U.S. Army Corps of Engineers Water Management Perspectives on Improving S2S Precipitation Forecasting

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Improving Sub-seasonal to Seasonal (S2S) Precipitation Forecasting Workshop
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US Army Corps of Engineers

ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER

“It’s the 21st Century, we need our water to work harder for us.”

Jeanine Jones, September 2016

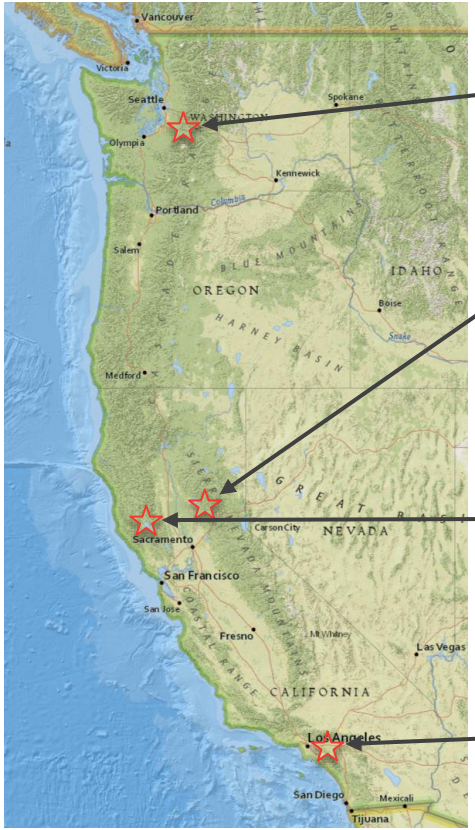
Forecasts in USACE Water Management

- For decades, official guidance dictated that USACE operates based on principle of “water on the ground”
- May 2016 Update to Engineer Regulation (ER) 1110-2-240 Water Control Management adds this sentence:
  - “Forecasted conditions may be used for planning future operations, but releases should follow the water control operations plan based on observed conditions within the watershed to the extent practicable.” *(emphasis added)*
- Policy change to *allow* Corps use of forecasts in water operations is in place, but ER doesn’t define how the change is to be implemented

Forecast Informed Reservoir Operations (FIRO)

- R&D effort to define how forecast information can be safely and effectively implemented officially in water control manual updates and practice
- FIRO viability assessed at candidate reservoirs through a careful, deliberate and collaborative process
  - FIRO pilot studies being conducted at four sites across the West with a variety of watershed, reservoir volume, and atmospheric and hydrologic driving conditions
  - Results to date indicate 5-20% potential improvement in water availability where FIRO is shown to be viable

