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RECLAMATION

Glen Canyon Monthly Operations Call

Basin Hydrology and Operations

February 23, 2022

Background

This briefing is being provided consistent with the provision in Attachment B - Section 1.1 of the LTEMP ROD which states:

“Annually, Reclamation will develop a hydrograph based on the characteristics above. Reclamation will seek consensus on the annual hydrograph through monthly operational coordination calls with governmental entities, and regular meetings of the GCDAMP Technical Working Group (TWG) and AMWG.

Reclamation will conduct monthly Glen Canyon Dam operational coordination meetings or calls with the DOI bureaus (USGS, NPS, FWS, and BIA), WAPA, and representatives from the Basin States and UCRC. The purpose of these meetings or calls is for the participants to share and seek information on Glen Canyon Dam operations. One liaison from each Basin State and from the UCRC may participate in the monthly operational coordination meetings or calls.”

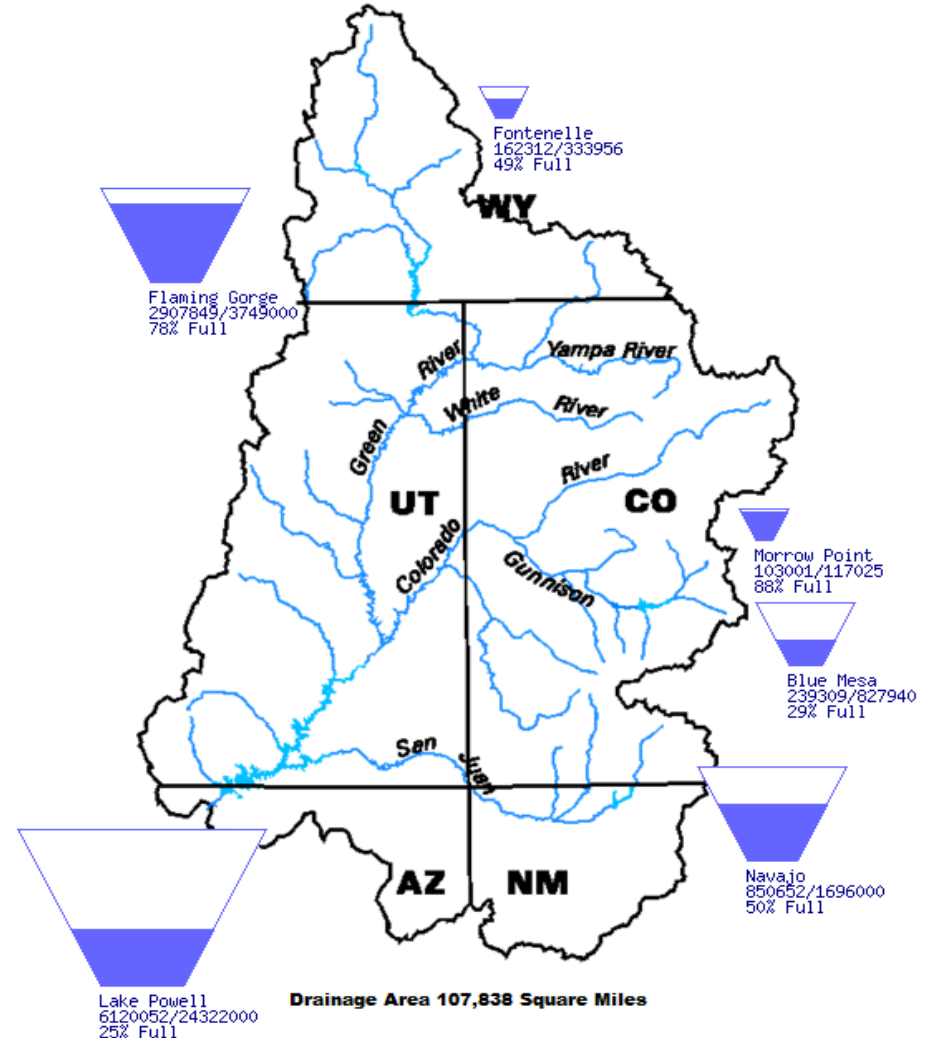


Upper Basin Storage (as of February 21, 2022)

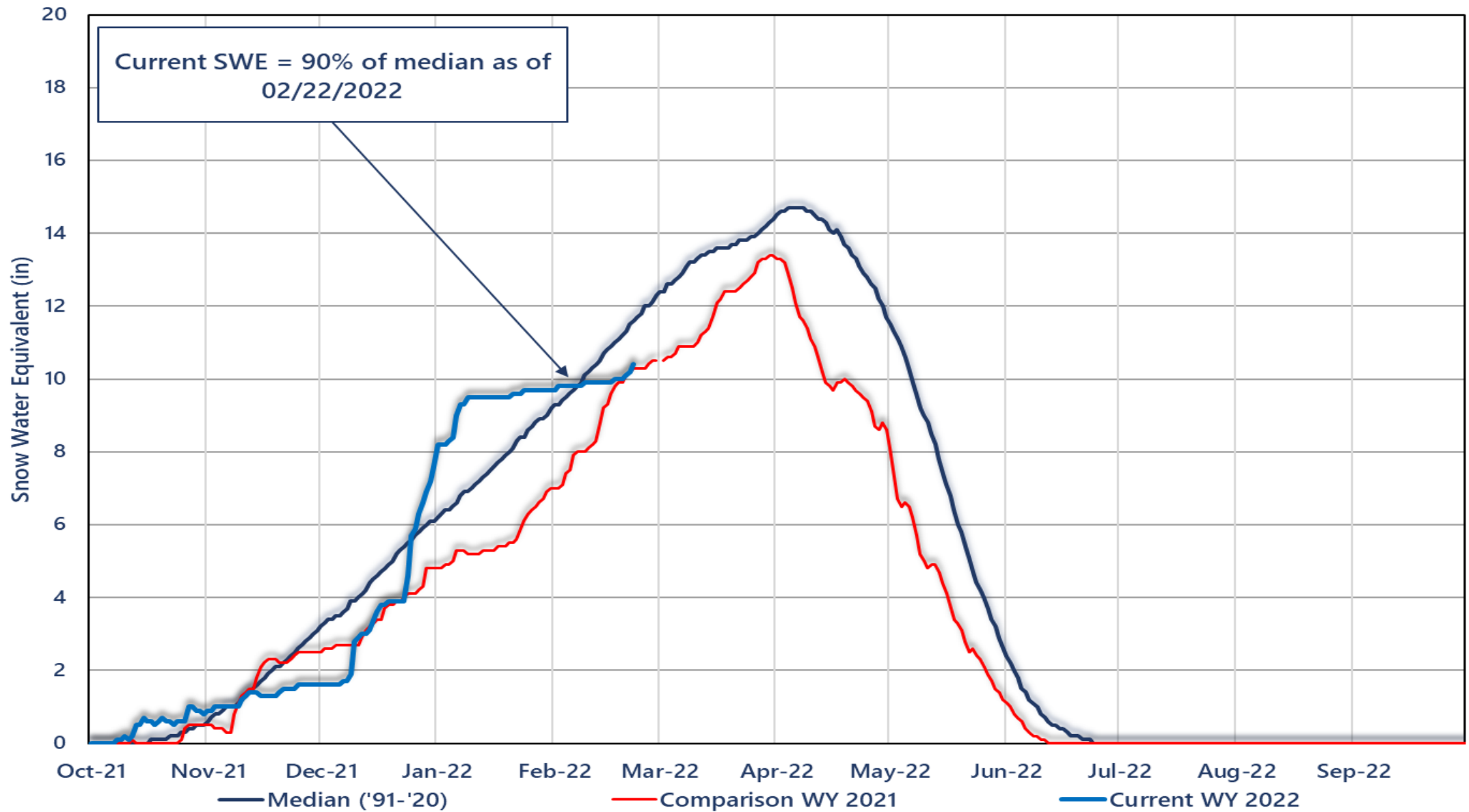
Data Current as of:
02/21/2022

Upper Colorado River Drainage Basin

Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	49	0.16	0.33	6,480.71
Flaming Gorge	78	2.91	3.75	6,017.95
Blue Mesa	29	0.24	0.83	7,436.21
Navajo	50	0.85	1.70	6,018.25
Lake Powell	25	6.16	24.32	3,528.12
UC System Storage	34	10.40	30.93	



