## Protect Lake Powell: Decrease releases and increase upstream conservation to help generate electricity, supply downstream users, and sustain Grand Canyon endangered fish

Direct Link: <http://tinyurl.com/ProtectLakePowell>

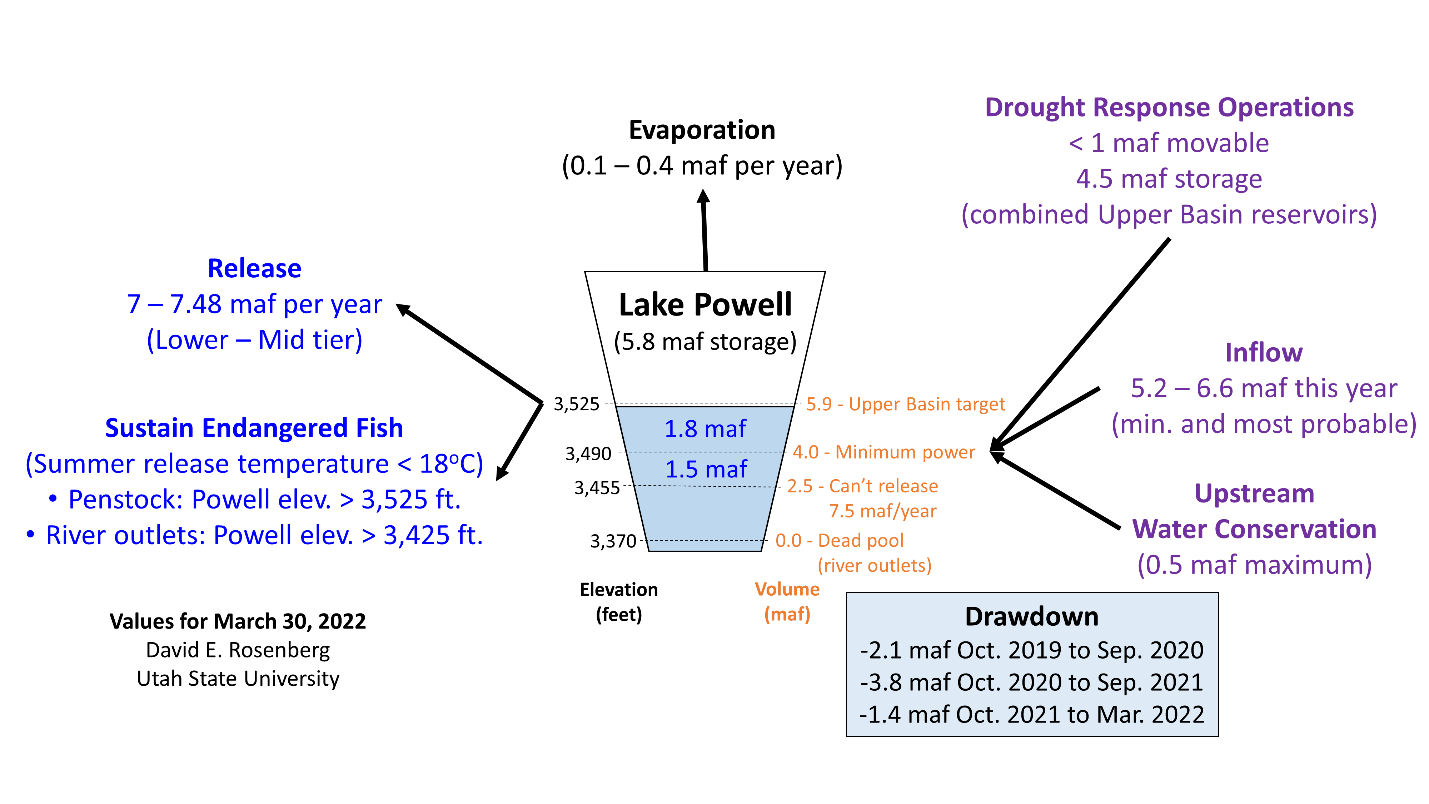
*Last Update: April 11, 2022.*

## **Introduction**

There is still opportunity to protect Lake Powell’s minimum power pool elevation of 3,490 feet (4.0 million acre-feet [maf] storage) even though current storage is ~5.8 maf and last year the reservoir drew down 3.8 maf.

