



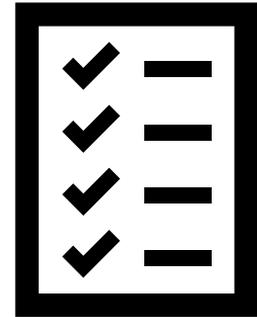
## **FIRO + New Bullards Bar Secondary Spillway: Enhancing public safety and climate change resiliency**

**John James, Yuba Water Agency**



# Today's Agenda

- **Yuba County flood history / Forecast**  
**Coordinated Operations**
- Yuba-Feather FIRO program
- New Bullards Bar Secondary Spillway project
- Questions



# Yuba County Flood History: Major Flood Events (1955)



## 10,000 Flee For Lives In Northern California

**Army Takes Over in Peru, Revolt Ends**

Violence Subsides in Arequipa After Troops Move In

**Fate of Whole Race at Stake Warns Pope**

Calls for Ban on Nuclear Tests in Christmas Message

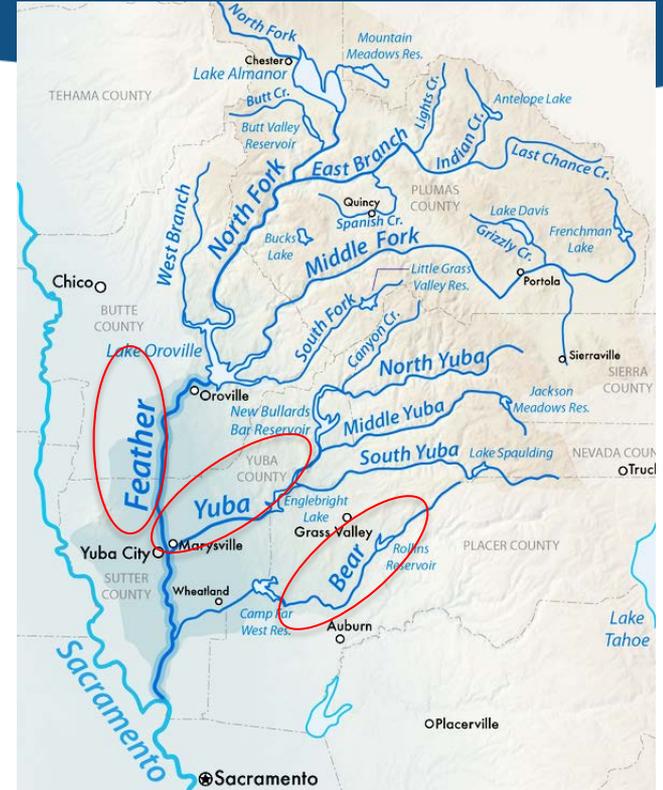
**Urgent Plea Sounded for Aid in Flood**

An urgent appeal to Yuba County residents to help their neighbors in the north-central California area was broadcast when Earl Zoltz, president of the Junior Chamber of Commerce, requested a \$100,000 loan from the Federal Reserve to help pay for the purchase of food, clothing, and blankets for the flood victims.

**Levee Break at Yuba City Floods Town**

Refugees from Marysville Forced to Flee Again

SAN FRANCISCO — The Pacific Star-Tribune Staff



# Yuba County Flood History: Major Flood Events (1986)

**February 20, 1986:** As the Yuba River recedes after a week of historic flows, a portion of the levee protecting Linda collapses, killing two and inundating 4,000 homes

**Early 1990:** Yuba Water requests Congress and U.S. Army Corps of Engineers initiate the Yuba River Basin Project to bring a 200-year level of flood protection to Yuba County



*The Peach Tree Mall and nearby lumber mill sit underwater just above a flooded North Beale Road.*

# Yuba County Flood History: Major Flood Events (1997)

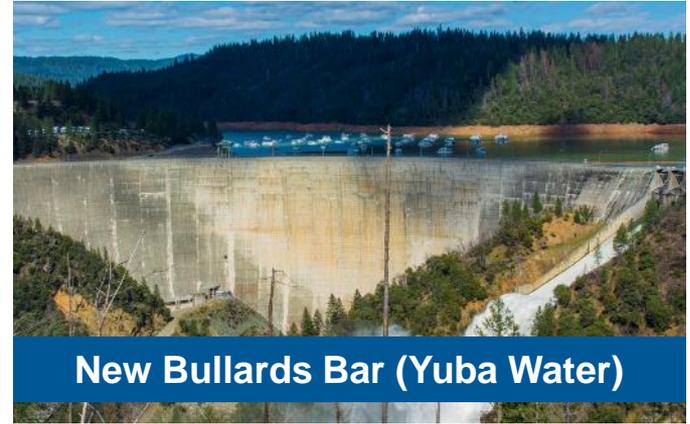
**January 2, 1997:** After eight days of heavy rainfall that caused rapid snowmelt and runoff and swollen rivers, two levee breaches claim three lives and nearly 1,000 homes



*Southern Yuba County near present day Plumas Lake and communities of Olivehurst, Linda and Arboga were hit especially hard during '97 flood.*



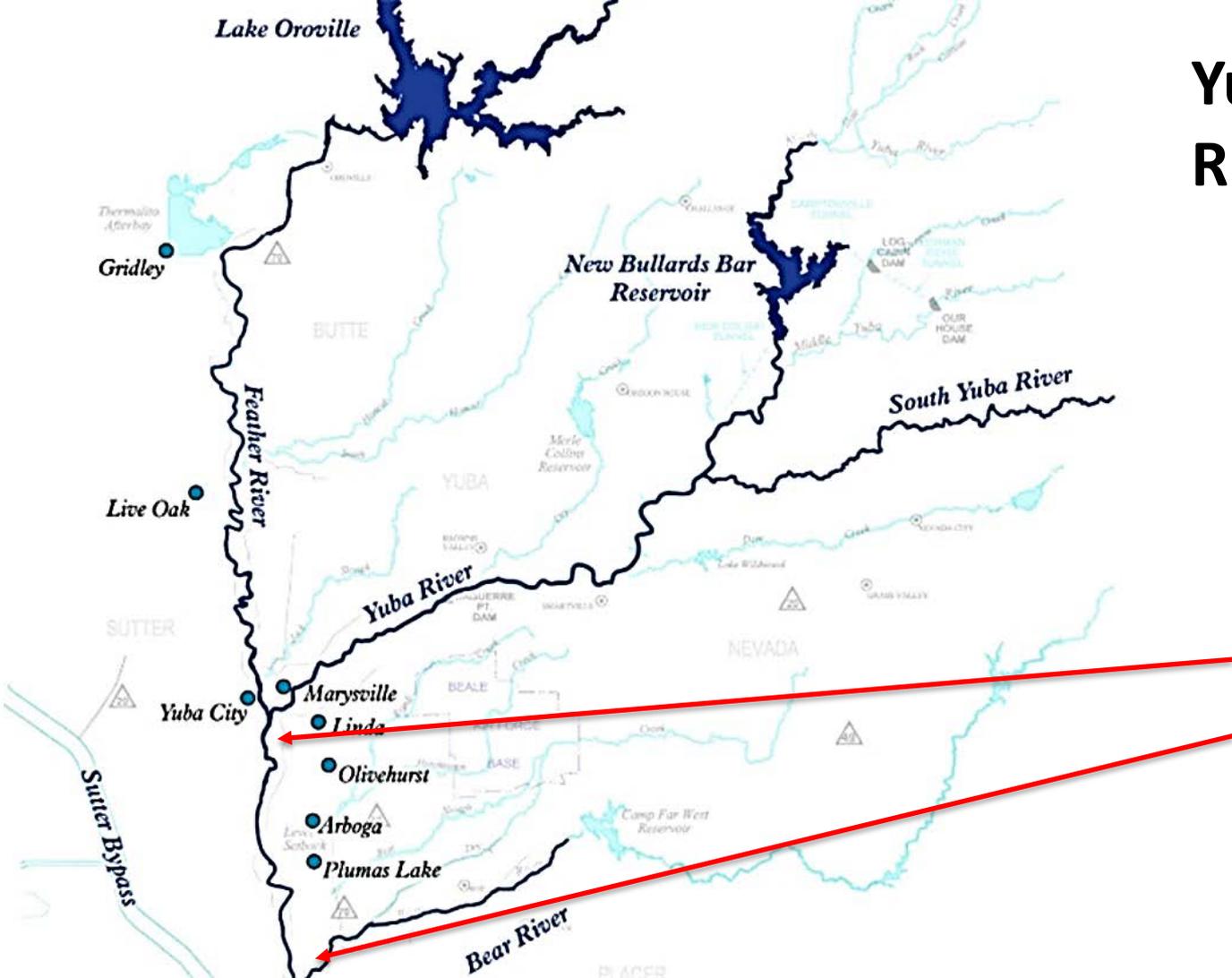
# Yuba-Feather River Forecast-Coordinated Operations (F-CO)