Colorado River Basin Above Lake Powell Snow Water Equivalent



Current SWE = 90% of median as of 02/22/2022

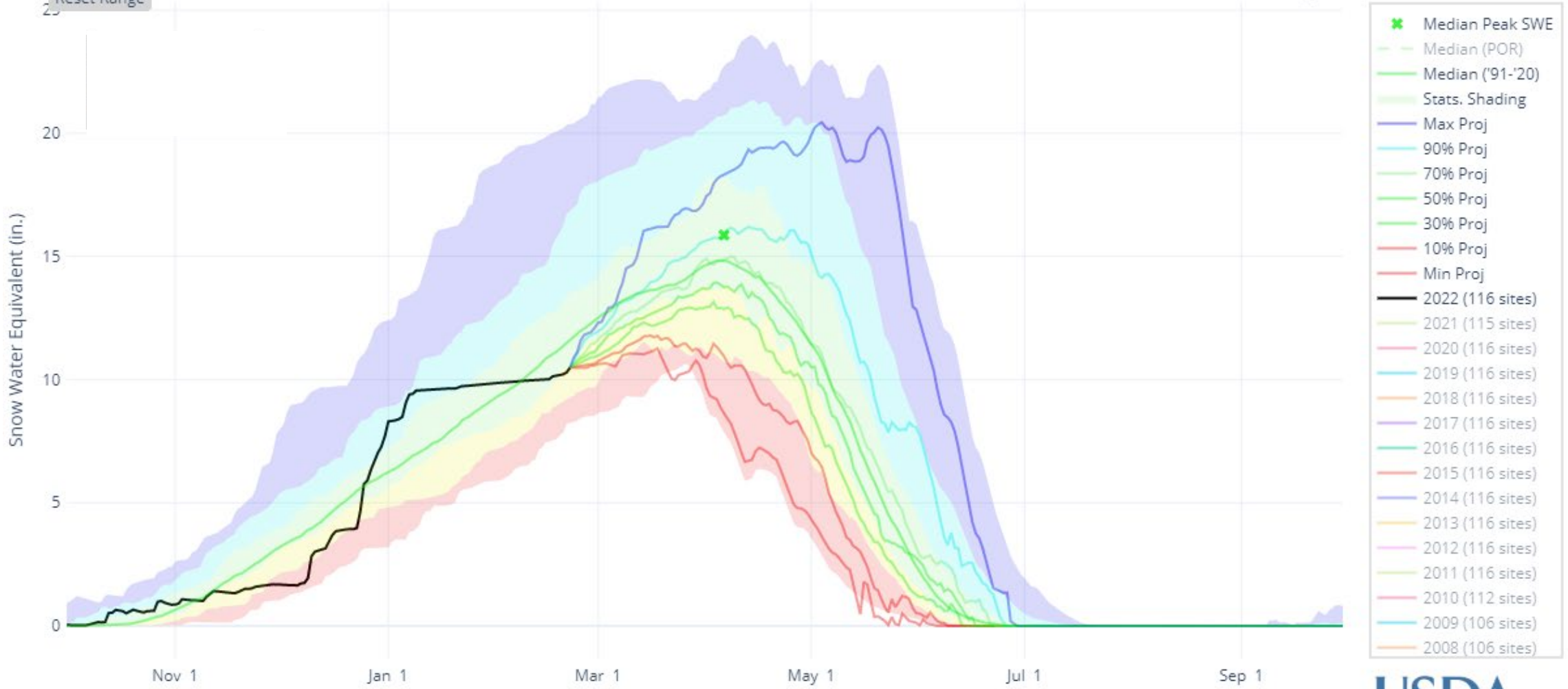


SNOW WATER EQUIVALENT PROJECTIONS IN UPPER COLORADO REGION

Reset Range

Link to data: CSV / JSON

Station List

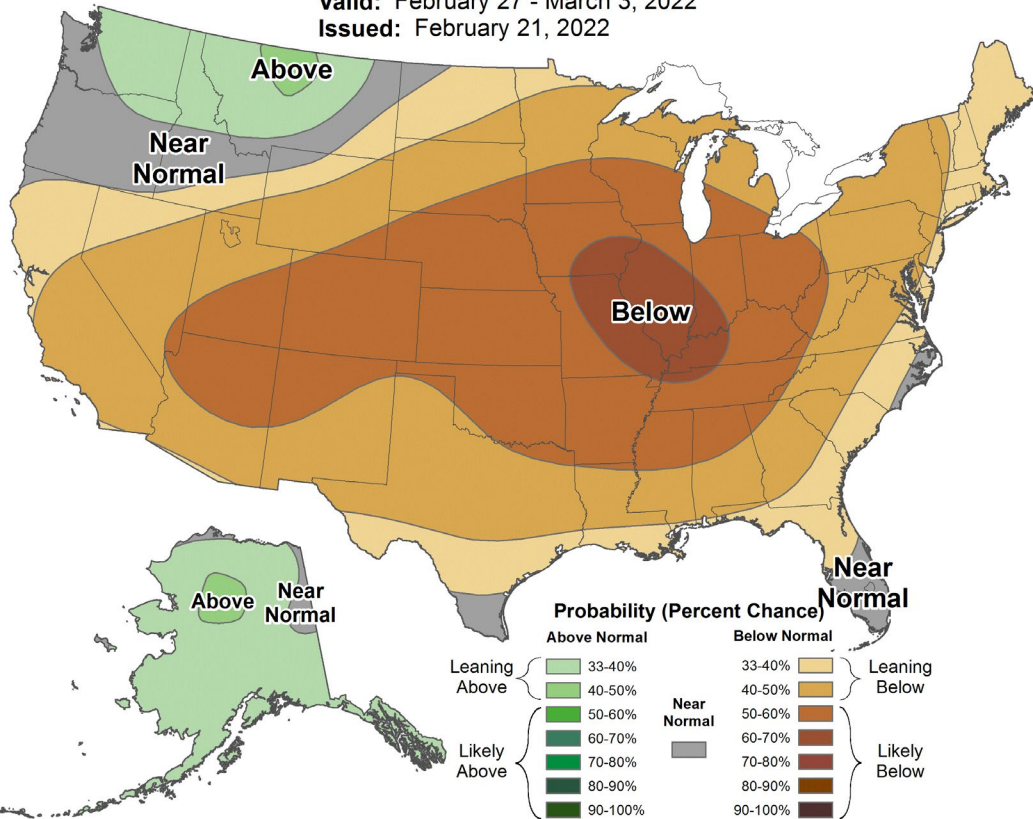


Climate Prediction Center Precipitation



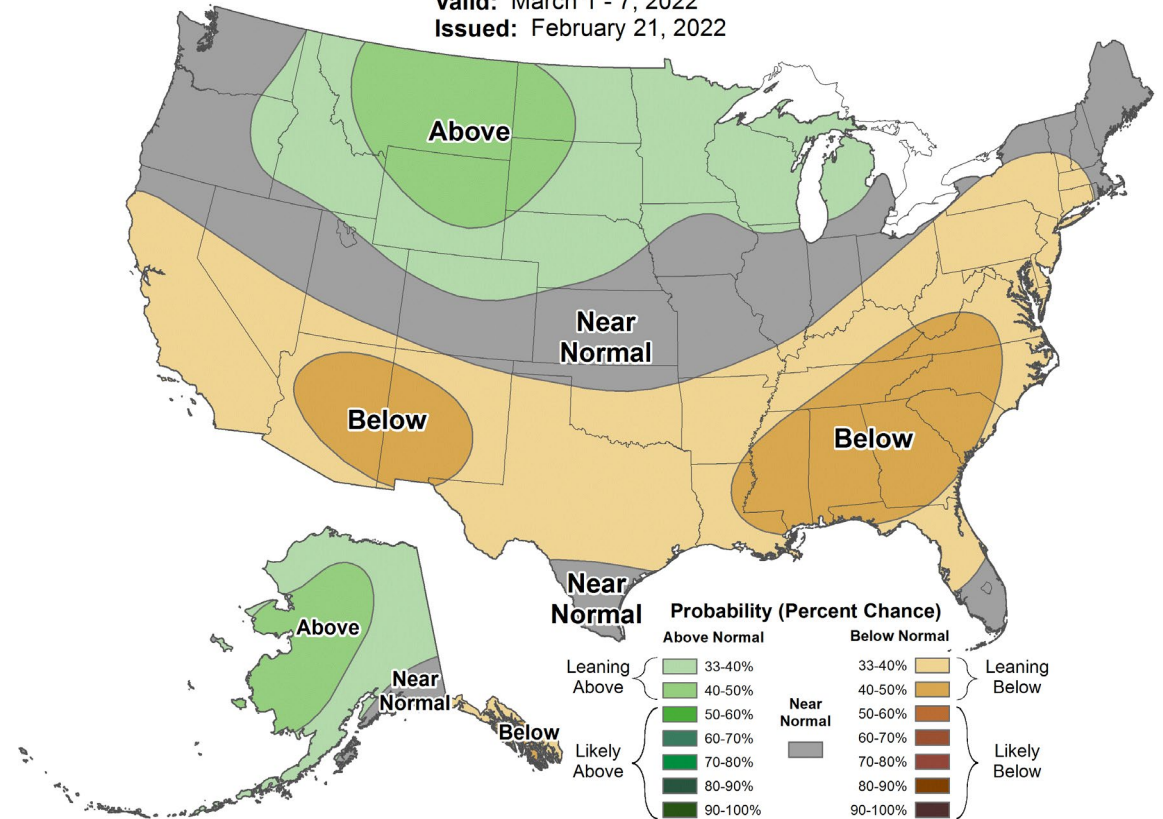
6-10 Day Precipitation Outlook

Valid: February 27 - March 3, 2022
 Issued: February 21, 2022



8-14 Day Precipitation Outlook

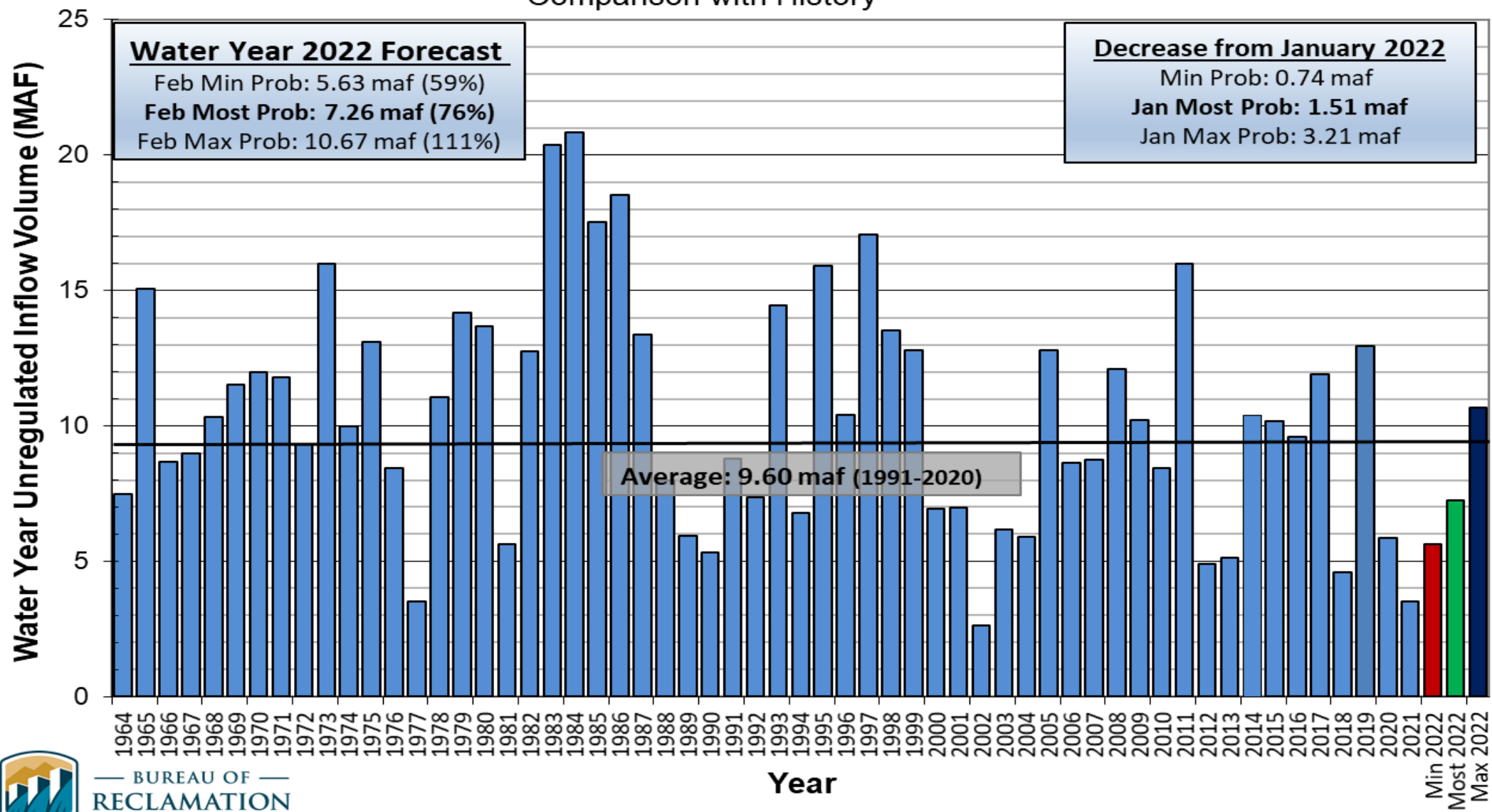
Valid: March 1 - 7, 2022
 Issued: February 21, 2022



Lake Powell Unregulated Inflow

Water Year 2022 Forecast *(issued February 3)*

Comparison with History



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Most Probable February Forecast Water Year 2022

Water Year 2022
Forecasted Unregulated Inflow
as of February 3, 2022

Reservoir	Unregulated Inflow (kaf)	1991-2020 Percent of Avg
Fontenelle	911	85
Flaming Gorge	1,125	80
Blue Mesa	810	90
Navajo	624	69
Powell	7,257	76

Powell midmonth = 6,472 kaf (67%)

April – July 2022
Forecasted Unregulated Inflow
as of February 3, 2022

Reservoir	Unregulated Inflow (kaf)	1991-2020 Percent of Avg
Fontenelle	615	84
Flaming Gorge	750	78
Blue Mesa	585	92
Navajo	455	72
Powell	5,000	78

Powell midmonth = 4,200 kaf (66%)