## The Data in Brief

Three inflow and three outflow factors affect Lake Powell storage (Figure 1; see Methods below for elaboration). Lake Powell’s drawdown from October 2020 to September 2021 is about the same volume as remains to drawdown to elevation 3,455 feet where Glen Canyon dam can no longer release 7.5 maf per year to meet downstream water delivery targets.



**Figure 1. Inflow and Outflow factors that affect Lake Powell storage.**

## Decrease Releases and Increase Upstream Conservation to Slow Reservoir Drawdown

Of the six factors in Figure 1 that affect Lake Powell storage, Colorado River managers can year-after-year influence **Lake Powell releases** and **upstream water conservation**.

Together, managers from the Colorado River Upper and Lower Basins and First Nations can ***decrease* Lake Powell releases** and ***increase* upstream water conservation** to slow reservoir drawdown to the minimum power pool and elevation where Glen Canyon Dam can no longer release water to meet downstream water delivery targets. Coordinated action to increase upstream conservation and decrease releases can double the effect of single-party protection efforts. Coordinated action can help to continue to generate electricity for rural communities in 7 western US states, supply downstream water users, and sustain endangered, native fish of the Grand Canyon.

What does this protect Lake Powell brief do well? And how to make more actionable the coordinated suggestions to decrease Lake Powell releases and increase upstream water conservation?

## Next Steps

1. Email [david.rosenberg@usu.edu](mailto:david.rosenberg@usu.edu?subject=Protect%20Lake%20Powell) or phone (435-797-8689) with feedback. Recommend how to make more actionable the suggestions to decrease Lake Powell releases and increase upstream water conservation. Use the subject line **Protect Lake Powell**.
2. Share this brief with managers and stakeholders (Link: <http://tinyurl.com/ProtectLakePowell>).
3. Email [david.rosenberg@usu.edu](mailto:david.rosenberg@usu.edu?subject=Protect%20Lake%20Powell)to ask to join as a co-author. **The goal is to add 5 co-authors** by May 1, 2022. At that time, we will decide their next steps.

