



UNIVERSITY OF CALIFORNIA  
Agriculture and Natural Resources



Utah Water Research Laboratory  
UtahStateUniversity

## How a 2 to 5-year experimental Lake Powell and Lake Mead release program tied to reservoir inflows can be a win for adaptive risk management

Brittany Fager, Anabelle Myers, Erik Porse, David Rosenberg

February 27, 2026

*This article is part of a new National Oceanic and Atmospheric Administration (NOAA) funded project to improve tools to communicate and manage sometimes conflicting risks of water shortages in the Colorado River Basin.*

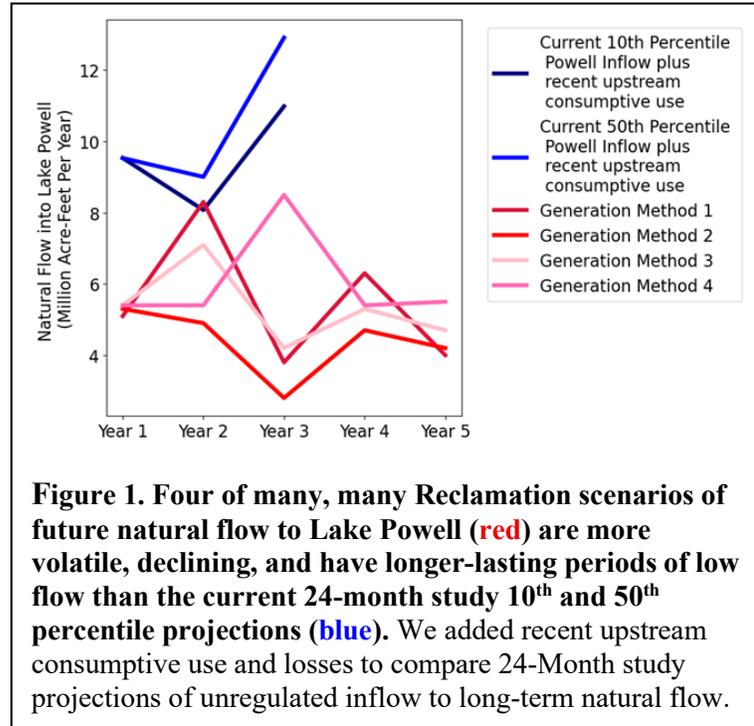
**Summary.** Lake Powell and Lake Mead are at risk of drawdown to their minimum power and dead pools in the next few years because current and proposed shortage and release operations tied to reservoir storage and sometimes prior natural flow cannot keep pace with U.S. Bureau of Reclamation's numerous scenarios of more volatile, declining, and longer-lasting periods of low flows. One experimental program to reduce risk can instead adapt reservoir releases to monitored changes in physical reservoir inflow and reservoir evaporation. First, stabilize reservoir storage by temporarily setting reservoir release to the physical reservoir inflow minus evaporation (the available water). Second, continue to stabilize storage by changing releases to match changes in physical reservoir inflow and evaporation. Third, build storage by decreasing releases from the release needed to stabilize reservoir storage. An experimental program has additional wins such as it can begin immediately or at any target reservoir elevation without the need for new agreements. A program can also stabilize and build reservoir storage even when low flows persist. Users who hold back some of their share of reservoir releases for later release can customize and adapt their strategies to manage future risks of water shortages. An experimental risk management program can help build operational experience and flexibility in a new era of low reservoir storage, volatile, declining, and longer-lasting low flows. We share links to further explore some of our new risk communication and adaptive management tools.

### Introduction

Within the U.S. Bureau of Reclamation's (Reclamation) hydrology generation methods and scenarios (Salehabadi et al., 2024; Smith et al., 2022), we have identified broad agreement that Colorado River flows will be more volatile, declining, and have longer-lasting periods of low flow than current adjusted February 24-month study 10<sup>th</sup> (minimum probable) and 50<sup>th</sup> (most probable) percentile flows (Figure 1)(Fager, 2026). Recent Reclamation proposals define rule curves that increase shortages from legal entitlements or decrease Lake Powell releases as individual or combined reservoir storage decline (USBR, 2007; USBR, 2026). Whenever river flow decreases faster than the rule curves, reservoir storage will continue to decline. To reduce



risk of Lake Powell and Lake Mead drawdown to their minimum power and dead pools in the next few years, we share one experimental program that adapts reservoir releases to monitored changes in physical reservoir inflow and reservoir evaporation because these variables most immediately effect reservoir storage and drawdown. We share how to stabilize, continue to stabilize, and build storage even as low flows persist. We identify additional wins and improvements over recent Reclamation proposals. A final section describes how an experimental risk management program can help build operational experience and flexibility in a new era of low reservoir storage, volatile, declining, and longer-lasting low flows.