Upper Colorado Basin

Projected Operations for Water Year 2022 Based on January 2022 Modeling



Lake Powell & Lake Mead Operational Table

Operating Determinations for Water Year/Calendar Year 2022

Lake Powell			Lake Mead		
Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) ¹	Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) ¹
3,700	Equalization Tier Equalize, avoid spills or release 8.23 maf	24.3	1,220	Flood Control Surplus or Quantified Surplus Condition Deliver > 7.5 maf	25.9
3,636 - 3,666 (2008-2026)	Upper Elevation Balancing Tier ³ Release 8.23 maf; if Lake Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf	15.5 - 19.3 (2008-2026)	1,200 (approx.) ²	Domestic Surplus or ICS Surplus Condition Deliver > 7.5 maf	22.9 (approx.) ²
3,575	Mid-Elevation Release Tier Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.5	1,145	Normal or ICS Surplus Condition Deliver ≥ 7.5 maf	15.9
	3,535.40 ft		1,105		11.9
			1,075	1,065.85 ft	9.4
				Shortage Condition Deliver 7.167 ⁴ maf Jan 1, 2022 Projection	
3,525	Lower Elevation Balancing Tier Balance contents with a min/max release of 7.0 and 9.5 maf	5.9	1,050	Shortage Condition Deliver 7.083 ⁵ maf	7.5
			1,025		5.8
3,490		4.0	1,000	Shortage Condition Deliver 7.0 ⁶ maf Further measures may be undertaken ⁷	4.3
3,370		0	895		0

Diagram not to scale

¹ Acronym for million acre-feet

² This elevation is shown as approximate as it is determined each year by considering several factors including Lake Powell and Lake Mead storage, projected Upper Basin and Lower Basin demands, and an assumed inflow.

³ Subject to April adjustments which may result in a release according to the Equalization Tier

⁴ Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

⁵ Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

⁶ Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

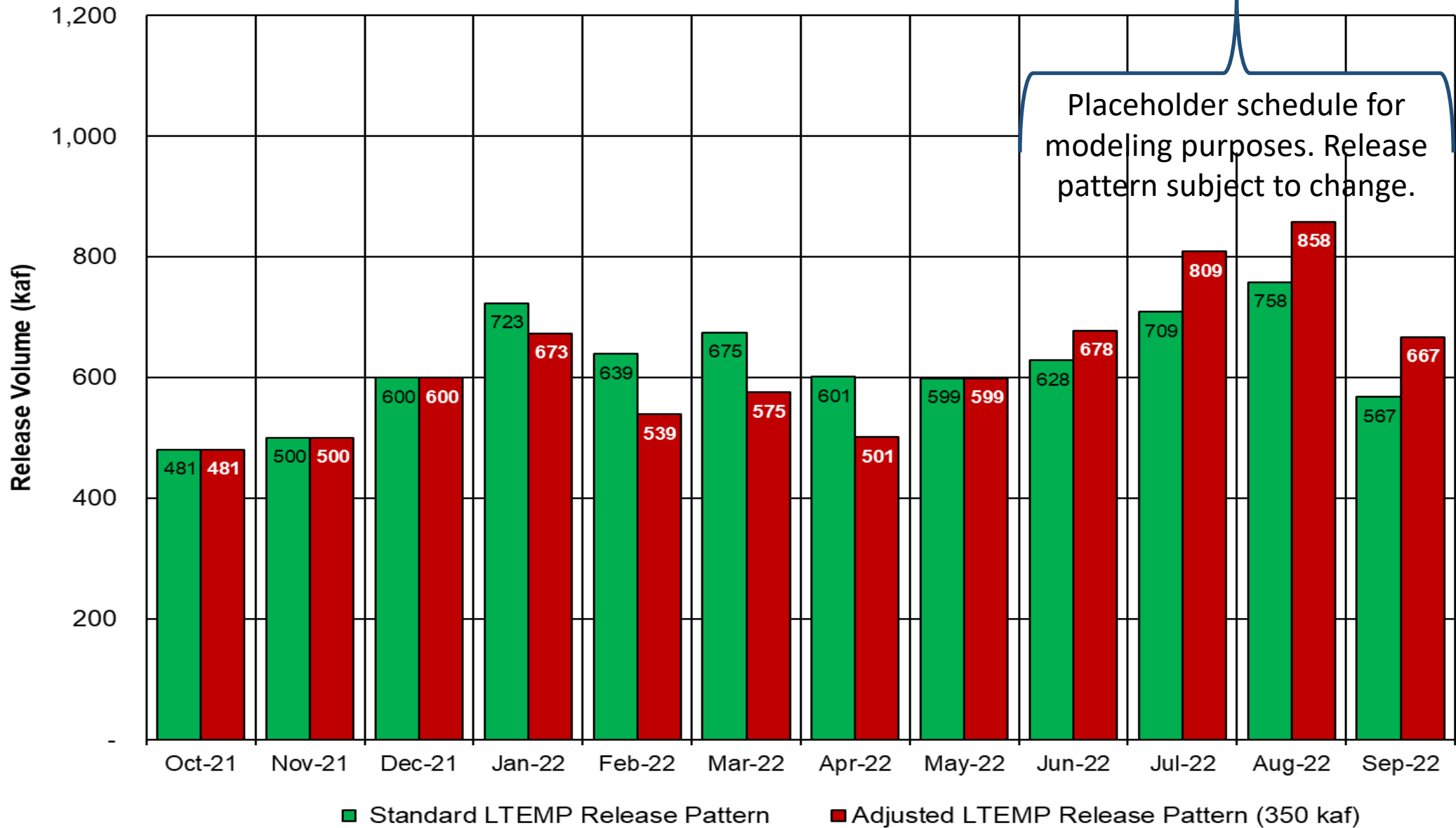
⁷ Whenever Lake Mead is below elevation 1,025 feet, the Secretary shall consider whether hydrologic conditions together with anticipated deliveries to the Lower Division States and Mexico is likely to cause the elevation at Lake Mead to fall below 1,000 feet. Such consideration, in consultation with the Basin States, may result in the undertaking of further measures, consistent with applicable Federal law.

¹ Lake Powell and Lake Mead operating determinations are based on August 2021 24-Month Study projections consistent with the 2007 Interim Guidelines and 2019 Drought Contingency Plans. These determinations will be documented in the 2022 Annual Operating Plan for Colorado River Reservoirs.



