

Forecast-Informed Reservoir Operations: The Next Five Years

*New Reservoir Configurations and
Weather Regimes*

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USACE-ERDC

**Second Joint TWDB-UTA-NIDIS
Workshop on Texas FIRO
September 21, 2023**



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FIRO Background

- **2012-2015** – Driest 3-year period in California history
- **May 2016** update to Water Control Management Policy *allows* use of forecasts in water management operations but does not define *how*
- FIRO is R&D effort to define *how* forecast information can be safely, effectively and officially implemented in water control manual (WCM) updates and practice
- FIRO viability assessed at candidate reservoirs through a careful, deliberate and collaborative process at pilot sites across the West with a variety of conditions



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Phases of FIRO Research & Development



Phase I – Lake Mendocino

- Oct 2014 – Dec 2020
- Initial FIRO pilot, defined viability assessment process and use of steering committees
- Preliminary Viability Assessment: Jul 2017
- Final Viability Assessment: Feb 2021

Phase II – Expanded Effort

- Oct 2019 – Dec 2023
- Added three more pilots:
 - Prado Dam
 - New Bullards Bar/Oroville Dams
 - Howard Hanson Dam
- Screening Process Development
 - USACE South Pacific Division dams as testbed



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FY23 Energy & Water Appropriations Bill

Water Operations Technical Support-Forecast Informed Reservoir

Operations [FIRO].— The Committee is pleased with the results of FIRO Phases 1 and 2 and eagerly anticipates the expansion of the program into regions where different storm types, in addition to Atmospheric Rivers, are key to heavy rain and flooding (e.g., tropical storms/hurricanes, large thunderstorm systems), and where longer forecast lead times may be required. Additional funding is recommended to complete Phase 2, start Phase 3 efforts, and perform necessary updates to the CWMS Ensemble Tool.

FY23: FIRO in USACE President's Budget for first time plus additional funding from Congressional Add

FY24: FIRO in USACE President's Budget as single largest Civil Works R&D effort within USACE



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FIRO Phase III: National Expansion Pathfinder

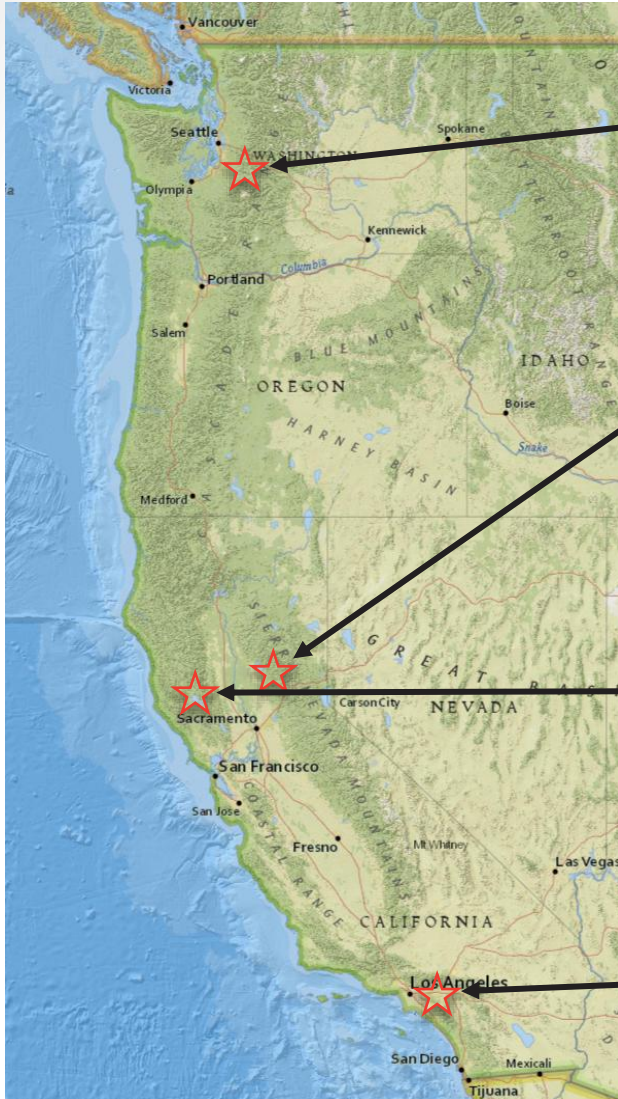
FY23-FY27



1. National forecast skill assessment and improvement campaign
 - Continued investment in Atmospheric River (AR) and other storm type forecast improvements that have yielded significant benefits
2. Completion of Phase II viability assessments to support planned WCM updates
 - Prado, Yuba-Feather, Howard Hanson, Lake Sonoma, Seven Oaks
3. Conduct full FIRO viability assessment on Willamette Valley, Oregon system of dams (14 dams in total)
 - Willamette Valley dam operations are managed in coordinated fashion from a single water management office