- Current forecast coordinated operations program is supported by a strong partnership among federal, state and local agencies
- Coordinate reservoir releases regulated by U.S. Army Corps of Engineers Water Control Manuals



# Yuba Feather River Systems



**WCM Common  
Downstream Control  
Points**

300,000 cfs

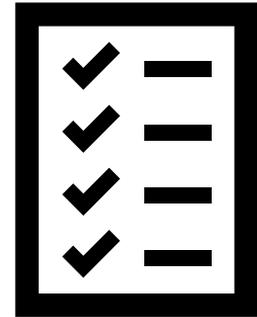
320,000 cfs





# Today's Agenda

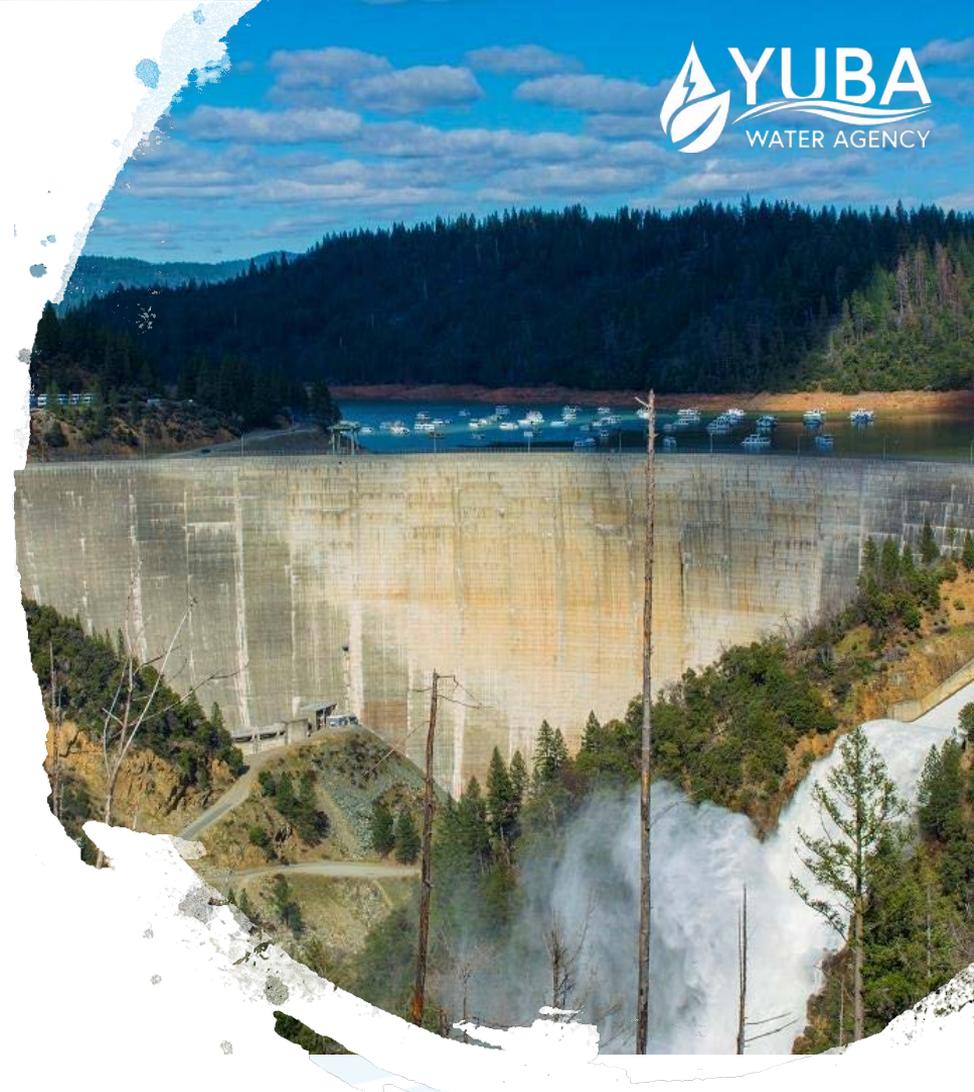
- Yuba County flood history / Forecast  
Coordinated Operations
- **Yuba-Feather FIRO program**
- New Bullards Bar Secondary Spillway project
- Questions



# Forecast-Informed Reservoir Operations (FIRO)



- Existing partnership projects:
  - Russian River, Lake Mendocino (2014)
  - Santa Ana River, Prado Dam (2017)
  - Yuba-Feather Rivers, Oroville and New Bullards Bar (2019)
- Uses improved forecasting to increase flexibility to store or release water
- Benefits include **reduced flood risk**, potential **water availability improvements**, **climate resilience**