Potential Lake Powell Monthly Release Volume Distribution

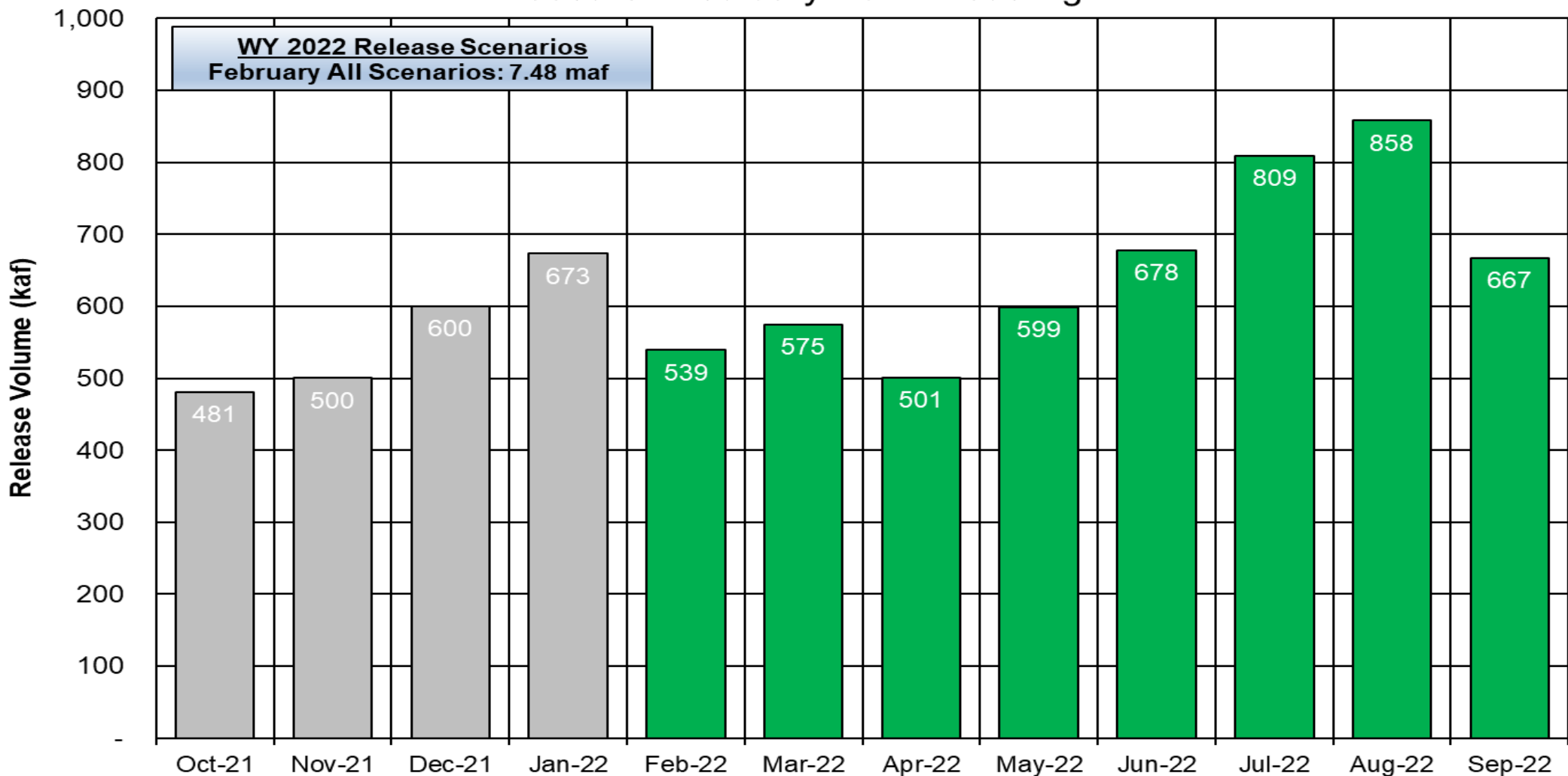
7.48 MAF Release Pattern for Water Year 2022



Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2022

Based on February 2022 Modeling



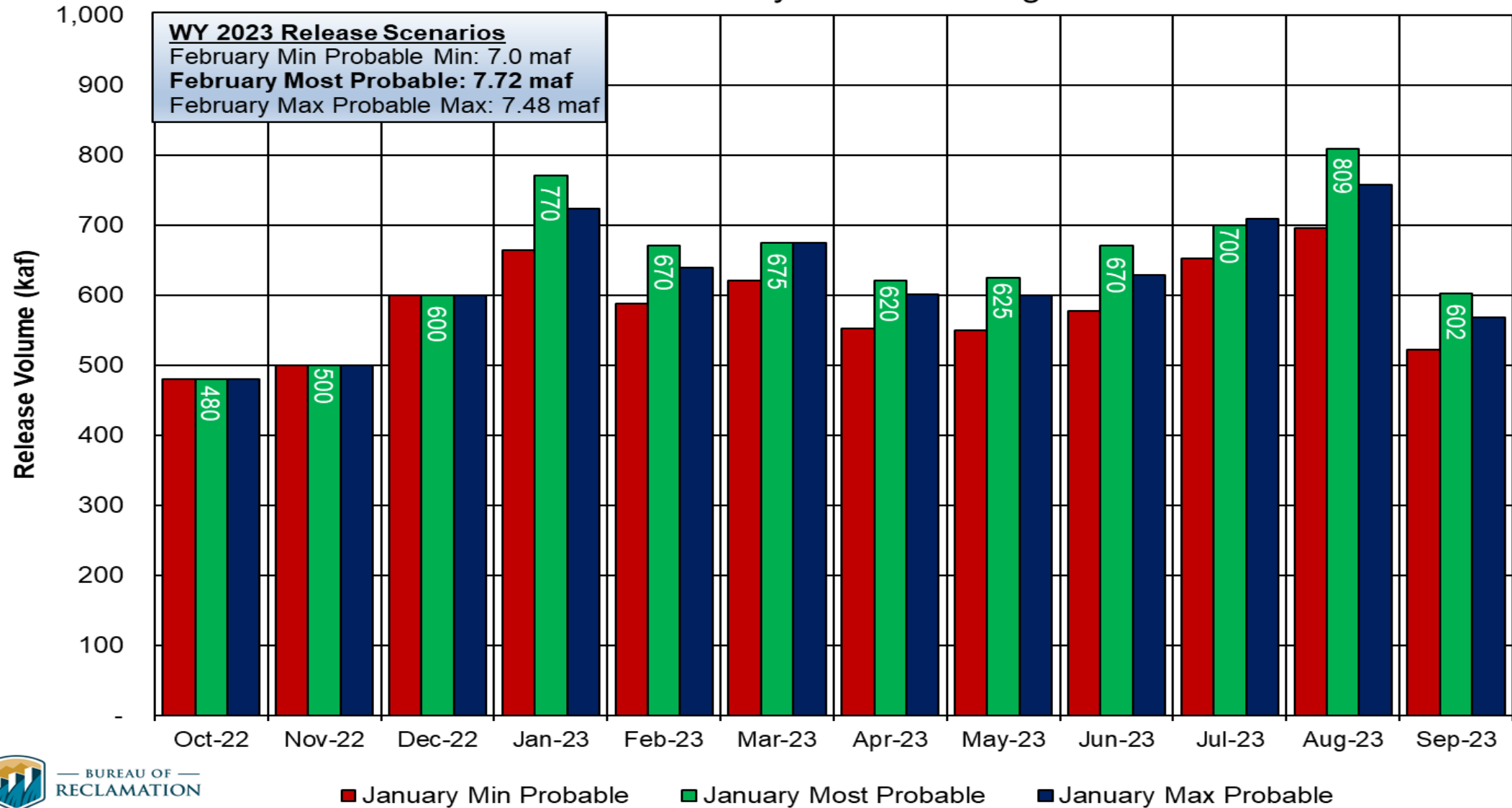
The Drought Response Operations Agreement (DROA) can be found here: <https://www.usbr.gov/dcp/finaldocs.html>



Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2023

Based on February 2022 Modeling



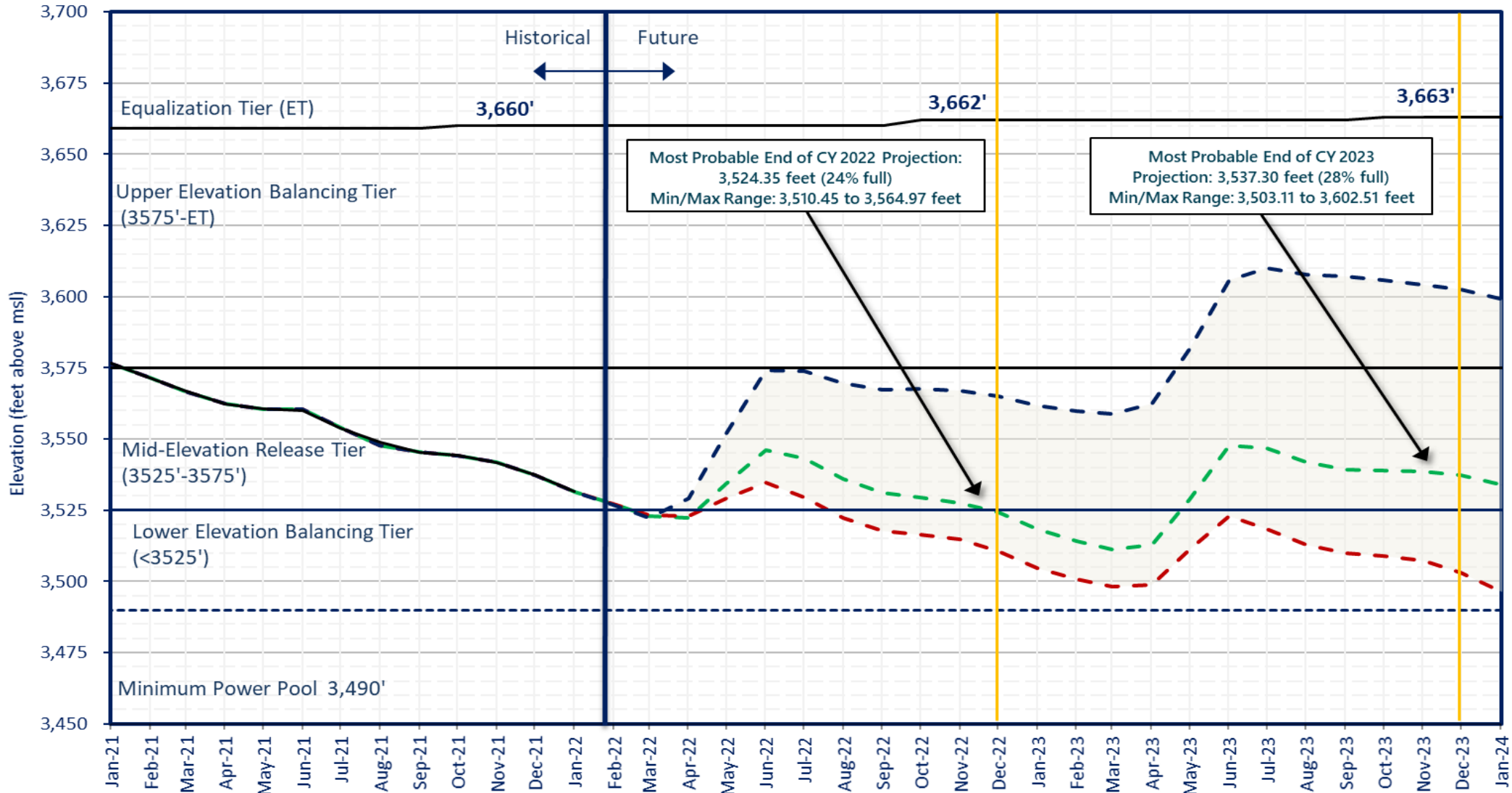
Reclamation Operational Modeling Model Comparison

	Colorado River Mid-term Modeling System (CRMMS)		CRSS
	24-Month Study Mode (Manual Mode)	Ensemble Mode (Rule-based Mode)	
Primary Use	AOP tier determinations and projections of current conditions	Risk-based operational planning and analysis	Long-term planning, comparison of alternatives
Simulated Reservoir Operations	Operations input manually	Rule-driven operations	
Probabilistic or Deterministic	Deterministic – single hydrologic trace	Deterministic OR Probabilistic 30 (or more) hydrologic traces	Probabilistic – 100+ traces
Time Horizon (years)	1 - 2	1 - 5	1 - 50
Upper Basin Inflow	Unregulated forecast, 1 trace	Unregulated ESP forecast, 35 traces	Natural flow; historical, paleo, or climate change hydrology
Upper Basin Demands	Implicit, in unregulated inflow forecast		Explicit, 2016 UCRC assumptions
Lower Basin Demands	Official approved or operational		Developed with LB users



Lake Powell End of Month Elevations

Projections from the February 2022 24-Month Study Inflow Scenarios



- February 2022 Most Probable Inflow - Lake Powell release of 7.48 maf in WY2022 and 7.72 maf in WY2023
- February 2022 Minimum Probable Inflow - Lake Powell release of 7.48 maf in WY2022 and 7.0 maf in WY2023
- - - February 2022 Maximum Probable Inflow - Lake Powell release of 7.48 maf in WY2022 and 7.48 maf in WY2023
- Historical Elevations

*The Drought Response Operations Agreement (DROA) can be found here: <https://www.usbr.gov/dcp/finaldocs.html>



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February 2022 24-MS Trigger Elevation Differences

- **Most probable**

- March 2022 - 3,522.88 feet (130 kaf below 3,525 ft)
- April 2022 – 3,522.19 feet (172 kaf below 3,525 ft)
- December 2022 – 3,524.35 feet (40 kaf below 3,525 ft)
- March 2023 – 3,511.21 feet (812 kaf below 3,525 ft)
- Elevations remain above 3,525 feet after April 2023
- Elevations remain above 3,490 feet entire most probable run



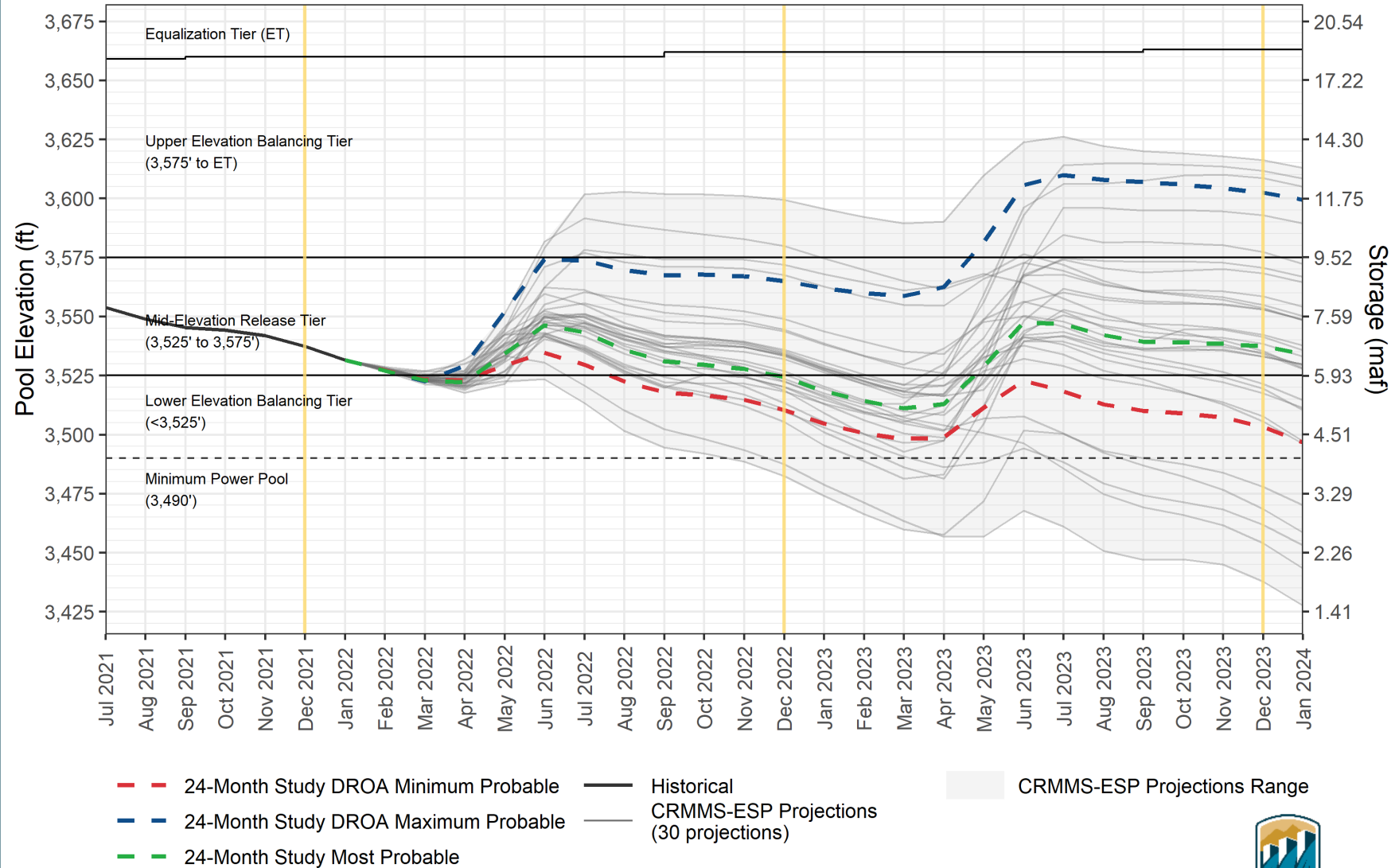
February 2022 24-MS Trigger Elevation Differences