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
Sacramento District, USACE



Lake Mendocino
Lake Sonoma (added in FY22)
Russian River, San Francisco District USACE



Prado Dam
Seven Oaks Dam (added in FY22)
Santa Ana River, Los Angeles District USACE

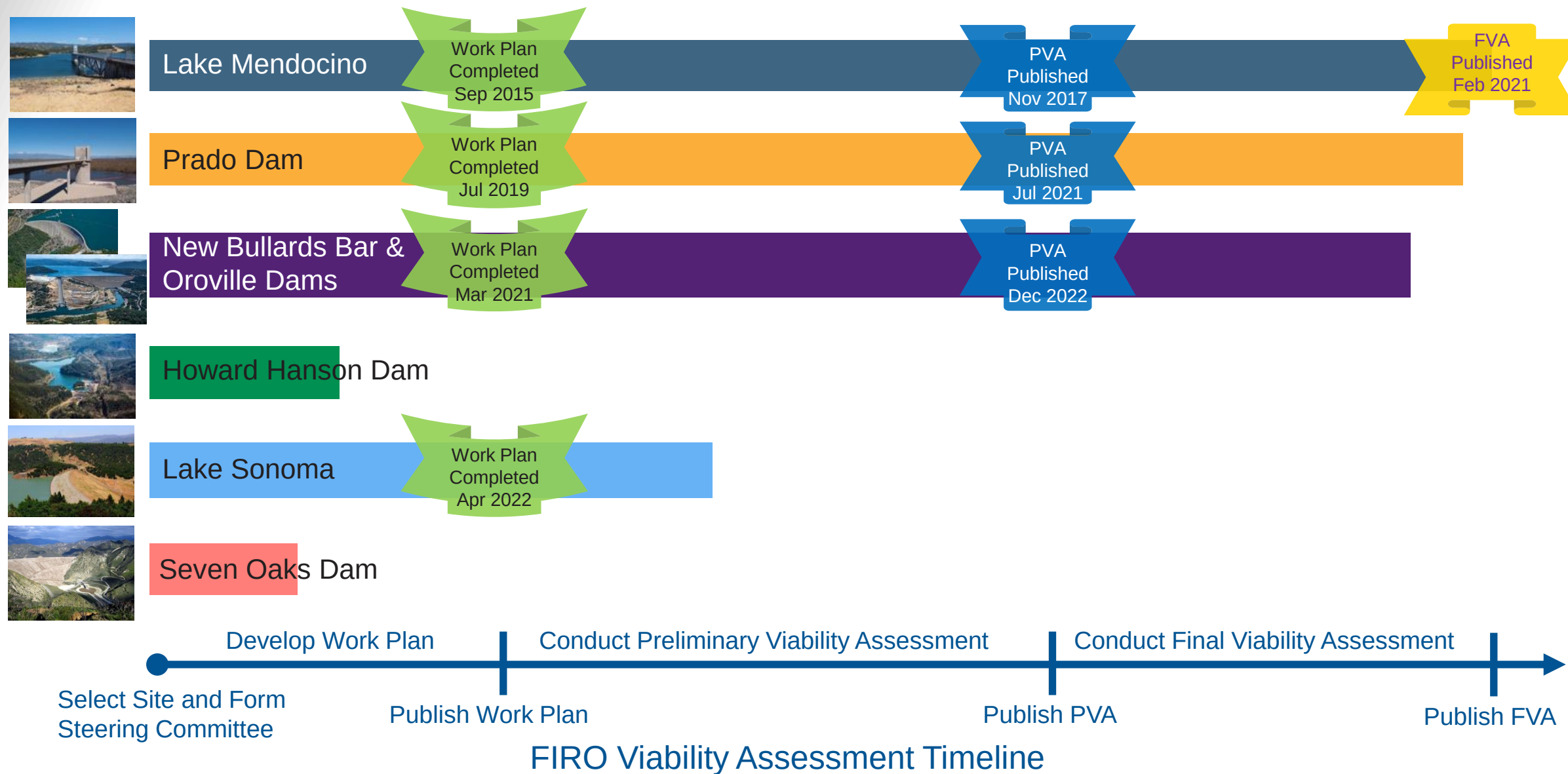


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FIRO R&D Viability Assessments – Current Status





