Lake Mendocino

FORECAST INFORMED RESERVOIR OPERATIONS FINAL VIABILITY ASSESSMENT

February 2021

Executive Summary

The Final Viability Assessment (FVA) is the culmination of a six-year effort led by the Lake Mendocino Forecast Informed Reservoir Operations (FIRO) multi-agency Steering Committee. The FVA demonstrates the viability of FIRO and provides strong support for the U.S. Army Corps of Engineers (USACE) to approve and adopt FIRO-based operations at Lake Mendocino, located in the Russian River watershed in northern California.

What is FIRO?

FIRO is a flexible water management approach that uses data from watershed monitoring and improved weather forecasting to help water managers selectively retain or release water from reservoirs for increased resilience to droughts and floods. FIRO applies emerging science and technology to optimize water resources and adapt to climate change without costly infrastructure.

The Case for FIRO at Lake Mendocino

Lake Mendocino has experienced significantly reduced water supply reliability since diversions from the Eel River were decreased in 2006. The goal of FIRO at Lake Mendocino is to update the 1950s-era Water Control Manual by applying forecasting advancements to increase water supply reliability without reducing—and while possibly enhancing—the existing flood protection capacity of Lake Mendocino and downstream flows for fish habitat.

Read the full Final Viability Assessment at https://escholarship.org/uc/item/3b63q04n.

FIRO Delivers Significant Benefits

Flooding and water supply in the Russian River basin are driven almost entirely by atmospheric rivers (ARs) (Figure 1), so the success of FIRO at Lake Mendocino depends on research to improve AR forecasts. A large body of work, led by the Center for Western Weather and Water Extremes (CW3E) at Scripps Institution of Oceanography, has enabled FIRO at Lake Mendocino. CW3E's work includes the AR Reconnaissance program, which fills major gaps in observations over the ocean to improve the accuracy of forecast models.

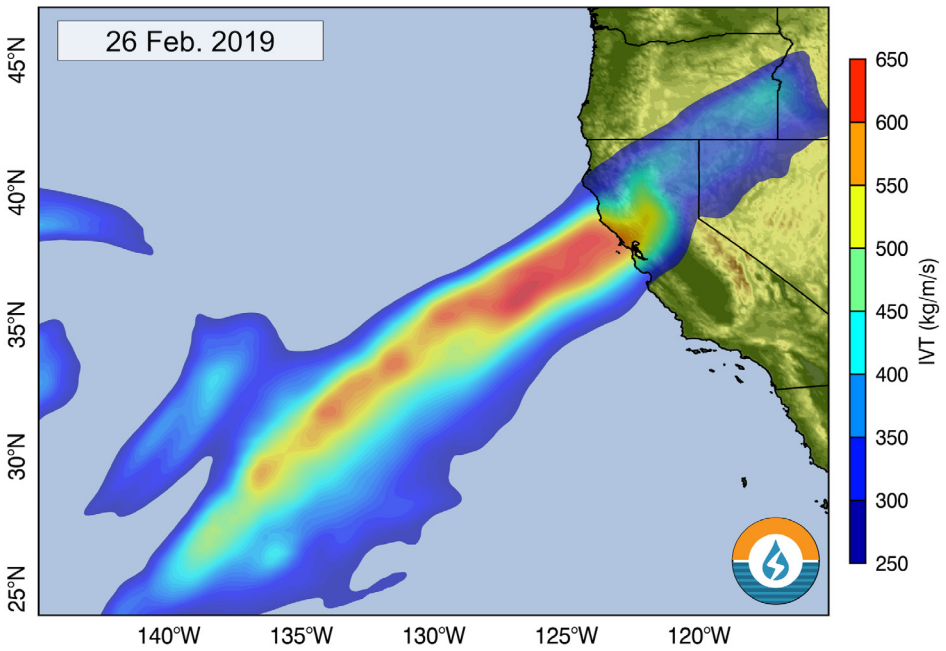


Figure 1. *An AR making landfall in the Russian River area on February 26, 2019. Shading represents integrated water vapor transport (IVT), which indicates the strength of the AR. An AR is like a river in the sky—a river of water vapor pushed by the wind.*

Results from Operational Testing at Lake Mendocino

USACE experimented with FIRO with planned major deviations from the Water Control Manual during water years (WYs) 2019 and 2020. In both years, FIRO increased water supply benefits and managed flood risks. Figure 2 shows the outcome for 2020, where FIRO increased water storage by nearly 20 percent, roughly equivalent to the water used by 22,000 households.

Alternatives Analysis and Modeled Benefits

The project team evaluated four FIRO alternatives and compared them with current operations. All four FIRO alternatives would allow more water storage to be carried into the dry season to avoid water supply shortages, and allow reservoir levels to be lowered below the guide curve to enable additional flood protection when major storms are predicted. After evaluating all options against 16 metrics, the project team selected a FIRO approach that can be implemented with USACE's standard decision tools while offering a pathway for growth with improving forecast skill and model refinements. An economic study showed that this option will result in significant benefits for fisheries, recreation, water supply, and dam operation.