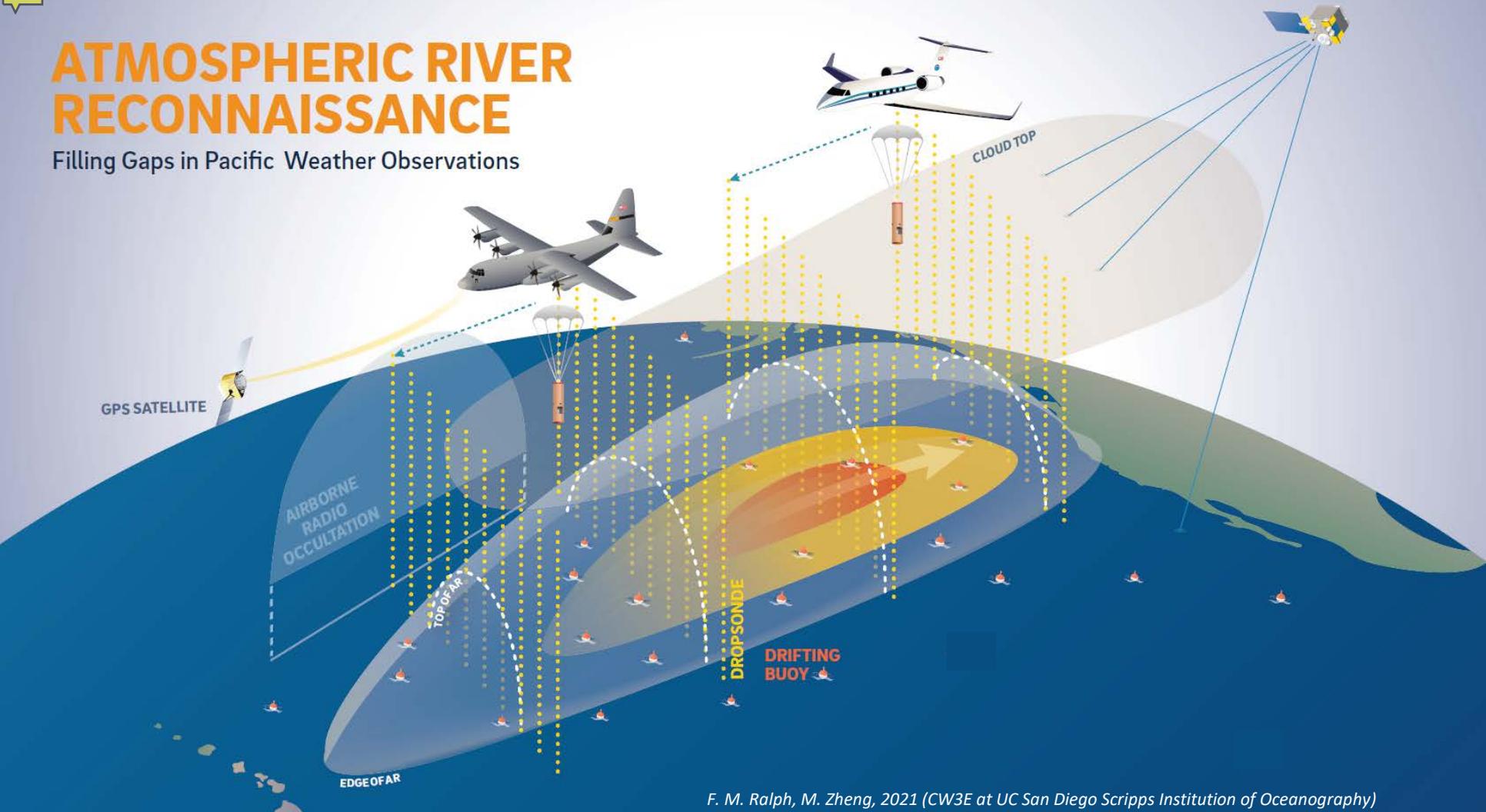


Center for Western Weather  
and Water Extremes  
SCRIPPS INSTITUTION OF OCEANOGRAPHY  
AT UC SAN DIEGO



# ATMOSPHERIC RIVER RECONNAISSANCE

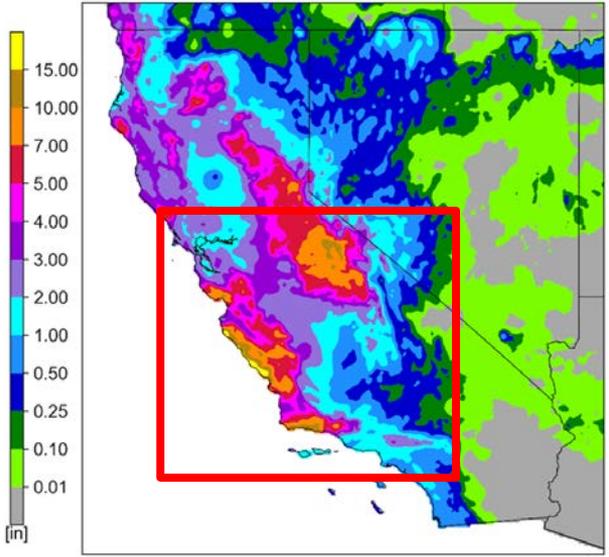
Filling Gaps in Pacific Weather Observations



# FIRO and AR Recon forecast improvement

## NCEP Stage IV 72-h QPE

Valid: 1200 UTC 26–29 Jan



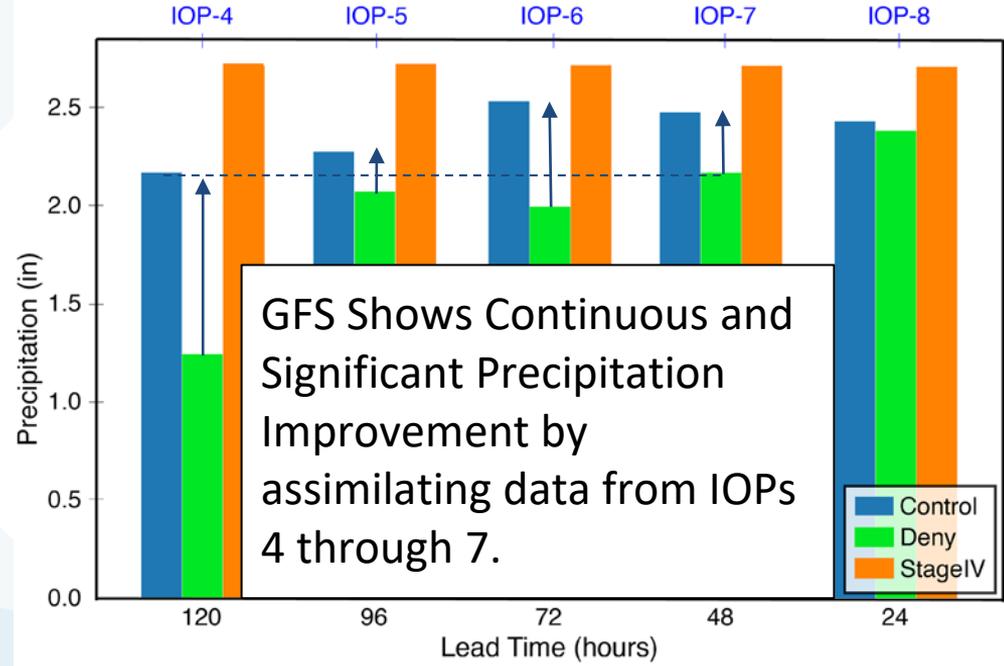
GFS precipitation forecast error at 120h (5-day) lead time *with drops* is equivalent to the 48h (2-day) error without drops.

## AR Recon Data Denial Experiments

*V. Tallapragada, F.M. Ralph, X. Wu, M. Zheng*

### Precip (in) by Forecast Hour (ST4 > 1in)

Valid: 29 Jan 2021, Lat: 34-37N, 122-119W



# Yuba Watershed FIRO Observations

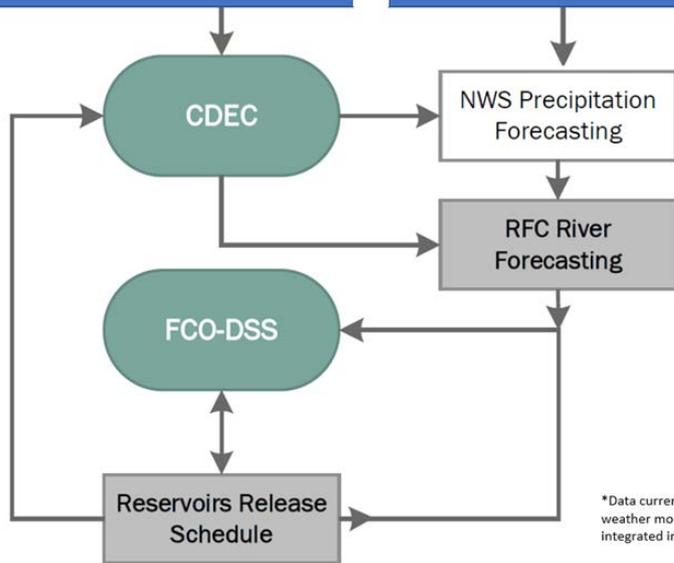
## New Yuba-Feather Watershed Field Meteorological Data

- Y-F Watershed Meteorological Observations
- Y-F Watershed Soil Moisture Sites
- Y-F Freezing Level observations (vertical radars)
- Y-F Snowpack condition observations