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Willamette Valley System

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- 14 dams in system
 - 13 USACE owned/operated
 - Scoggins is USBR owned/operated but USACE regulated as a “Section 7” dam
- Steering Committee formation is underway





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FIRO Phase III: National Expansion Pathfinder

FY23-FY27

- 4.** Conduct full viability assessment of system of 8+ dams in another region nationally
 - Explore a region where different storm types (in addition to ARs) are key to heavy rain and flooding (e.g., tropical storms/hurricanes, long-lived thunderstorm clusters, Nor'Easters)
- 5.** Conduct full viability assessments on two single dams in other regions nationally
- 6.** Apply FIRO screening process nationally across USACE portfolio of dams
 - Result will be identification of FIRO-suitable sites to help prioritize future FIRO viability assessment efforts



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Scaling Up FIRO with the Screening Process



748 Dams with
USACE regulatory
involvement

Over 300 of these
have managed
outlets

FIRO studies are
completed, initiated
or underway at only
a few

National
Inventory of
Dams

Where is FIRO **possible**? Where is the potential **benefit worth the effort**?
Where is more **research investment** needed to improve forecast skill?



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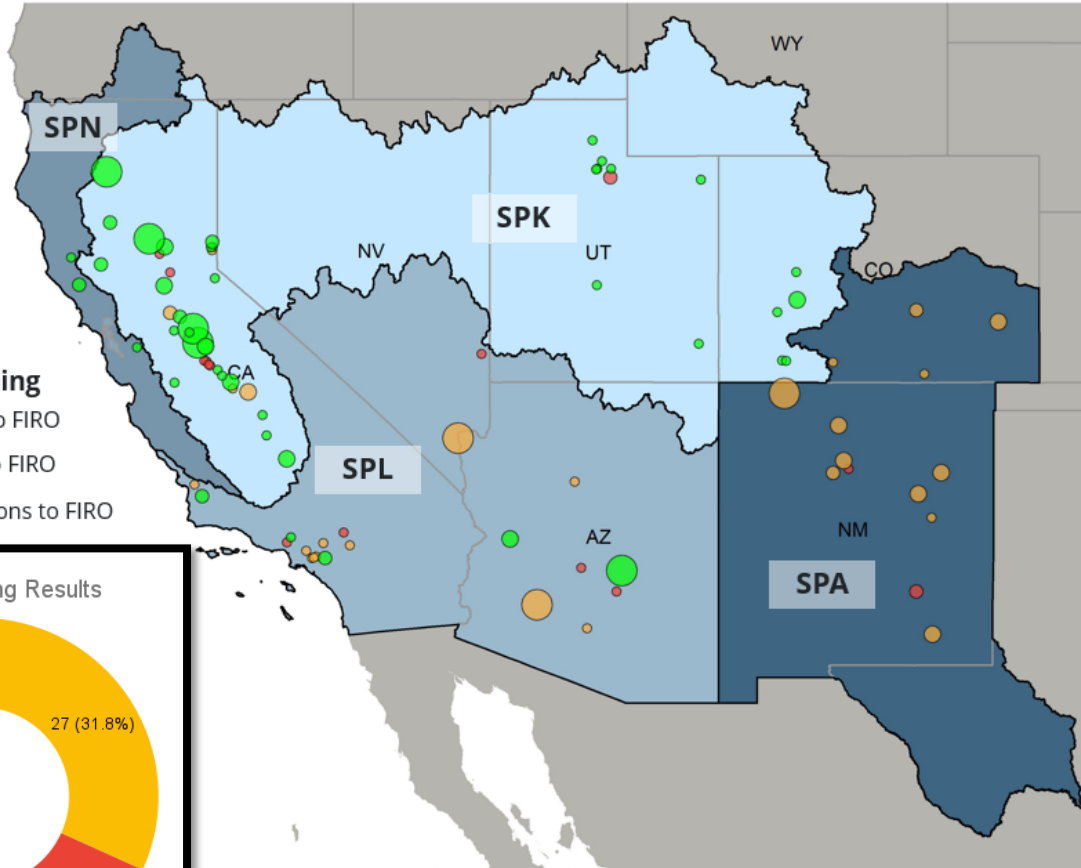
FIRO Phase II - Developing the Screening Process