## Methods

|  |  |  |
| --- | --- | --- |
| **Component** | **Method(s)** | **Reference** |
| Drought response operations | One-time release of water from Upper Colorado River reservoirs such as Flaming Gorge to Lake Powell. Existing records of decision limit the volume of releases to Lake Powell. | Attachment A1 of USBR (2019) |
| Inflow | Two inflow scenarios for the current water year are Reclamation’s minimum probable and most probable forecast inflow. The statistical basis for minimum probable an most probable is the prior 30 years. Inflow this year may be worse than the minimum probable value because streamflow is declining over time due to basin aridification. | (USBR, 2021) |
| Upstream water conservation | Maximum volume of water conservation listed in the Upper Basin demand management plan if the Upper Basin states approve the plan. Require farmers and ranchers that take payments to invest the money in on-farm water conservation to keep investments in local communities and make more water available in future years. | Attachment A2 of USBR (2019); Rosenberg (2021b) |
| Evaporation | Reservoir evaporation at current active storage down to dead pool (zero active storage) using evaporation rates of 4.9 to 6.5 feet per year. Lake Powell evaporation rates have not been measured in decades. Annual evaporation volume is the product of the reservoir area and evaporation rate. Reservoir area is estimated from the reservoir storage-area curve in the Colorado River Simulation System model. | (Rosenberg, 2021a; Schmidt et al., 2016; Wheeler et al., 2019; Zagona et al., 2001) |
| Release | Release is specified in the 2007 Interim Guidelines. 7 maf per year is the lowest release specified in the guidelines and occurs when Lake Powell elevation is below 3,525 feet (low tier). A 7.48 maf release occurs when Lake Powell’s elevation is above 3,525 and below 3,575 feet and Lake Mead’s storage volume is higher than Lake Powell. See Wheeler et al. (2019; Figure 15) for a diagram of the operations. In Fall 2021, Lake Powell storage was above 3,525 feet (mid tier) and triggered a current year release of 7.48 maf. Presently, Lake Powell is below 3,525 feet (low tier) and may release 7 maf next year. There is also discussion to lower this year’s release to 7 maf. | USBR (2007) |
| Sustain Endangered Fish | It is thought that summertime Lake Powell release temperatures below 18oC can sustain native, endangered fish populations of the Grand Canyon from predation by non-native fish. Using release temperature data through the penstocks and lake temperature profiles at nearby Wahweap, Lake Powell is thought to release 18oC or cooler water when reservoir level is above 3,525 feet and water is released through the hydropower penstocks. Lake Powell can also release 18oC or cooler water when the water level is above 3,425 feet and water is released through the river outlets. The 18oC water temperature criteria does not include the entrainment of non-native fish that live in the reservoir and their passage through the penstocks. In the lower Grand Canyon, native fish populations are presently doing well. This success is thought to be because Lake Mead storage is low and the Pierce Rapid blocks passage of non-native fish from the lake upstream to the Colorado River. | Sidebar 1 and Appendix II in Wheeler et al. (2021) |
| Reservoir Storage | Reservoir storage is related to reservoir elevation using the elevation-storage relationship in the Colorado River Simulation System model. | (Wheeler et al., 2021; Zagona et al., 2001) |
| Change in reservoir storage | Monthly Lake Powell operations data were downloaded then filtered on the month of October (water year). Values in adjacent rows were subtracted to obtain the annual change in storage. | USBR (2022) |

## Tasks To Do

1. Update with new storage-elevation curve for Lake Powell that was released a few weeks ago.
2. Share code to calculate change in reservoir storage.
3. Verify river outlet capacity in figure against data in Colorado River Simulation System model.

## Support Material

* [**PowellInBrief-DecreaseReleasesIncreaseInflowsToProtectPowerSupplyFish.docx**](https://github.com/dzeke/ColoradoRiverCoding/raw/main/ProtectPowellInBrief/ProtectPowellInBrief-CoordinatedActionsToHelpGeneratePowerDeliverWaterSustainNativeFish.docx) – Word source file for the brief.
* [**PowellInBrief-DecreaseReleasesIncreaseInflowsToProtectPowerSupplyFish.md**](https://github.com/dzeke/ColoradoRiverCoding/blob/main/ProtectPowellInBrief/ProtectPowellInBrief-CoordinatedActionsToHelpGeneratePowerDeliverWaterSustainNativeFish.md) – Markdown version of Word doc for viewing on Github.
* [**LakePowell04-08-2022T11.32.01.csv**](https://github.com/dzeke/ColoradoRiverCoding/raw/main/ProtectPowellInBrief/LAKEPOWELL04-08-2022T11.32.01.csv) – Monthly Lake Powell operations data downloaded from (USBR, 2022).
* [**PowellBypass.xlsx**](https://github.com/dzeke/ColoradoRiverCoding/raw/main/ProtectPowellInBrief/PowellBypass.xlsx) – Lake Powell bypass elevation-capacity curve downloaded from the Colorado River Simulation System model.
* [**ProtectLakePowellInBrief-DataAssembly.pptx**](https://github.com/dzeke/ColoradoRiverCoding/raw/main/ProtectPowellInBrief/ProtectLakePowellInBrief-DataAssembly.pptx) – Powerpoint source file for data assembly in Figure 1.
* [**ProtectLakePowellInBrief-DataAssembly.png**](https://github.com/dzeke/ColoradoRiverCoding/raw/main/ProtectPowellInBrief/ProtectLakePowellInBrief-DataAssembly.png) – PNG version of Figure 1.

## References

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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>.

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