## New Atmospheric Profile Data

- Yuba-Feather Local Radiosondes\*
- ARRecon Pacific Ocean Dropsondes\*

West-WRF high resolution Atmospheric River model\*\*

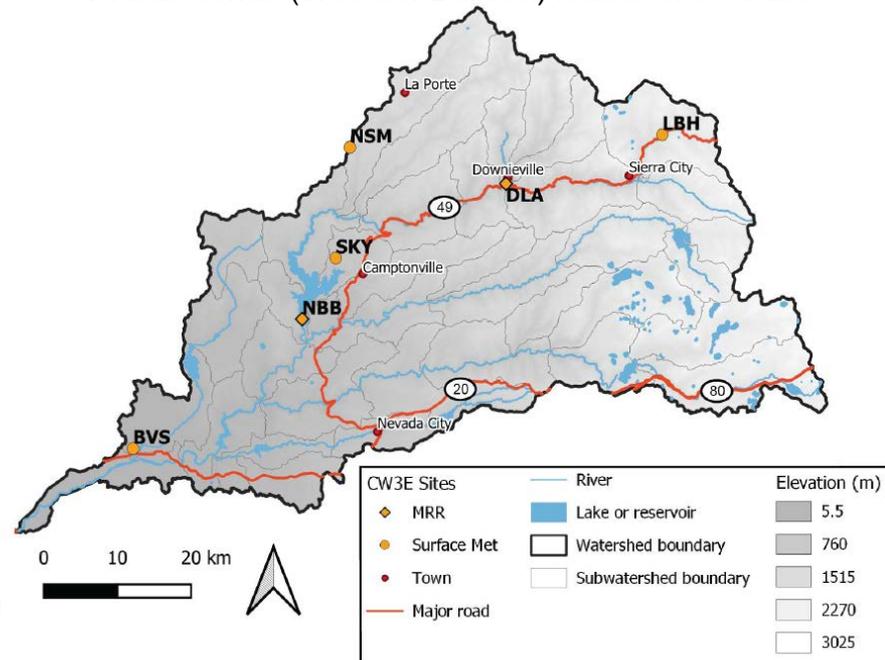


\*Data currently being ingested into global weather models and thus already indirectly integrated into NWS precipitation forecast

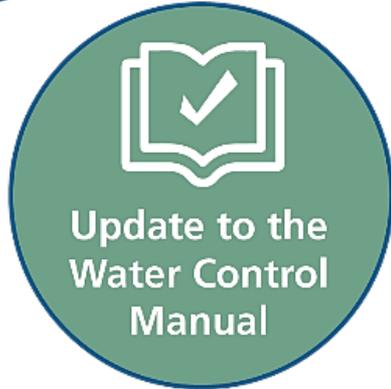
\*\*West-WRF local WFO/RFC integration TBD

## New Meteorological and Hydrologic Observations

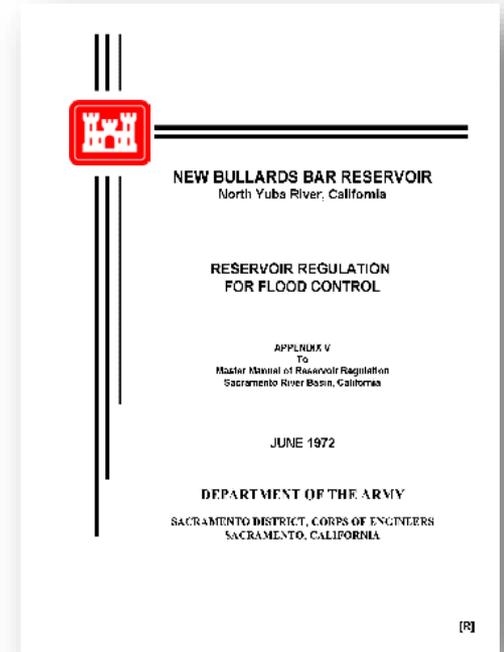
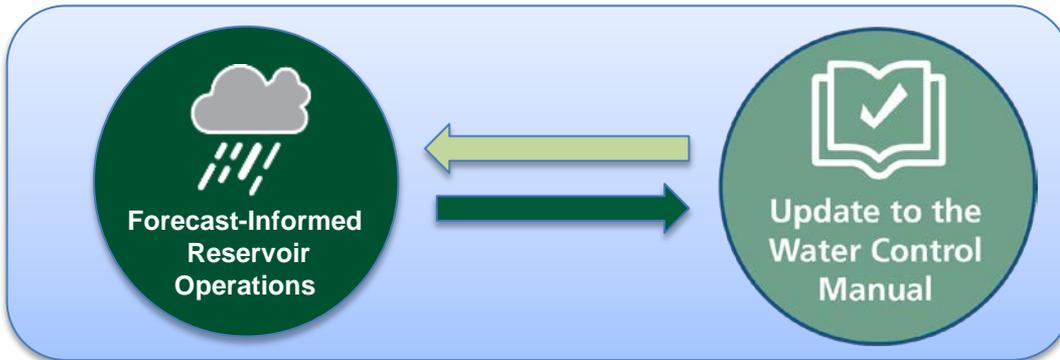
- 8 new Met/Soil sites in Yuba & Feather Watersheds
- 2 MRR radar sites - Yuba
- 1 Radiosonde (Weather Balloon) launch site - Yuba



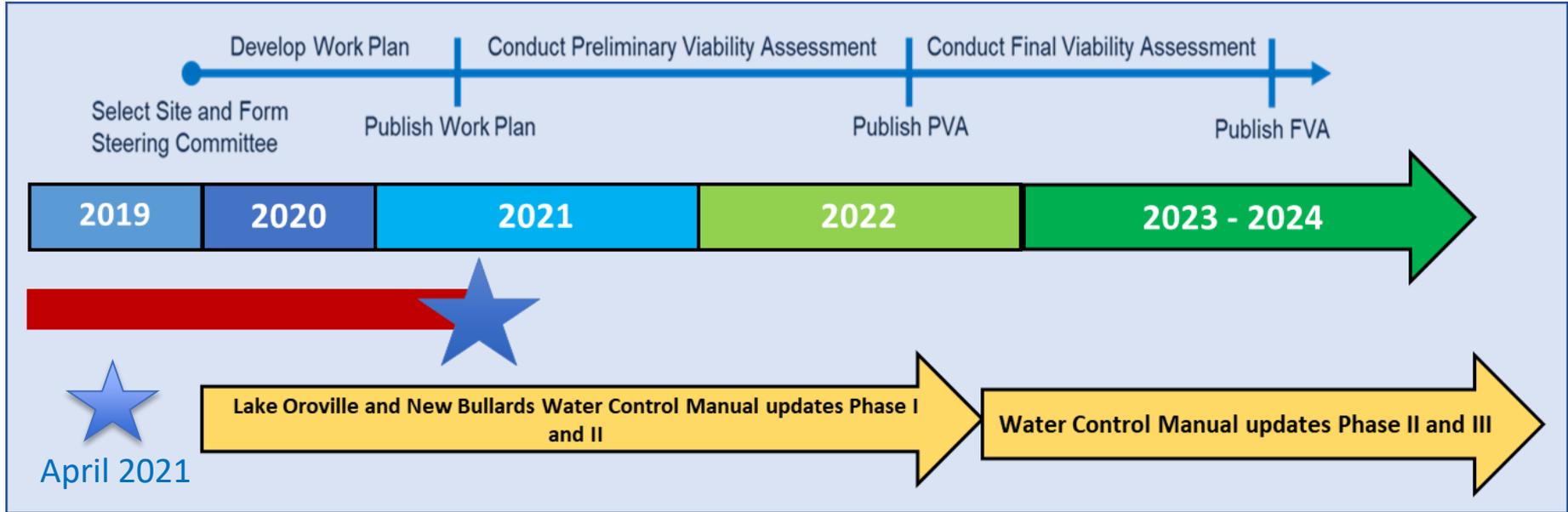
# U.S. Army Corps Water Control Manual Update



Yuba Water is working with the **U.S. Army Corps of Engineers** to develop new operational procedures for managing flood flows, and the new procedures will be informed by the FIRO research.