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2022 – Stage A beta test

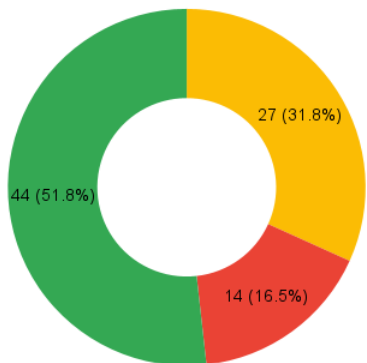
FIRO Screened Reservoirs
USACE South Pacific Division



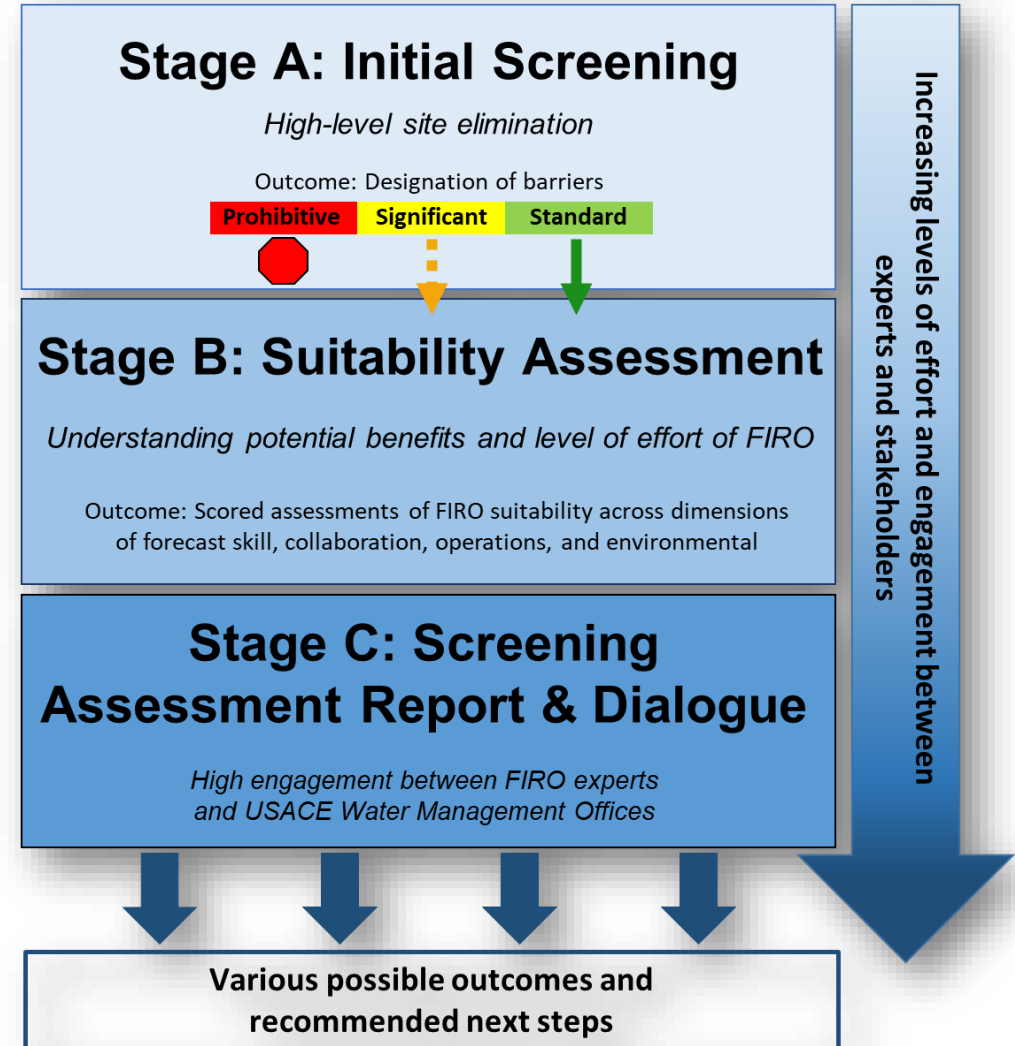
FIRO Stage A Screening

- Prohibitive barriers to FIRO
- Significant barriers to FIRO
- Standard considerations to FIRO