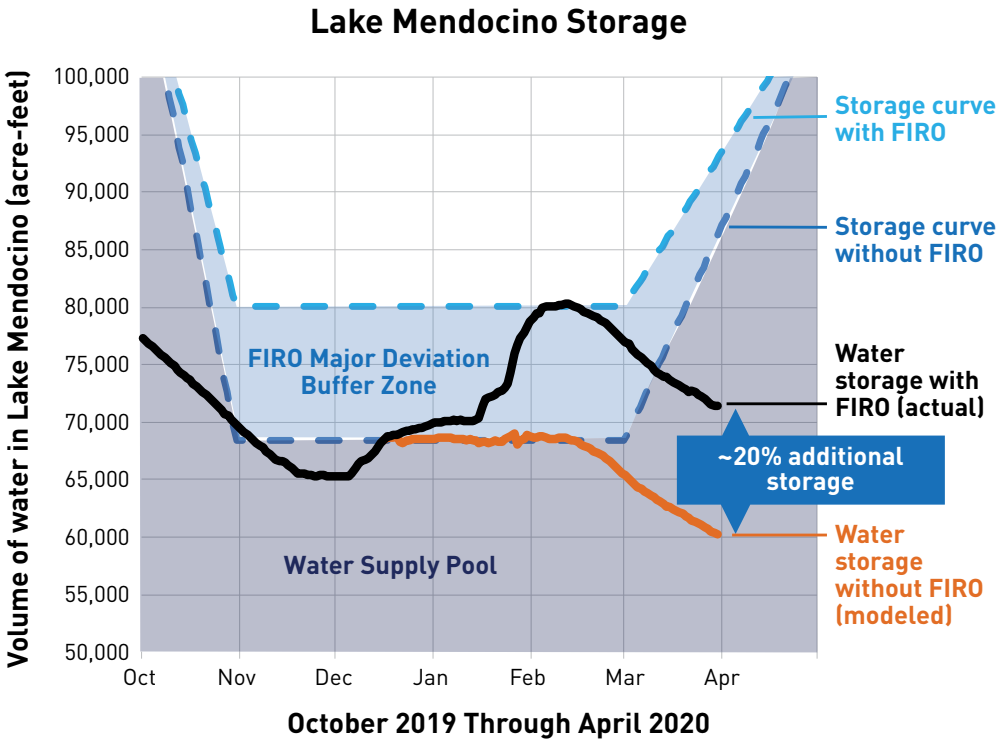


Figure 2. *Lake Mendocino storage increased by about 20 percent during major deviation operations in WY 2020, compared with modeled storage without FIRO, during a year when precipitation was 38 percent of average.*

Transferability to Other Reservoirs

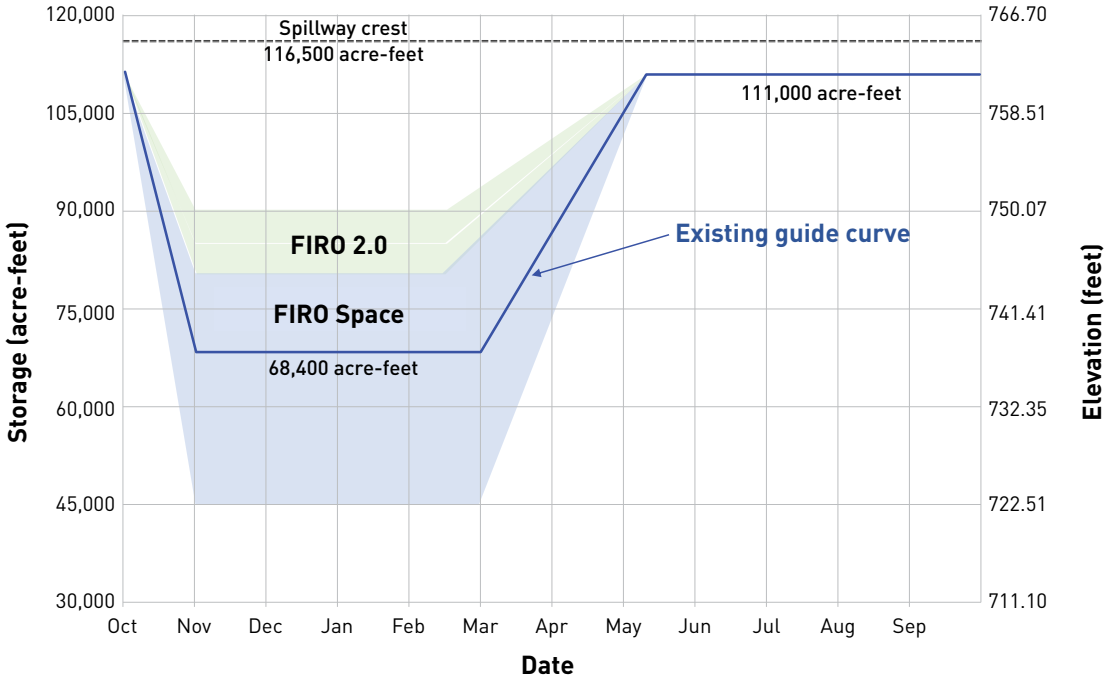
FIRO is being assessed at Prado Reservoir, New Bullards Bar Reservoir, and Lake Oroville in California, as well as the Howard Hanson Dam in Washington. Lessons learned from these projects will be incorporated into a screening tool to help prioritize FIRO assessments at other sites across the United States.

Model for Successful Collaboration

By building a partnership between research and operations, the Steering Committee established a model for future FIRO assessments. Key success factors included:

- An environment of trust, cooperation, and engagement.
- Positioning this effort within the realm of research and development, which created a safe space for exploration to seek common ground among diverse groups concerned with water supply reliability, flood risk, and fisheries.
- Multiple levels of USACE involvement, from dam operator to senior officials, which built support for major policy change.

Figure 3. *Conceptual FIRO Space for Lake Mendocino.*



Recommendations and Opportunities for Continued Improvement

The Steering Committee recommends updating the Water Control Manual to adopt FIRO and include the concept of "FIRO Space," as shown in Figure 2. This update is now in progress. With AR research investment, additional benefits may be possible. This future phase—dubbed "FIRO 2.0"—can result in even greater operational improvements as scientific advances improve forecast skill (Figure 3). This phased movement can be triggered by measurable improvements in forecast skill and reservoir operator confidence.

Center for Western Weather and Water Extremes
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