# Yuba-Feather Forecast Informed Reservoir Operations and Water Control Manual Update Timeline



Center for Western Weather and Water Extremes  
SCRIPPS INSTITUTION OF OCEANOGRAPHY  
AT UC SAN DIEGO

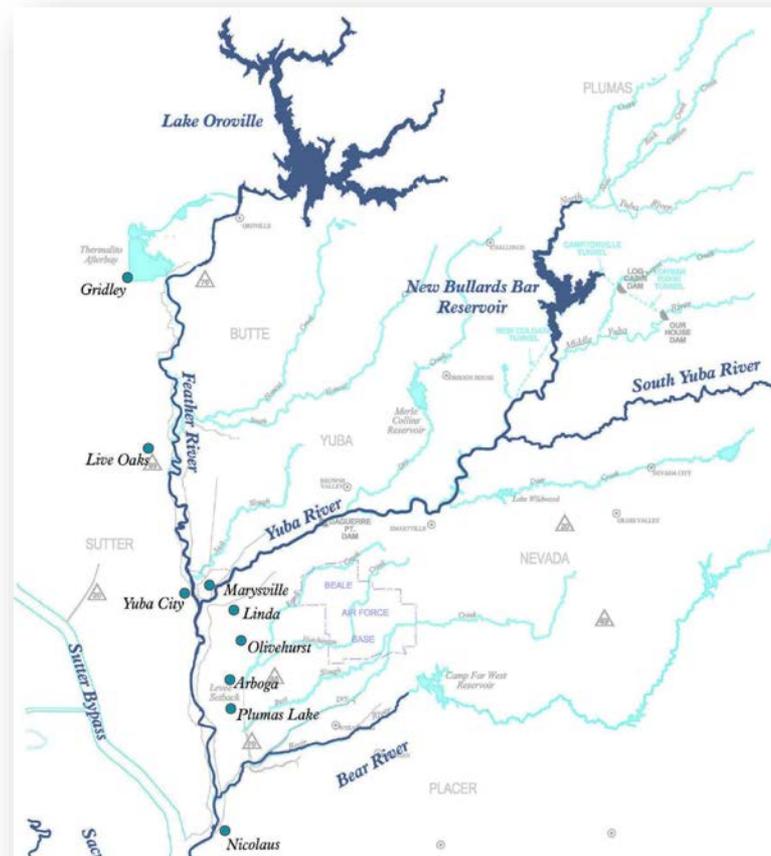


# Yuba-Feather FIRO / Oroville and New Bullards Bar Water Control Manual Update System Objectives

## FIRO

The Yuba-Feather FIRO flood risk reduction target goal is to provide the **functional equivalent of 260,000 AF of flood storage space\*** for New Bullards Bar and Lake Oroville combined, to ensure adequate system flood storage.

*\*Marysville Dam and Reservoir would have provided 260,000 acre-feet of flood storage along the lower Yuba river.*



## WCM

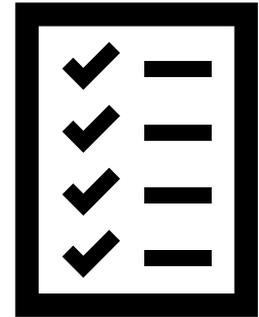
Coordinate operations in Yuba-Feather watershed to minimize exceedance of:

1. **300,000 cfs in the Feather River below Yuba River**
2. 320,000 cfs in the Feather River below Bear River, insofar as possible
3. **Without necessity for Marysville Dam and Reservoir**



# Today's Agenda

- Yuba County flood history / Forecast Coordinated Operations
- Yuba-Feather FIRO program
- **New Bullards Bar Secondary Spillway project**
- Questions



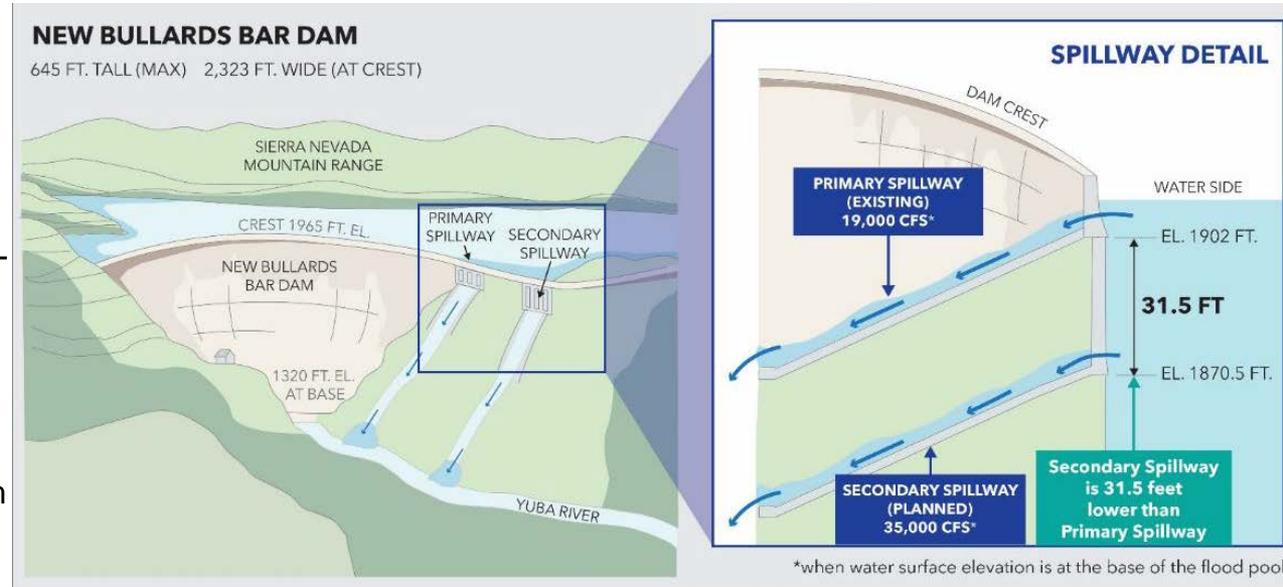
# New Bullards Bar Dam Secondary Spillway

