td>Completed. Hold ongoing Commission dialogue on the topic.</td>
</tr>
<tr>
<td>9</td>
<td>Mtg 7</td>
<td>Ongoing. Will address during annual dam safety and project updates.</td>
</tr>
<tr>
<td>10</td>
<td>Mtg 7</td>
<td>Ongoing.</td>
</tr>
<tr>
<td>11</td>
<td>Mtg 8</td>
<td>For future Commission consideration.</td>
</tr>
<tr>
<td>12</td>
<td>Mtg 8</td>
<td>For future Commission consideration.</td>
</tr>
<tr>
<td>13</td>
<td>Mtg 8</td>
<td>Completed.</td>
</tr>
<tr>
<td>14</td>
<td>Mtg 8</td>
<td>Update planned for 2022.</td>
</tr>
<tr>
<td>15</td>
<td>Mtg 9</td>
<td>Completed. CNRA provided update to Sen. Nielsen's office</td>
</tr>
<tr>
<td>16</td>
<td>Mtg 9</td>
<td>On track. Update at Q1 2022 meeting.</td>
</tr>
<tr>
<td>17</td>
<td>Mtg 9</td>
<td>On track. Update at Q1 2022 meeting.</td>
</tr>
<tr>
<td>18</td>
<td>Mtg 9</td>
<td>On track. Update at July 2022 meeting.</td>
</tr>
</tbody>
</table>
### Commission Roadmap

#### Stakeholder Technical Workshop (April 22, 2022)

**Topics**
- Flood safety
- Downstream community concerns
- Stakeholder input and questions

#### Public Meeting (July 29, 2022) Facilities and Safety

**Topics**
- Stakeholder Technical Workshop readout
- OCAC Report: First draft review/feedback
- Dam facilities asset management
- Dam facilities annual maintenance plan

**Status Updates**
- Drought updates
Commission Report
Development Timeline

- Review timeline for Report development (Aug 2021) COMPLETE
- High-Level Report Outline (December 2021) COMPLETE
- Present Detailed Report Outline (March 2022) COMPLETE
- Version 1 Draft Report (July 2022)
- Version 2 Draft Report (Q3 2022)
- Present Final Report (Q4 2022)
ITEM 3
DEPARTMENT OF WATER RESOURCES
UPDATES
State Water Project
Dam Safety Program Progress
New Piezometers and Palermo Intake

Oroville Citizens Advisory Commission Meeting
March 25, 2022

David Sarkisian, Manager
Dam Safety Services
Division of Operations and Maintenance
Status of Piezometer Installations

- New piezometers were identified through the Oroville Dam Safety Comprehensive Needs Assessment (CNA) and endorsed by the CNA Independent Review Board and 10th Part 12D Independent Consulting Board as *Early Implementation Projects*.
  - Flood Control Outlet piezometers
  - Oroville Dam Toe piezometers
  - Oroville Dam Coreblock and Grout Gallery piezometers
- Federal Energy Regulatory Commission (FERC) and Division of Safety of Dams (DSOD) review and approval required prior to installation.
Flood Control Outlet Piezometers

- Four piezometers installed in 2020, each outfitted with two vibrating wire instruments for redundancy.
- Replace original instruments that reached their useful life in mid-2000’s.
- Provide information on uplift pressures and effectiveness of grout curtain and drains.
- Since installation, low reservoir levels (less than 800 feet) have persisted.
- One piezometer has shown a modest response to precipitation.
Oroville Dam Toe Piezometers

- Eight piezometers installed in 2020, each outfitted with real-time vibrating wire instruments.
- Enhances surveillance for internal erosion-related potential failure modes and informs seepage analyses and modeling.
- Data has further demonstrated the strong influence of precipitation on groundwater levels within the “seepage collection pool” within the dam.
Oroville Dam Coreblock and Grout Gallery Piezometers