- **Min probable**

- March 2022 - 3,523.17 feet (113 kaf below 3,525 ft)
- April 2022 – 3,522.87 feet (131 kaf below 3,525 ft)
- December 2022 – 3,510.45 feet (854 kaf below 3,525 ft)
- March 2023 – 3,498.10 feet (1.52 maf below 3,525 ft)
- Elevations remain above 3,490 feet entire min probable run



Lake Powell End-of-Month Elevations CRMMS Projections from February 2022

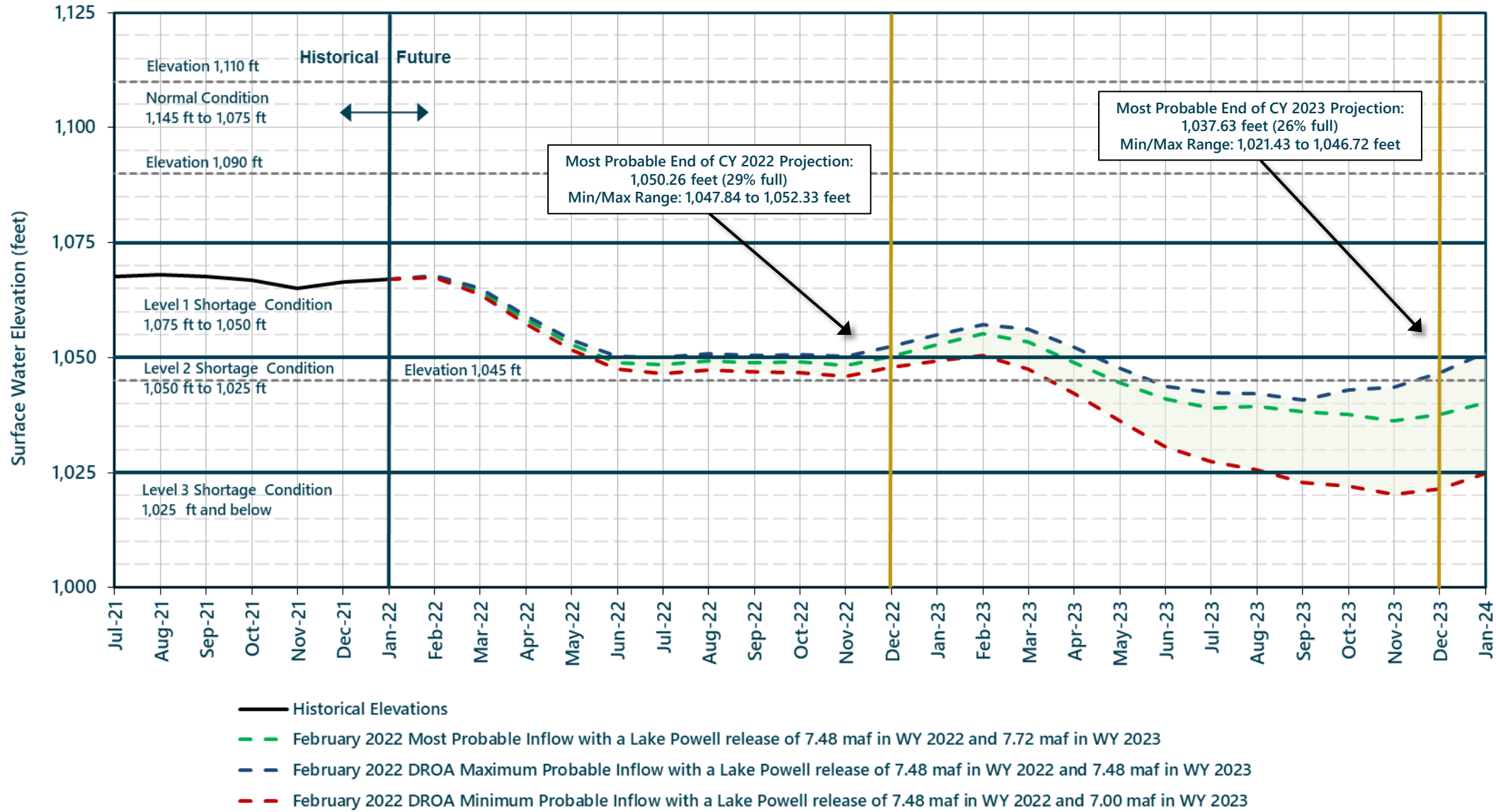


Provisional until official publication



Lake Mead End of Month Elevations

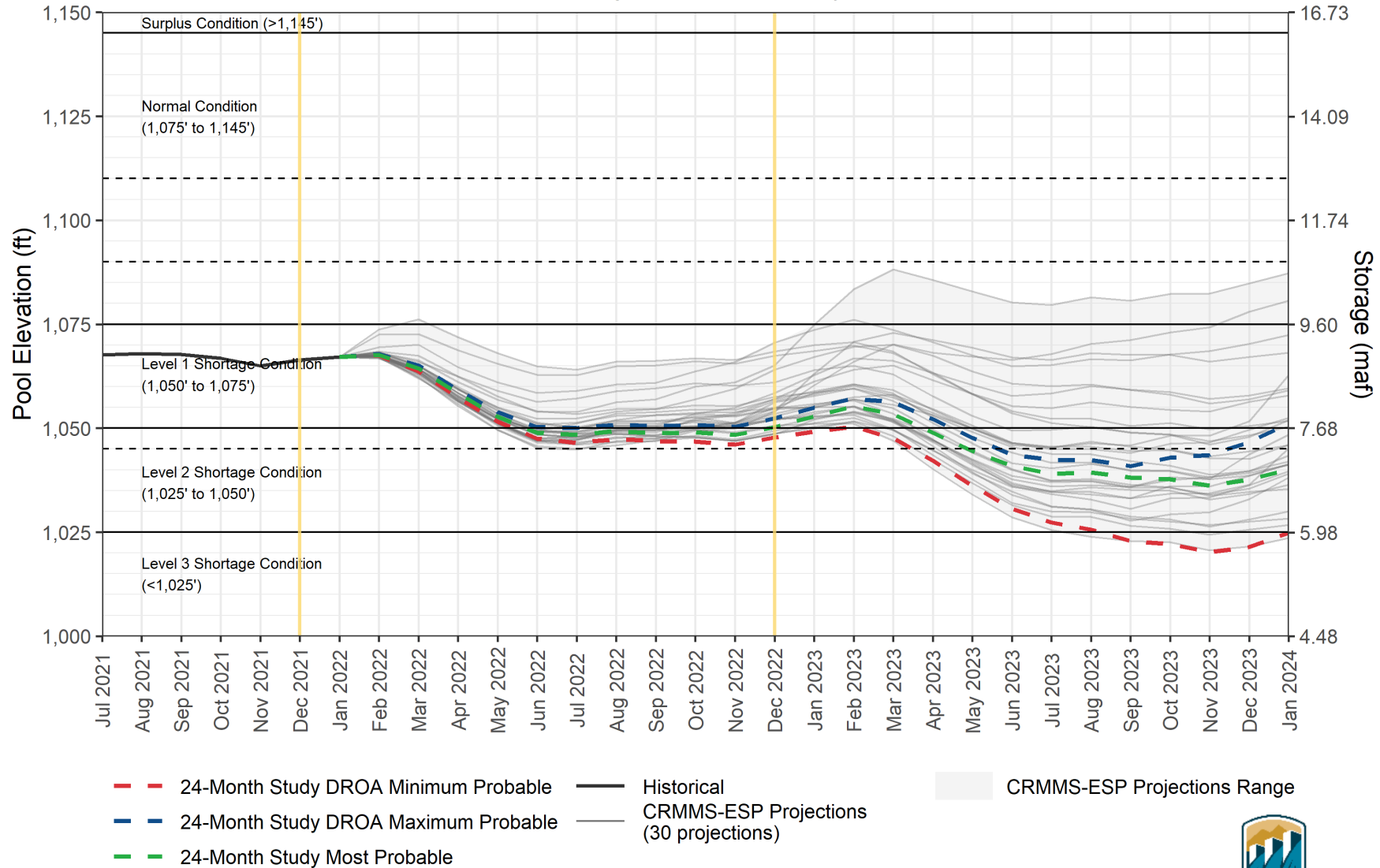
Projections from the February 2022 24-Month Study Inflow Scenarios