## Proposed project

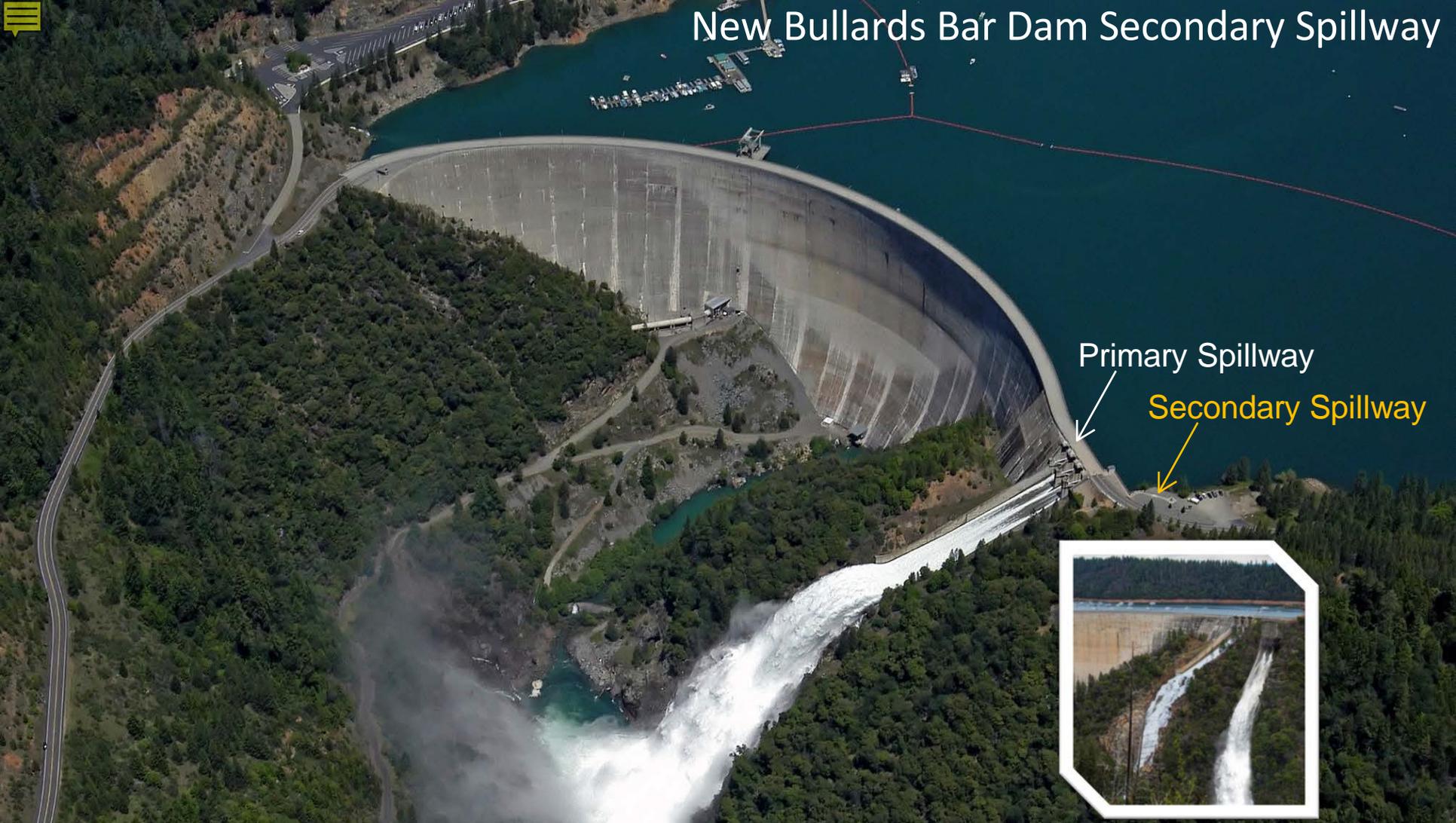
- An additional open channel spillway at New Bullards Bar Dam
- Allows for releases at a lower reservoir water elevation (31.5 feet lower than current spillway)
- Discharge capacity of 35,000 cubic-feet-per second (cfs)

## Public safety benefits

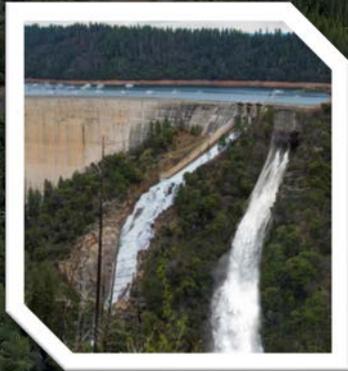
- Redundancy and increased operational flexibility for managing outflow from dam
- Enhances public safety in Yuba-Feather region by reducing flood stage downstream



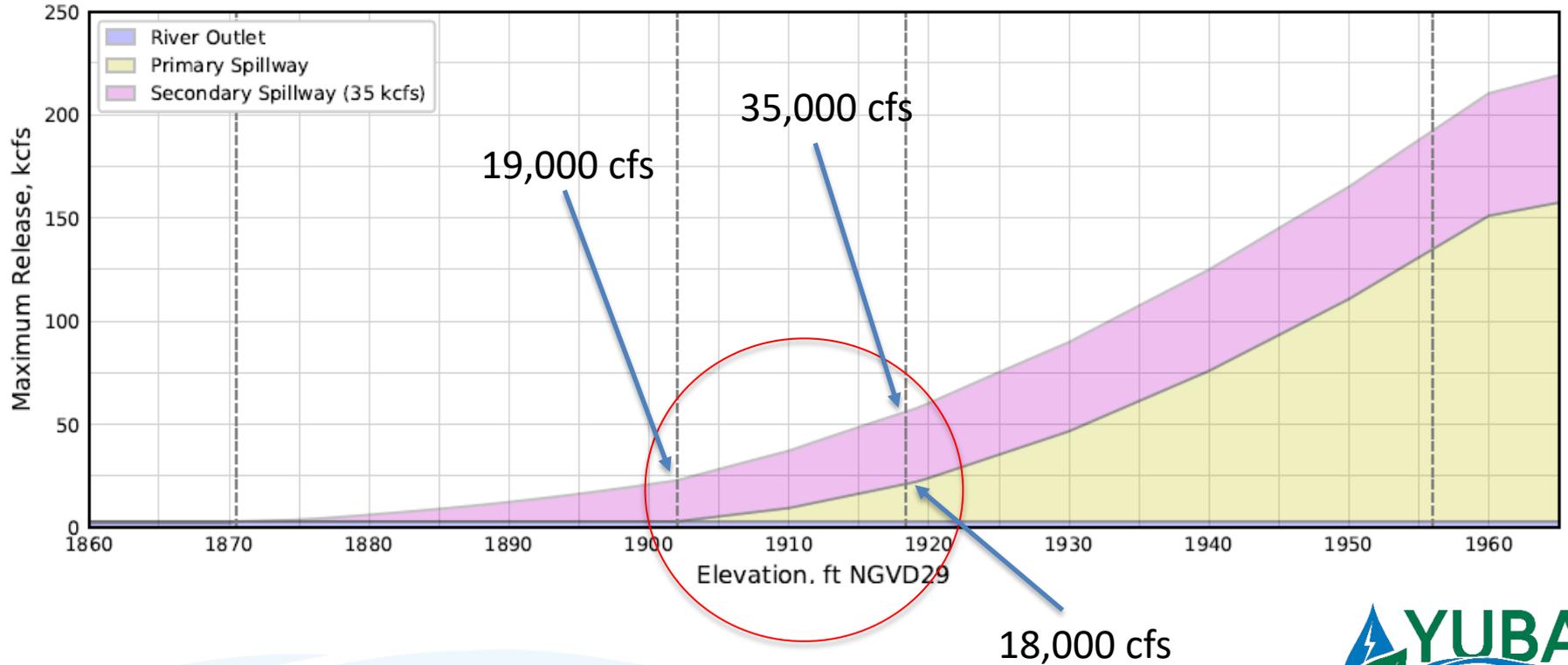
# New Bullards Bar Dam Secondary Spillway