- Eight piezometers planned, as well as improvements to seepage weir instrumentation.
- Enhances surveillance for numerous internal erosion-related potential failure modes and informs seepage analyses and modeling.
- Installation planned for Fall 2022.
Palermo Tunnel Bulkhead Closure Improvements

• 2016: Bulkhead removal and tunnel inspection via remotely operated vehicle – Elev 575 ft.
• 2017-2018 Bulkhead Refurbishment
• Project Mobilization - September 27th-29th, 2021
  – Intake Location and Cleaning
  – Trashrack Removal
  – Bulkhead Template Testing
  – New Pulley System Installation
  – Bulkhead Installation & Commissioning
• De-Mobilization - December 20th-21st, 2021
Palermo Tunnel Bulkhead Closure

Mobilization

Staging

Template

Commissioning
Thank you
ITEM 4
RISK SCENARIO PRESENTATION
Cal OES Hazard Mitigation Plan Grant Opportunity

Update to the Local Hazard Mitigation Plan
Characterizing Hazard from Elevated Oroville Dam Releases

Dr. Rune Storesund, P.E., G.E.
Director & Principal Consultant
SafeR³ (non-profit)
Overview

• Hazard: Elevated releases from Oroville Dam

• Risk (consequences) not documented
  • Releases above 150,000 cfs (probable maximum flood release 625,000 cfs)
  • Evacuation areas sequencing & routes
  • Evacuation timing

• Quantifying consequences important for ‘benefit/cost’ evaluations
  • Installation of Oroville Dam ‘low-level outlet’ to allow releases well before major storms
  • Bolstering downstream flood conveyance and flood systems

• Submit Cal OES HMPG to update LHMP to include hazard from elevated releases
Assume this is not a full dam breach, but rather 'safety incidents'....

### Table ES-2 Butte County Hazard Identification Assessment

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Geographic Extent</th>
<th>Likelihood of Future Occurrences</th>
<th>Magnitude/Severity</th>
<th>Significance</th>
<th>Climate Change Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate Change</td>
<td>Extensive</td>
<td>Likely</td>
<td>Limited</td>
<td>Medium</td>
<td>–</td>
</tr>
<tr>
<td>Dam Failure</td>
<td>Extensive</td>
<td>Occasional</td>
<td>Catastrophic</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Drought &amp; Water shortage</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Earthquake and Liquefaction</td>
<td>Extensive</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Flooeds: 100/200/500 year</td>
<td>Significant</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Flooeds: Localized Stormwater</td>
<td>Significant</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Hazardous Materials Transport</td>
<td>Significant</td>
<td>Likely</td>
<td>Limited</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Invasive Species: Aquatic</td>
<td>Limited</td>
<td>Likely</td>
<td>Limited</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Invasive Species: Pests/Plants</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Landslide, Mudslide, and Debris Flow</td>
<td>Significant</td>
<td>Likely</td>
<td>Critical</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Levee Failure</td>
<td>Significant</td>
<td>Occasional</td>
<td>Critical</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Severe Weather: Extreme Heat</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Severe Weather: Freeze and Winter Storm</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Severe Weather: Heavy Rain and Storms (Hail, Lightning)</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Severe Weather: Wind and Tornado</td>
<td>Extensive</td>
<td>Highly Likely/likely</td>
<td>Critical</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Stream Bank Erosion</td>
<td>Significant</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Volcano</td>
<td>Extensive</td>
<td>Unlikely</td>
<td>Negligible</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Wildfire</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Catastrophic</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>
HAZARD LIKELIHOOD

1997 Oroville Evacuation @ ~165,000 cfs

ELEVATED OROVILLE DAM RELEASES

150,000 cfs 200,000 cfs 300,000 cfs 400,000 cfs 500,000 cfs 625,000 cfs

Drought/Water Shortage
Floods (Localized Stormwater)
Severe Weather
  Extreme Heat
  Freeze/Winter Storm
Wildfires