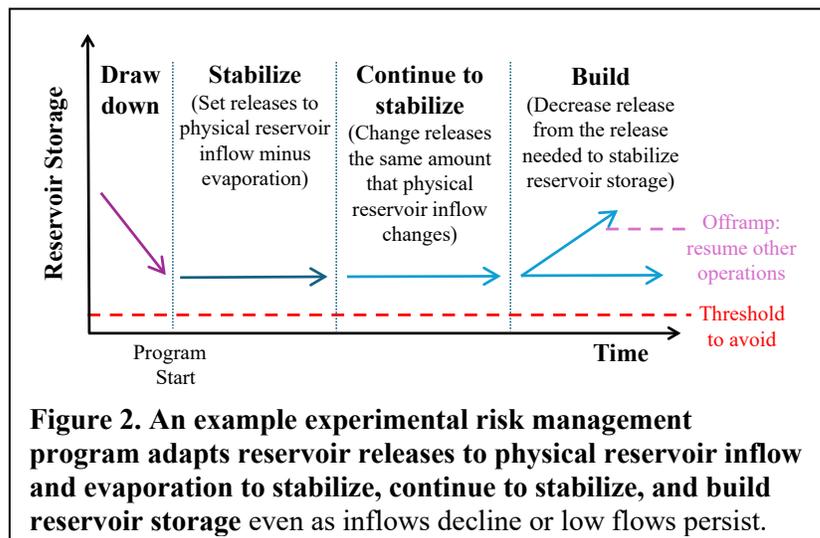


**Figure 1. Four of many, many Reclamation scenarios of future natural flow to Lake Powell (red) are more volatile, declining, and have longer-lasting periods of low flow than the current 24-month study 10<sup>th</sup> and 50<sup>th</sup> percentile projections (blue). We added recent upstream consumptive use and losses to compare 24-Month study projections of unregulated inflow to long-term natural flow.**

### Experimental program to adaptively manage risk with rapid changing hydrology

One way to reduce risk of drawing down Lake Powell and Lake Mead to their minimum power and dead pools is to adapt reservoir releases to monitored changes in physical reservoir inflow and reservoir evaporation because inflow, evaporation, and releases most immediately effect reservoir storage and drawdown. An example experimental program for Lake Powell can (Figure 2):

1. Stabilize storage by temporarily setting the Lake Powell release to the physical reservoir inflow minus evaporation (the available water).
2. Continue to stabilize Lake Powell storage by



**Figure 2. An example experimental risk management program adapts reservoir releases to physical reservoir inflow and evaporation to stabilize, continue to stabilize, and build reservoir storage even as inflows decline or low flows persist.**



UNIVERSITY OF CALIFORNIA  
Agriculture and Natural Resources



Utah Water Research Laboratory  
UtahStateUniversity

changing releases to track changes in physical reservoir inflow and evaporation.

3. Build Lake Powell storage by decreasing releases from the release needed to stabilize reservoir storage. Stop experimental releases when storage exceeds an offramp.

A similar approach can be taken for Lake Mead. For Lake Mead, the physical reservoir inflow is the Lake Powell release plus 0.6 to 1.0 million acre-feet per year of gains along the Grand Canyon (Rosenberg, 2022; Wang and Schmidt, 2020). Any of the steps to stabilize or build Lake Powell or Lake Mead storage can occur during any timeframe—weekly, monthly, seasonally, or annually with a preference for shorter periods to reduce changes in reservoir inflow and evaporation and thus changes in releases.

### Additional wins

An experimental program to adaptively manage near-term risk could also:

- A. Begin immediately or at any target reservoir elevation without the need for new agreements.
- B. Stabilize and build reservoir storage even when low flows persist.
- C. Temporarily build storage through a second mechanism where one or more users downstream of Lake Powell voluntarily hold some of their share of the available water in Lake Powell for future release.
- D. Users who hold some of their share of the available water gain flexibility to customize and adapt their individual strategies to manage their future risks of water shortages.