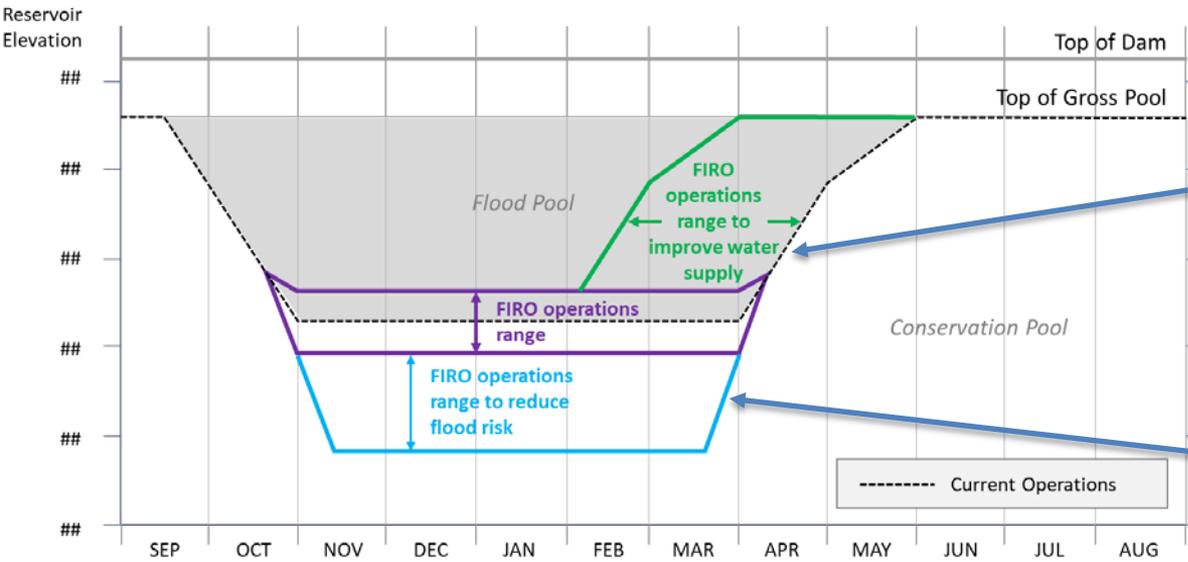
Primary Spillway  
Secondary Spillway



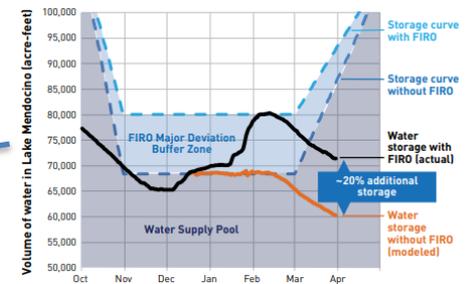
# New Bullards Bar Dam Secondary Spillway Release Capability



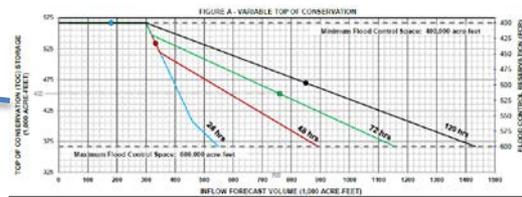
# New Bullards Bar preliminary "FIRO Space" concept