Current FIRO Pilot Project Locations



Howard Hanson Dam

Green River, Seattle District USACE

New Bullards Bar Dam

Yuba River, Yuba Water Agency

Oroville Dam

Feather River, CA Dept. of Water Resources

Lake Mendocino/Coyote Valley Dam

East Fork Russian River, San Francisco District USACE

Prado Dam

Santa Ana River, Los Angeles District USACE

FIRO R&D Viability Assessments – Current Status

Lake Mendocino

FVA Published Feb 2021

Prado Dam

PVA Published July 2021

Work Plan Completed 3/5/21

New Bullards Bar & Oroville Dams

Howard Hanson Dam

Develop Work Plan

Conduct Preliminary Viability Assessment

Conduct Final Viability Assessment

Select Site and Form Steering Committee

Publish Work Plan

Publish PVA

Publish FVA

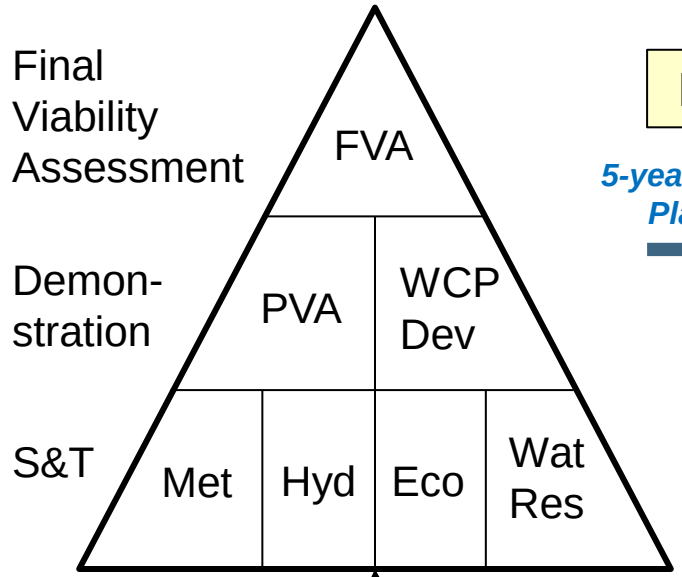
FIRO Viability Assessment Timeline

Collaboration is Key to FIRO Success

- FIRO pilots are led by interagency Steering Committees carefully formed with senior representatives from stakeholder agencies and academic partners
  - Blend of engineers and scientists from research, operations and regulatory perspectives
  - Each agency responsible for supporting their engagement

"This is exactly how we want the Federal Government to operate"
Jaime Shimek
12 April 2018
House Democratic E&W Appropriations Committee Staff

FIRO Viability Assessment Process



Interim

5-year Water Control Plan Deviation

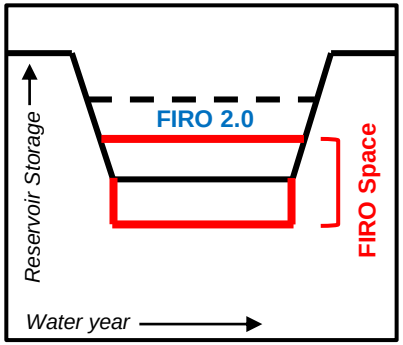
Meteorological Research	Hydrologic Research
Ecosystem Factors	Water Resources Ops