Readers who wish to further explore some of these new risk communication and management tools can find them online at (Fager, 2026; Myers, 2025; Myers et al., 2025)

### Improvements on recent proposals

An experimental risk management program can begin at higher reservoir storage than dead pool operations in recent Reclamation proposals (USBR, 2026). Rather than wait for years with large flows, the experimental program has multiple mechanisms to build storage even if flow declines or remains low. The experimental program can also address deficiencies in Reclamation's proposed storage and recovery program. The program counts contributions as *reductions* in consumption *from legal entitlements* and *mandatory shortages*. The program is unsustainable when total legal entitlements minus mandatory shortages exceed the physical reservoir inflow and evaporation—conditions for which there is broad agreement will occur going forward. The experimental risk management program is sustainable because users can only hold back water that was physically available to release. Storage and recovery proposals also prohibit releases when reservoir storage is low to prevent further reservoir drawdown. In contrast, users can release some up to all of their water held in the experimental program at any time because those releases can only drawdown reservoir storage to the level where the experimental program first stabilized storage.



UNIVERSITY OF CALIFORNIA  
Agriculture and Natural Resources



Utah Water Research Laboratory  
UtahStateUniversity

## Conclusions

There is broad agreement in Reclamation's hydrology that Colorado River flows will be more volatile, declining, and have longer-lasting periods of low flows than current short-term operational forecasts. To manage for the near-term risk of Lake Powell and Lake Mead drawdown to critical elevations, we suggested a new experimental program that adapts reservoir releases to monitored changes in physical reservoir inflow and evaporation. We shared steps to stabilize, continue to stabilize, and build reservoir storage even as inflows decline or low flows persist. An experimental risk management program can help build operational experience and flexibility in a new era of low reservoir storage, volatile, declining, and longer-lasting low flows.

## Data availability and reproducibility.

The data, models, and code referenced in this piece are available at (Fager, 2026; Myers, 2025; Myers et al., 2025).

## Requested Citation

Brittany Fager, Anabelle Myers, Erik Porse, David Rosenberg (2026). "How a 2 to 5-year experimental Lake Powell and Lake Mead release program tied to reservoir inflows can be a win for adaptive risk management." Utah State University Digital Commons.  
<https://doi.org/10.26077/749c-2bd9>.

## References

- Fager, B. (2026). "Lake Powell Inflow Comparisons." *Github, Utah State University*.  
<https://github.com/BrittanyFager/LakePowellInflow>.
- Myers, A. (2025). "Code Efforts Supporting 'Immersive Model for Lake Mead Based on the Principle of Division of Reservoir Inflow'." *Hydroshare*.  
<https://www.hydroshare.org/resource/6623ca4699f2485b9772f4daded15dd4/>.
- Myers, A., Rosenberg, D., Akbar, H., and Porse, E. (2025). "Immersive Model for Lake Mead Based on the Principle of Divide Reservoir Inflow." *Hydroshare*.  
<http://www.hydroshare.org/resource/23bf9eb290ce4c6a8290c214e6b04da4>.
- Rosenberg, D. E. (2022). "Adapt Lake Mead Releases to Inflow to Give Managers More Flexibility to Slow Reservoir Drawdown." *Journal of Water Resources Planning and Management*, 148(10), 02522006. [https://doi.org/10.1061/\(ASCE\)WR.1943-5452.0001592](https://doi.org/10.1061/(ASCE)WR.1943-5452.0001592).
- Salehabadi, H., Tarboton, D. G., Wheeler, K. G., Smith, R., and Baker, S. (2024). "Quantifying and Classifying Streamflow Ensembles Using a Broad Range of Metrics for an Evidence-Based Analysis: Colorado River Case Study." *Water Resources Research*, 60(7), e2024WR037225. <https://doi.org/10.1029/2024WR037225>.
- Smith, R., Zagona, E., Kasprzyk, J., Bonham, N., Alexander, E., Butler, A., Prairie, J., and Jerla, C. (2022). "Decision Science Can Help Address the Challenges of Long-Term Planning in



UNIVERSITY OF CALIFORNIA  
Agriculture and Natural Resources



Utah Water Research Laboratory  
UtahStateUniversity

- the Colorado River Basin." *JAWRA Journal of the American Water Resources Association*, 58(5), 735-745. <https://doi.org/10.1111/1752-1688.12985>.
- USBR. (2007). "Record of Decision: Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lakes Powell and Mead." U.S. Bureau of Reclamation. <https://www.usbr.gov/lc/region/programs/strategies/RecordofDecision.pdf>.
- USBR. (2026). "Post-2026 Operational Guidelines and Strategies for Lake Powell and Lake Mead – Draft Environmental Impact Statement." U.S. Bureau of Reclamation. <https://www.usbr.gov/ColoradoRiverBasin/post2026/draft-eis/>.
- Wang, J., and Schmidt, J. C. (2020). "Stream flow and Losses of the Colorado River in the Southern Colorado Plateau." Center for Colorado River Studies, Utah State University, Logan, Utah. <https://qcnr.usu.edu/coloradoriver/files/news/White-Paper-7.pdf>.