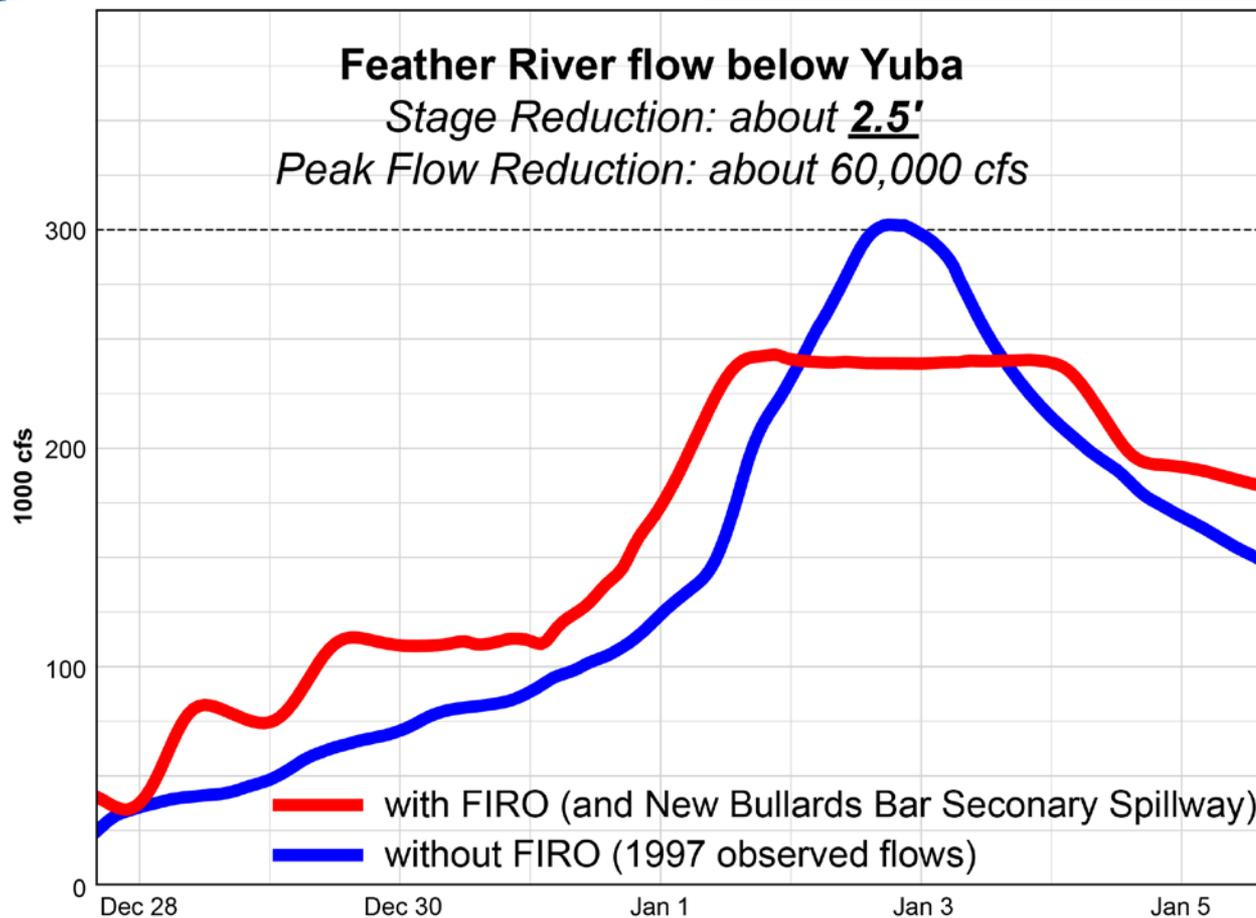
Lake Mendocino FIRO FVA



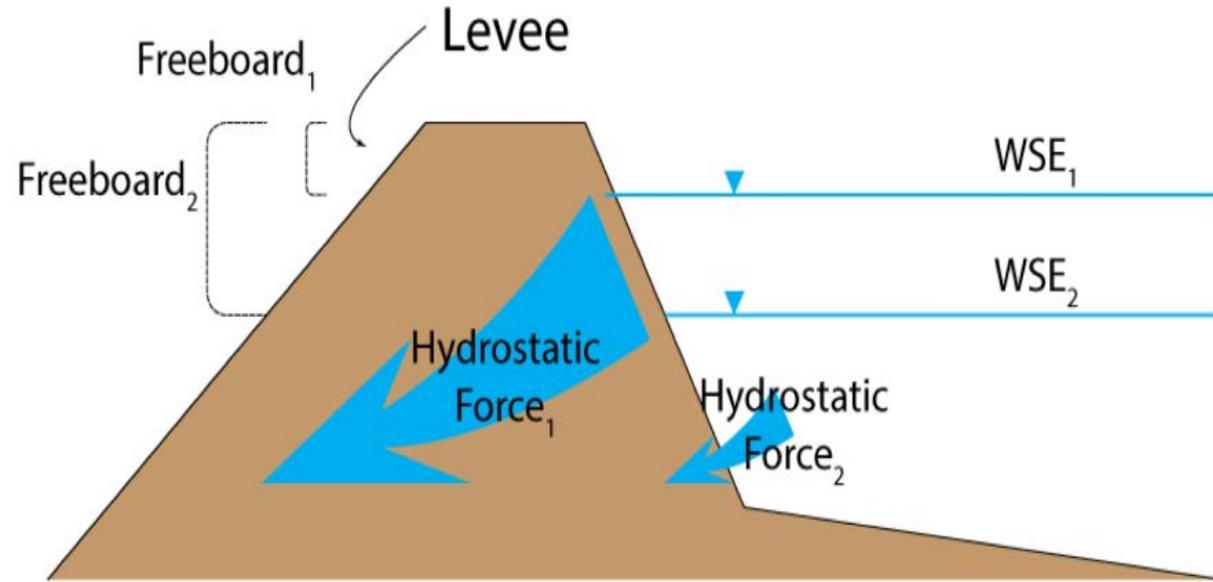
Lake Folsom FCD



# Reducing Peak Flows During Flood Events



# New Bullards Bar Dam Secondary Spillway



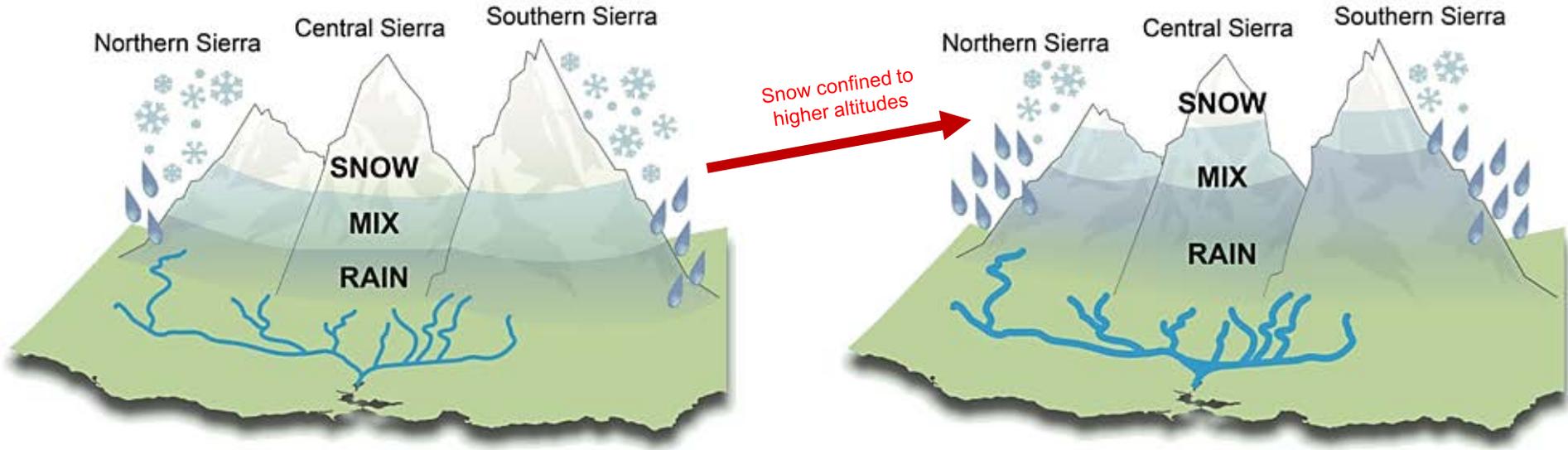
**Stage Reduction:** Reduction in hydraulic loading on levees, minimize risk undermining and piping

**Example:** 2.5 feet of stage reduction at high river levels is equivalent to ~60,000 cfs of flow on the Feather River

# Building Climate Change Resiliency

TODAY

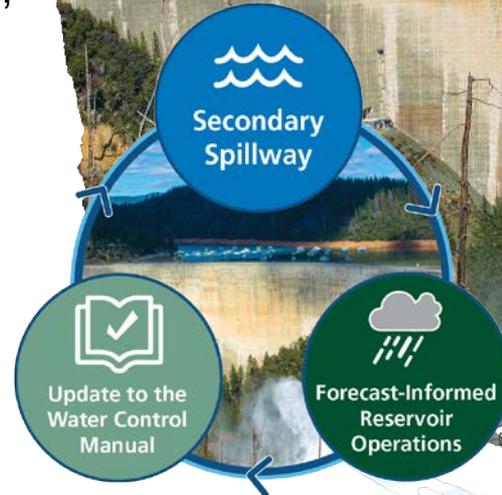
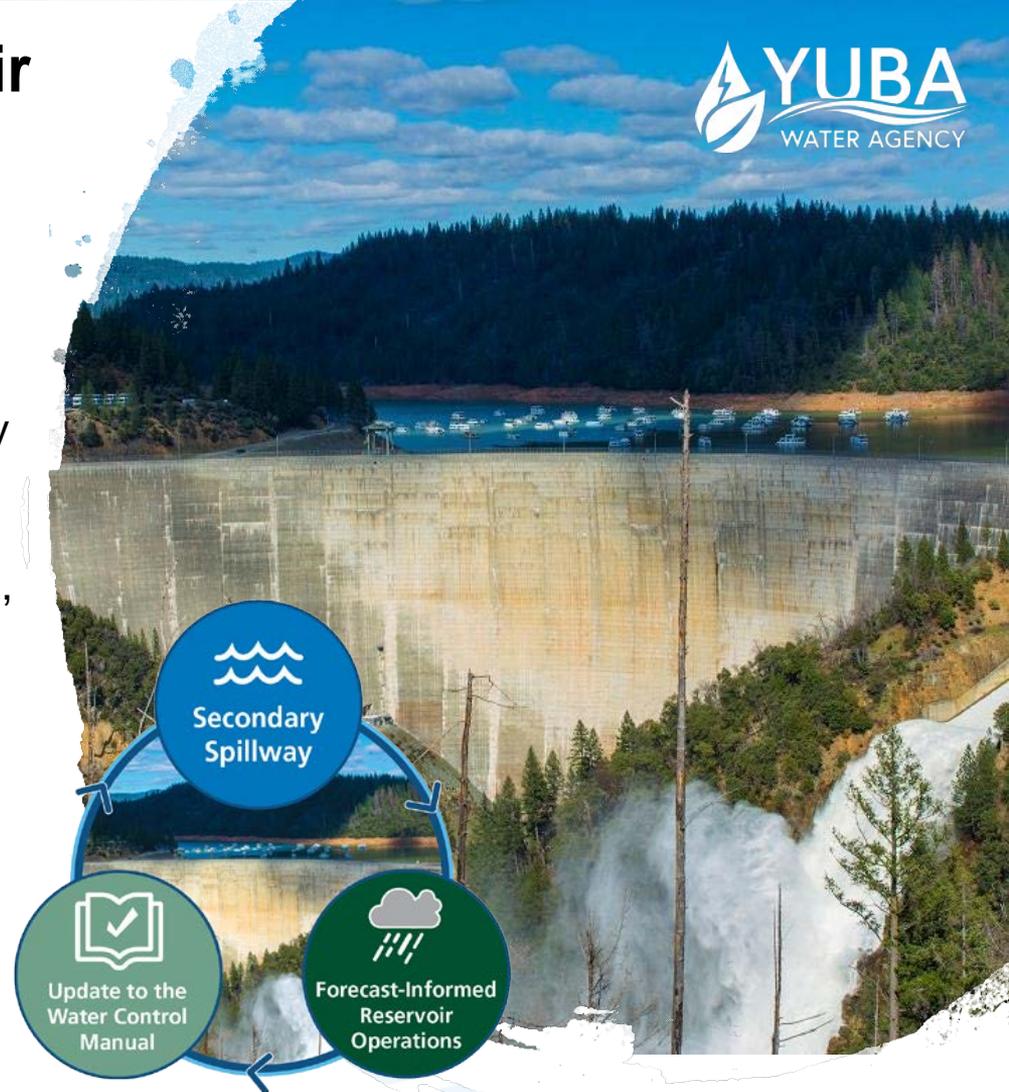
FUTURE



CVFPP 2017

# Forecast-Informed Reservoir Operations (FIRO)

- Improves forecasting for more adaptive water management strategies
- Informs updates to reservoir operational rules to use forecasts and improve flexibility
- Benefits include **reduced flood risk**, potential **water availability improvements**, and **climate change resilience**
- Enhances benefits of infrastructure improvements such as **New Bullards Bar Secondary Spillway**
- Promotes collaboration and trust between federal, state and local reservoir operators





Questions?



Follow us on social @yubawater  
Visit our website at [yubawater.org](http://yubawater.org)