R&D Process

WCM Studies

Additional Technical Studies for WCM Update Process
Study 1
Study 2
etc…

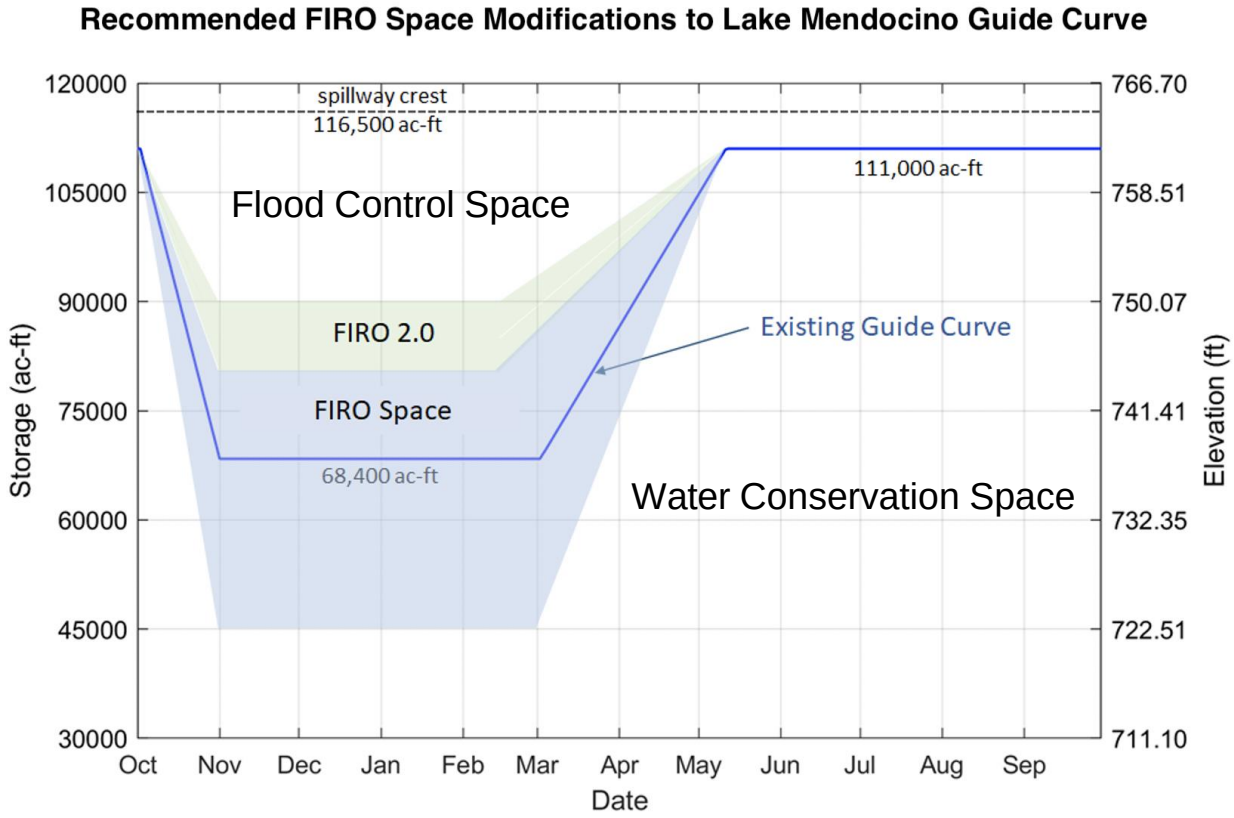
WCM Update



Operations Process

FIRO is based on a research and operations partnership that spans the entire assessment and WCM update process

FIRO = Flexibility for Water Managers



Lake Mendocino FIRO Benefits – WY 2020

3rd driest winter on record in Russian River watershed

10,825 ac-ft is enough water for ~22,000 homes for a year

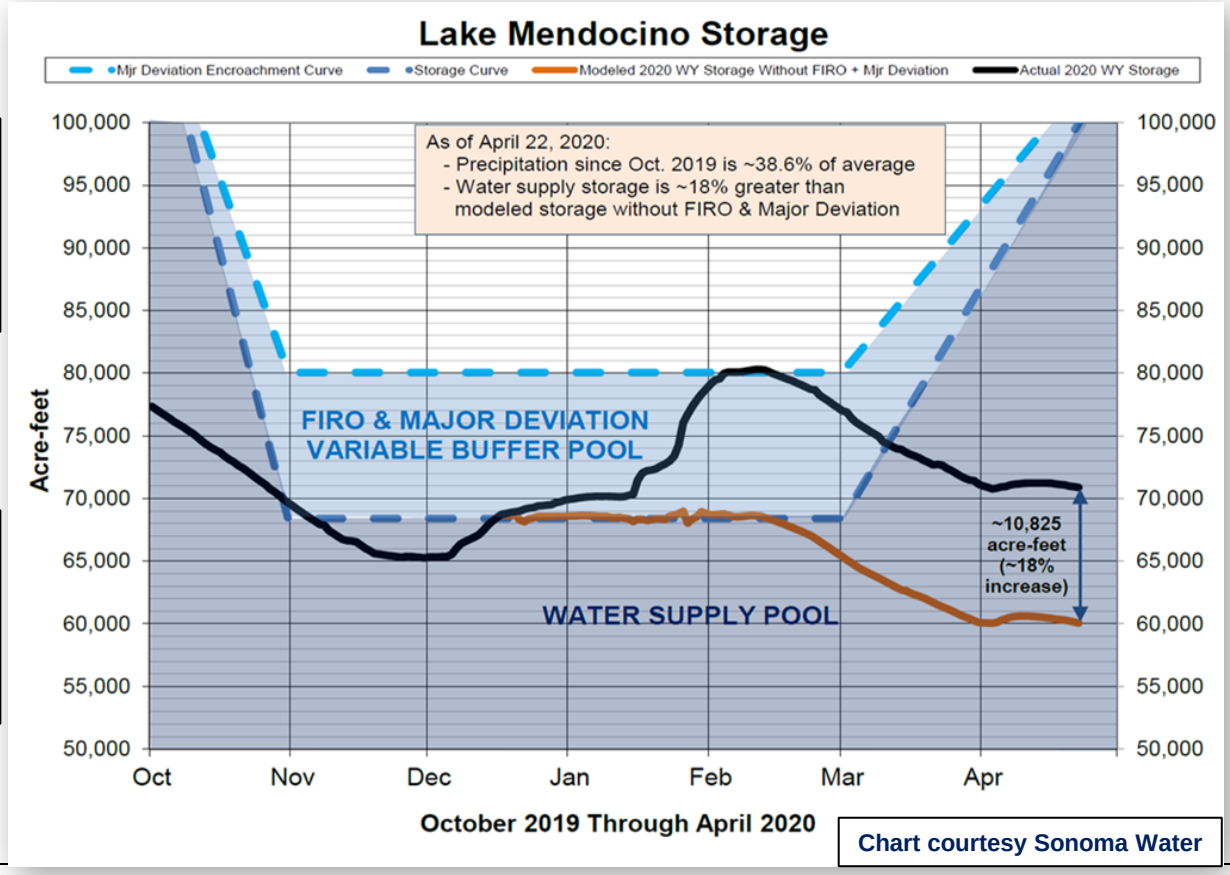
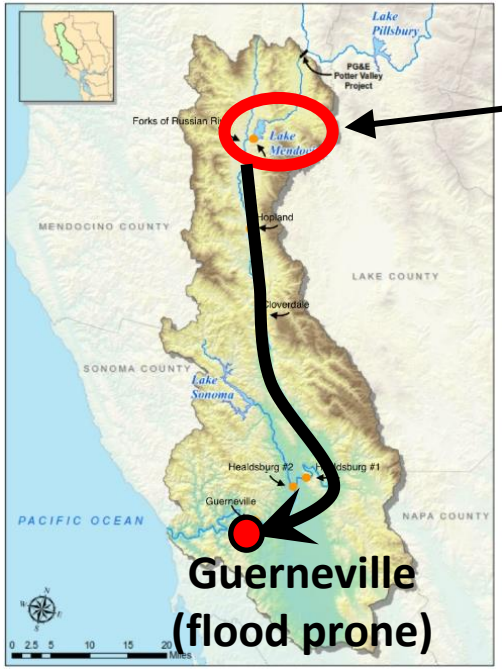