SPD Stage A Screening Results



2023 – Stage B beta test

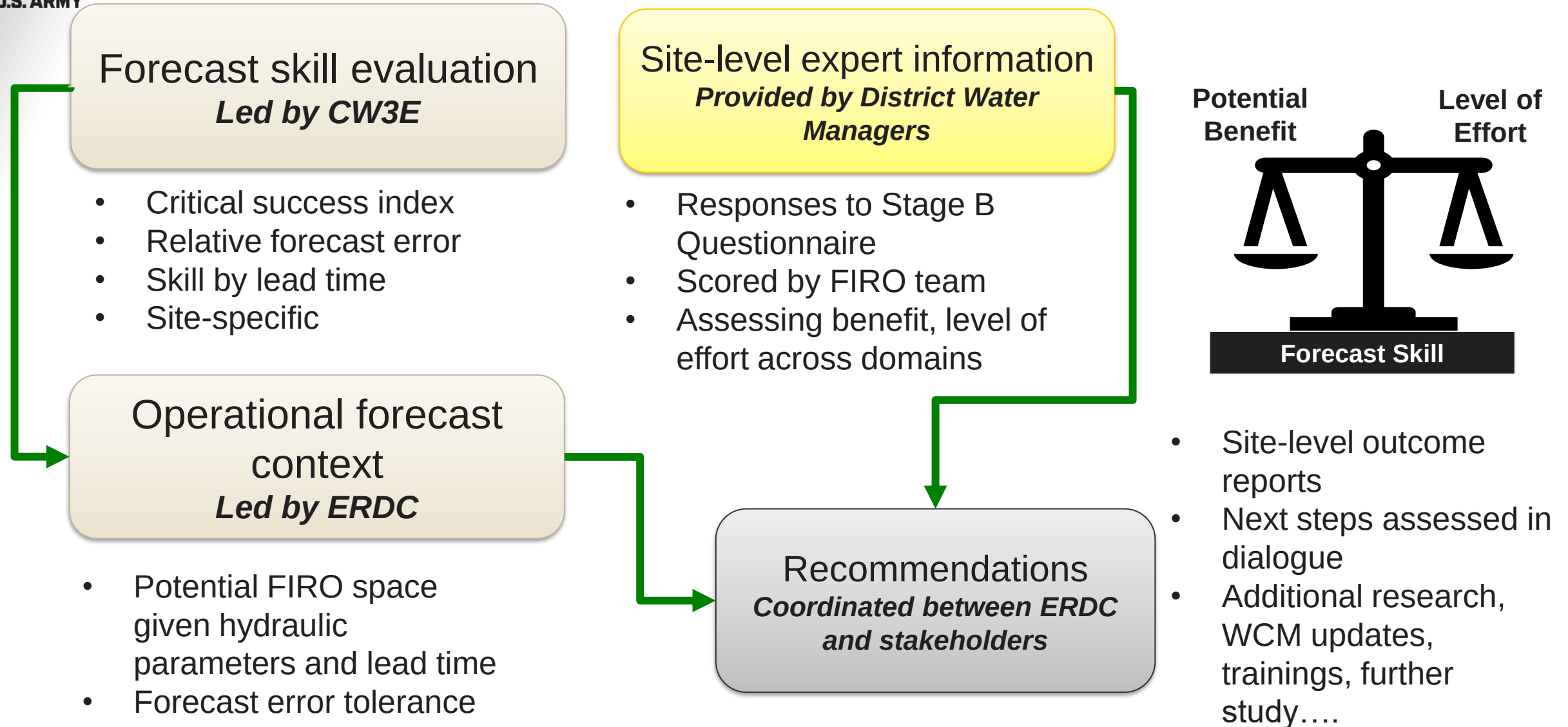




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FIRO Phase II/III – Refining the process and outcomes





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National FIRO Program Leadership



- USACE: Two national FIRO-specific positions created to support FIRO R&D and implementation going forward
 - **National FIRO Program Lead:** Cary Talbot
 - **Water Management Integration Lead:** Joe Forbis
- FIRO Phase III Atmospheric Science and Program Support Effort: Center for Western Weather & Water Extremes (CW3E)
 - **Lead Scientist/PI:** Dr. Marty Ralph



Thank you!