Earthquake > Mw 7.0
Full Dam Failure
Volcano
“Ark Storm”
CHAPTER 8 - PROJECT ACCOMPLISHMENTS

45. EXAMPLES OF OPERATION

a. Routings of the December 1955 flood, January and December 1964 flood in accordance with the flood (chart A-1) is graphically presented on chart 31.

b. Coordination of reservoir operation for flood control between Oroville and Yuba River Reservoirs is shown in chart 31. The chart shows the results of a coordinated operation of Oroville and New Bullards Bar Reservoirs, with primary standard project storm centered on Feather River Basin above Oroville and coordinate operation of Oroville and New Bullards Bar Reservoirs, with primary standard project storm centered on Yuba River below New Bullards Bar and Marysville reservoirs, with primary standard project storm centered on Marysville reservoirs.

c. Hypothetical operation of Oroville Reservoir during the spillway design flood is shown in graphical form on chart 35. The routing of this flood by the Department of Water Resources starts at gross pool elevation and attains a maximum storage of 3,617,000 acre-feet (at 917 ft. elevation) and a maximum outflow of 623,200 c.f.s.

d. Stage-duration curves are presented on chart 34, a stage frequency curve on chart 35, and seasonal variation of reservoir storage frequency on chart 36.

e. Project and preproject rain-flood frequency curves are shown on chart B-2 (asheet 3).
Collaboration Overview

1. Submit NOI to Cal OES HMPG (letters of support)
   DUE: April 8, 2022 (very soon!)

2. Update LHMP
   A) Generate Inundation Maps (work with DWR, use existing models):
      200,000 cfs  250,000 cfs  300,000 cfs  350,000 cfs  400,000 cfs
      450,000 cfs  500,000 cfs  550,000 cfs  600,000 cfs  650,000 cfs
   B) Establish Evacuation Zones, Routes, and Warning Times
   C) Identify and list impacted critical infrastructures
   D) Estimate life-loss, economic, and environmental damage costs
   E) Frame and quantify recommended proactive risk-reduction actions (future HMPG ‘projects’)
THANK YOU!

Dr. Rune Storesund, P.E., G.E.
SafeR³ (non-profit)
154 Lawson Road
Kensington, CA 94707

rune@safer3.world
(510) 225-5389
ITEM 5
PUBLIC SAFETY PARTNERSHIPS
Dam Safety
Planning Division

Emergency Action Plans
Water Code Sections 6160 and 6161

- Owners of state-regulated, jurisdictional dams must submit an Emergency Action Plan (EAP) to Cal OES and DWR if classified as EH, H, or S
- EAP must include a DWR-approved inundation map
- Includes deadlines for submissions
- Cal OES review timelines are given
- Owners must update the EAP, including the map, at a minimum every 10 years
Government Code Section 8589.5

• EAP must be developed in consultation with local public safety agencies
• EAP must adhere to FEMA’s Guidelines
  • 6 Elements of an EAP

<table>
<thead>
<tr>
<th>Emergency Notification Flowcharts</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparedness Activities</td>
<td>Inundation Maps</td>
</tr>
<tr>
<td>Response Process</td>
<td>Additional Info in Appendices</td>
</tr>
</tbody>
</table>

• Dam owner must conduct an EAP notification exercise with local public safety agencies once a year
California Jurisdictional Dams

- Extremely High: 264
- High: 440
- Significant: 171
- Low: 367
  - No mapping or EAP requirement

- Total: 1,242 dams
Emergency Action Plans

What is an EAP?

• Identifies potential emergency conditions at a dam
• Specifies actions to be followed to minimize property damage or loss of life
• Based on approved inundation maps, which show critical areas of evacuation in case of a dam emergency
Dam Owner Outreach to Public Safety Agencies

Who

- Those impacted by dam incident
  - Local: law enforcement, fire, OES,
  - State/Fed: NWS, DWR (DSOD, FOC), Cal OES

How

- Meetings, phone calls, etc.