Chart courtesy Sonoma Water

Seeing the lake so full makes Kyle Farmer, a rancher in Potter Valley, happy every time he drives by it. “It’s a huge deal to become adaptive like that. I don’t think bureaucracies do that naturally,” he said. “It restored my faith in the government, obviously, a little bit.”

Drought or dangerous flooding? Research aims to tame atmospheric river risks — and save California’s rain
By Rachel Becker
www.CalMatters.org
25 February 2020

How much forecast lead time is required to enable FIRO on Lake Mendocino?



Lake Mendocino

Lake Mendocino Release *Approximate* Travel Time

Takes 1-3 days to flow 74 miles*

→ Guerneville → Ocean

Bottom Line

- **Two days to release the extra water, plus**
- **1-3 days to flow past flood-prone area downstream**

➔ **Predictive skill is needed at 3-5 days lead-time for the storms that produce heavy rain and possible flooding**

Slide courtesy Marty Ralph, CW^{3}E

*Based on information from Coyote Valley Dam and Lake Mendocino Water Control Manual (1986)

USACE Water Management Forecast Lead Time Needs

- For many western reservoirs, 5-7 days is sufficient to safely evacuate FIRO space held above existing guide curve levels *during rainy season (Nov – Mar)*
- Systems with lower elevation differences between reservoir and control points and/or limited downstream channel capacities (e.g. San Joaquin), longer forecast lead times would increase FIRO viability
- During snow melt season (Mar – Jul), longer-range forecasts of heat waves and potential warm rains would greatly improve water managers' ability to handle challenges induced by spring flows in systems with significant snow melt runoff

Key Takeaways

- USACE has entered a new phase of water management where forecasts are being officially incorporated into water control manuals and other water management practices
- Improved atmospheric forecasting skill in both short term and long term forecast horizons is critical to improving FIRO viability
- Research-supported improvements in forecasting skill of AR events (AR Recon, West-WRF, etc.) as well as S2S climate trends such as prolonged droughts and heat waves are critical to helping agencies like USACE realize the increased benefits of FIRO 2.0
- FIRO provides an effective means of increasing the efficiency and resiliency of existing water resources infrastructure to achieve multi-purpose benefits – all without costly construction projects