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Lake Mendocino FIRO Benefits – WY 2020



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3rd driest winter on record in Russian River watershed

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

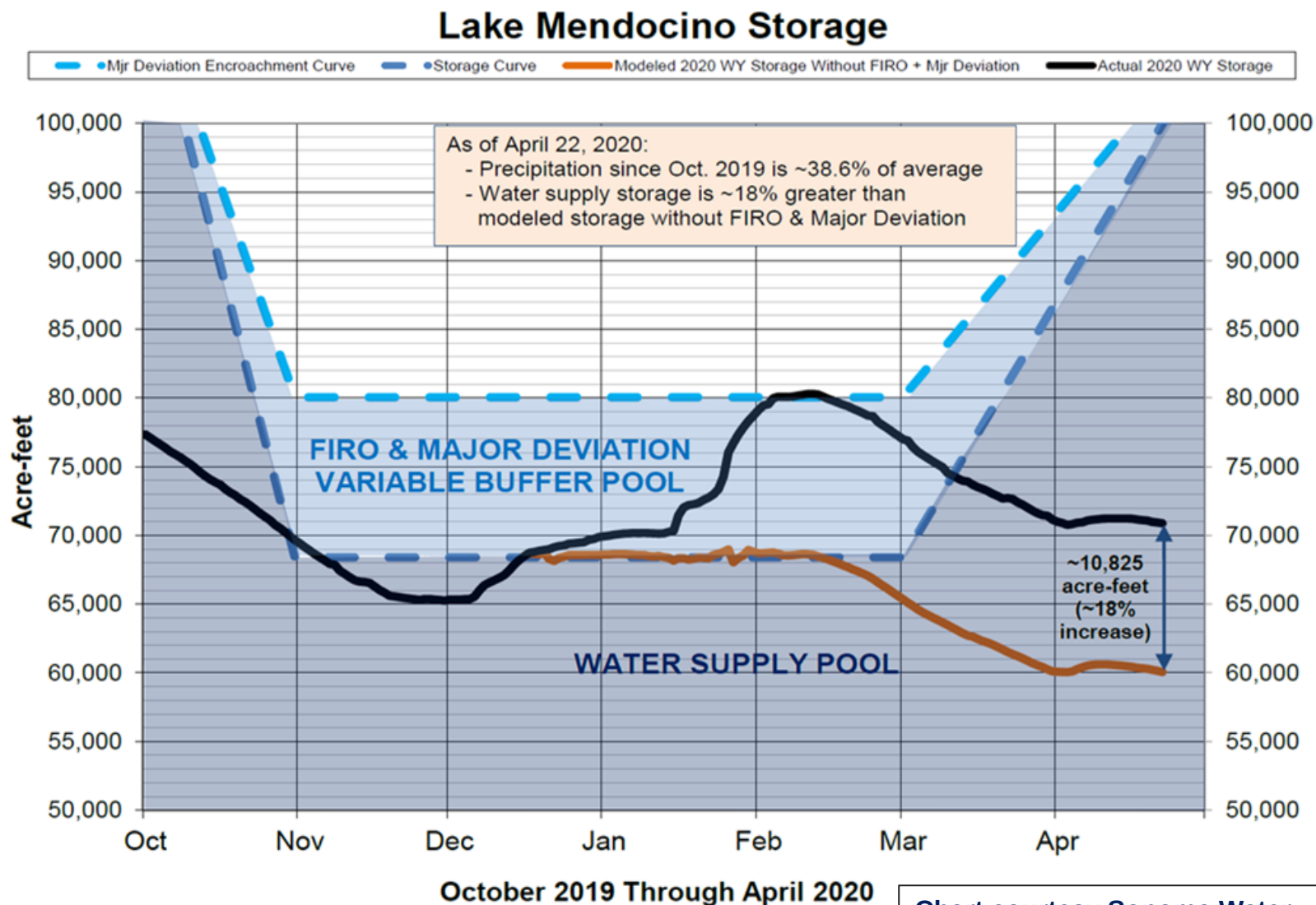


Chart courtesy Sonoma Water

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.”