When

- Earlier is better
- Have something to show those groups
Incorporating Outreach into Plan

Methods to Meet Statutory Requirement:

• Signature Page

• Narrative explaining which agencies were consulted during development of the plan and what the contributions were

• Agenda, sign-in roster, and minutes from EAP development meeting(s)

• Include the agencies’ roles within the EAP
Notification Flowcharts

Flowcharts

- Identifies who is to be notified of a dam safety incident, by whom, and in what order.
- One chart or a set of charts may be needed depending on the complexity on the hazards associated with the dam and affected downstream areas.
- Should include emergency level, individuals who will conduct notifications, prioritization of notifications, individuals who will be notified.
Questions?

Lori Nezhura
Deputy Director, Planning Preparedness, and Prevention
Cal OES
State Water Project
Inundation Mapping for Oroville Dam

Oroville Citizens Advisory Commission Meeting
March 25, 2022

David Sarkisian, Manager
Dam Safety Services
Division of Operations and Maintenance
Oroville-Thermalito Complex Inundation Maps

- Illustrate flooding that could result from a hypothetical failure of a dam.
- Included in a dam’s Emergency Action Plan to inform the owner and downstream emergency management agencies.
- Prior to 2017, inundation maps were largely driven by FERC requirements.
- Pre-2017 Inundation Mapping Efforts for Oroville Dam
  - 2013 Fair Weather Failure of Oroville Dam – included in EAP
  - 2015 - Hypothetical Gate Failure Inundation Maps for Oroville and Thermalito Diversion Dams
Senate Bill 92

- In 2017, Senate Bill amended California Water Code to require all state jurisdictional dams, except low hazard dams, to have inundation maps and emergency action plans.
  - DSOD approves inundation maps
  - CalOES approves emergency action plans
  - Included inundation maps for critical appurtenant structures (CAS).
- 2018 Mapping Efforts for Oroville Dam CAS’
  - Emergency Spillway
  - Flood Control Outlet
  - Parish Camp Saddle Dam
  - Bidwell Bar Canyon Saddle Dam
- Maps available on DSOD’s website
  https://fmds.water.ca.gov/maps/damim/
Inundation Map Content

- Regulations require that maps depict Fair Weather scenarios
  - Initial Wave Arrival Time (1-foot)
  - Maximum Depth
  - Maximum Velocity
  - Deflood Time
- Information is intended to inform Public Safety Agencies (PSAs).
- Particularly useful for PSAs and communities for evacuation and recovery planning.
Thermalito Facilities Inundation Mapping

- Thermalito Diversion Dam Fair Weather Failure
- Thermalito Diversion Dam Radial Gate Failures
- Thermalito Forebay Dam and Headworks Fair Weather Failure
- Thermalito Afterbay Dam (multiple breach locations) Fair Weather Failure

- In 2017, DWR developed “incremental flow” inundation maps to better understand the downstream channel capacity.
- Assumption: Levees overtop but do not fail.
- Two hydrograph patterns utilized
  - High Volume & Low Volume Event
  - For each event, maps developed for 100K, 125K, 150K, 175K, 225K, 300K, and 400K
Summary

• The 2017 legislation and regulations for inundation mapping have enhanced public safety and awareness in regard to dam-related flood hazards.

• There are numerous inputs and parameters to consider in hydraulic modeling – each inundation map is unique and applies to its specific scenario.

• Hydraulic models developed to generate Fair Weather Failure Inundation Maps for EAPs can be leveraged to answer a multitude of questions and hypothetical scenarios.

• GIS shapefiles from inundation maps are being leveraged by Public Safety Agencies for their planning.
Questions?

Thank you.
ITEM 6
PUBLIC COMMENT

The Oroville Dam Citizens Advisory Commission will now take public comment.

We appreciate your input.
ITEM 7
ADJOURN

Thank you all for joining us today, our next Oroville Dam Citizens Advisory Commission meeting will be on July 29, 2022.