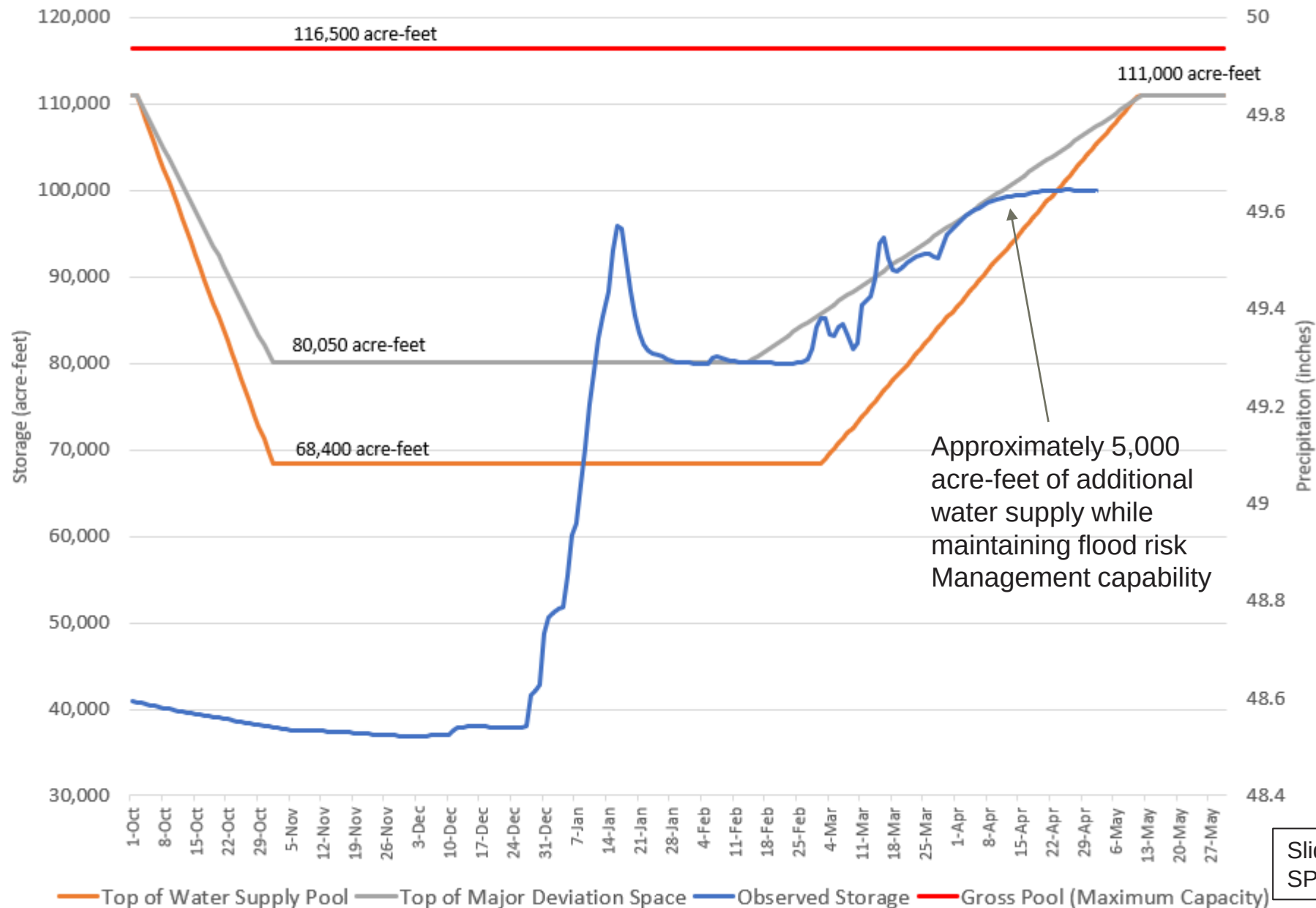
Drought or dangerous flooding? Research aims to tame atmospheric river risks — and save California’s rain
By Rachel Becker
www.CalMatters.org
25 February 2020



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Lake Mendocino Storage for Water Year 2023



Slide Courtesy Patrick Sing
SPN Water Manager



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Lake Sonoma Storage for Water Year 2023