The Drought Response Operations Agreement (DROA) is available online at: <https://www.usbr.gov/dcp/finaldocs.html>.



Lake Mead End-of-Month Elevations CRMMS Projections from February 2022



Provisional until official publication



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Upper Colorado Basin

Hydropower Maintenance



Glen Canyon Dam Power Plant Unit Outage Schedule for 2022

Unit Number	Oct 2021	Nov 2021	Dec 2021	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	
1					[Outage]								
2						[Outage]							
3													
4													
5							[Outage]						
6							[Outage]						
7	[Outage]							[Outage]					
8	[Outage]												
Units Available	6	6	6	6	5	4	6	5	6	6	6	6	
Capacity (cfs)	18,700	18,600	11,700	18,700	14,800	11,300	18,000	15,000	18,700	18,650	18,400	18,250	FEB MOST ²
Capacity (kaf/month)	1,150	1,110	1,110	1,160	810	1,090	1,070	970	1,090	1,150	1,130	1,090	FEB MOST
Max (kaf) ¹	481	500	600	673	539	575	501	599	678	809	858	667	7.48 maf
Most (kaf) ¹	481	500	600	673	539	575	501	599	678	809	858	667	7.48 maf
Min (kaf) ¹	481	500	600	673	539	575	501	599	678	809	858	667	7.48 maf
										(updated 02-22-2022)			

1 Projected release, based on February 2022 minimum, most and maximum probable inflow projections and 24-Month Study model runs.
 2 Dependent upon availability to shift contingency reserves, which will increase capacity by 30-40MW (3%) at current efficiency.



Glen Canyon Dam Power Plant Unit Outage Schedule for 2023

Unit Number	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023	Sep 2023
1												
2												
3												
4												
5												
6												
7												
8												
Units Available	5	6	6	8	4	6	6	6	6	6	6	4
Capacity (cfs)	14,800	18,100	18,000	24,400	11,100	17,550	17,600	18,200	18,800	18,750	18,600	11,700
Capacity (kaf/month)	950	1,080	1,110	1,450	750	1,080	1,050	1,120	1,120	1,150	1,140	780
Max (kaf) ¹	480	500	600	723	639	675	601	599	628	7709	758	568
Most (kaf) ¹	480	500	600	770	670	675	620	625	670	700	809	602
Min (kaf) ¹	480	500	600	664	587	620	552	550	577	652	696	522

FEB MOST²

FEB MOST

7.48 maf

7.72 maf

7.0 maf

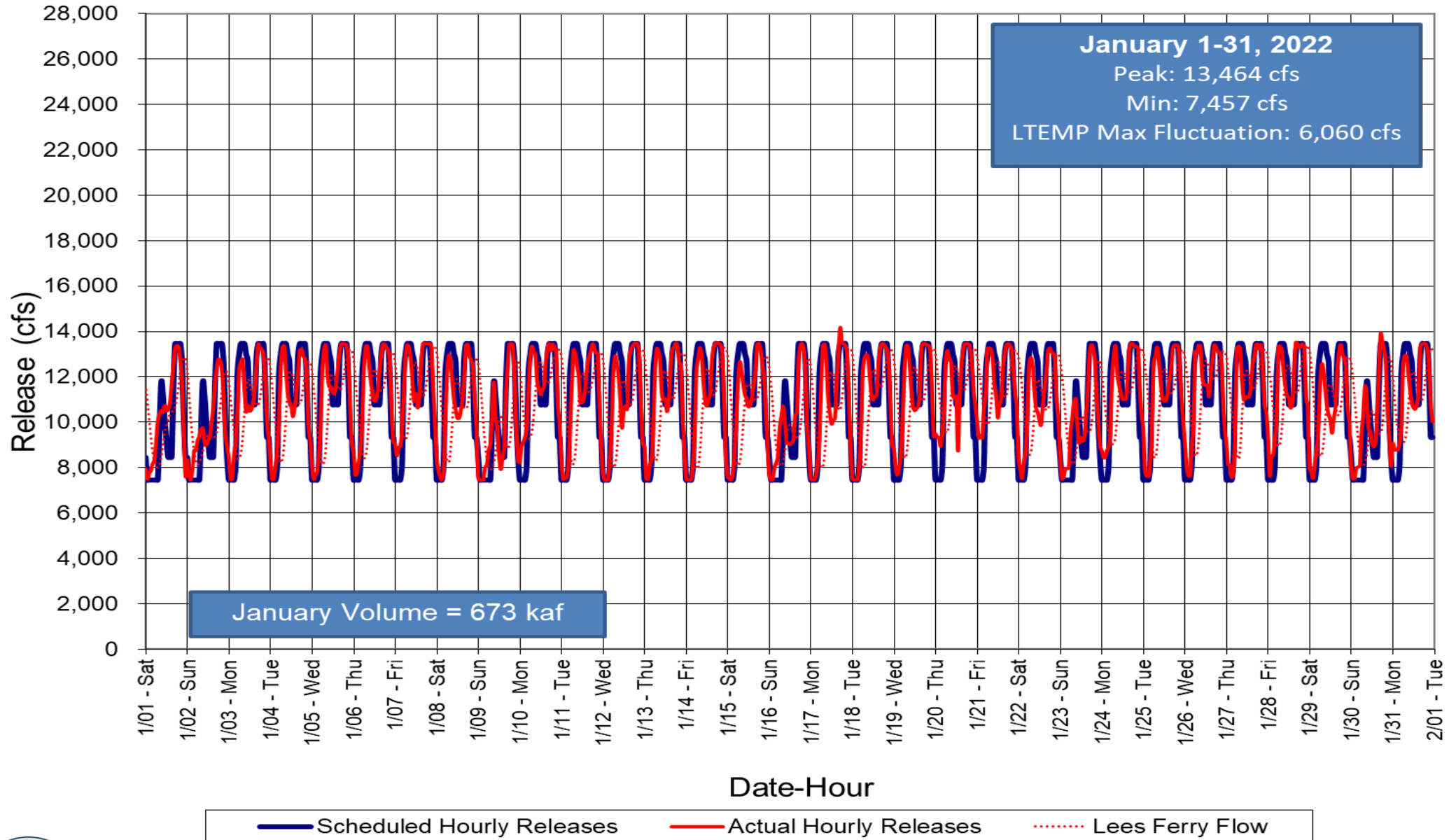
(updated 02-22-2022)

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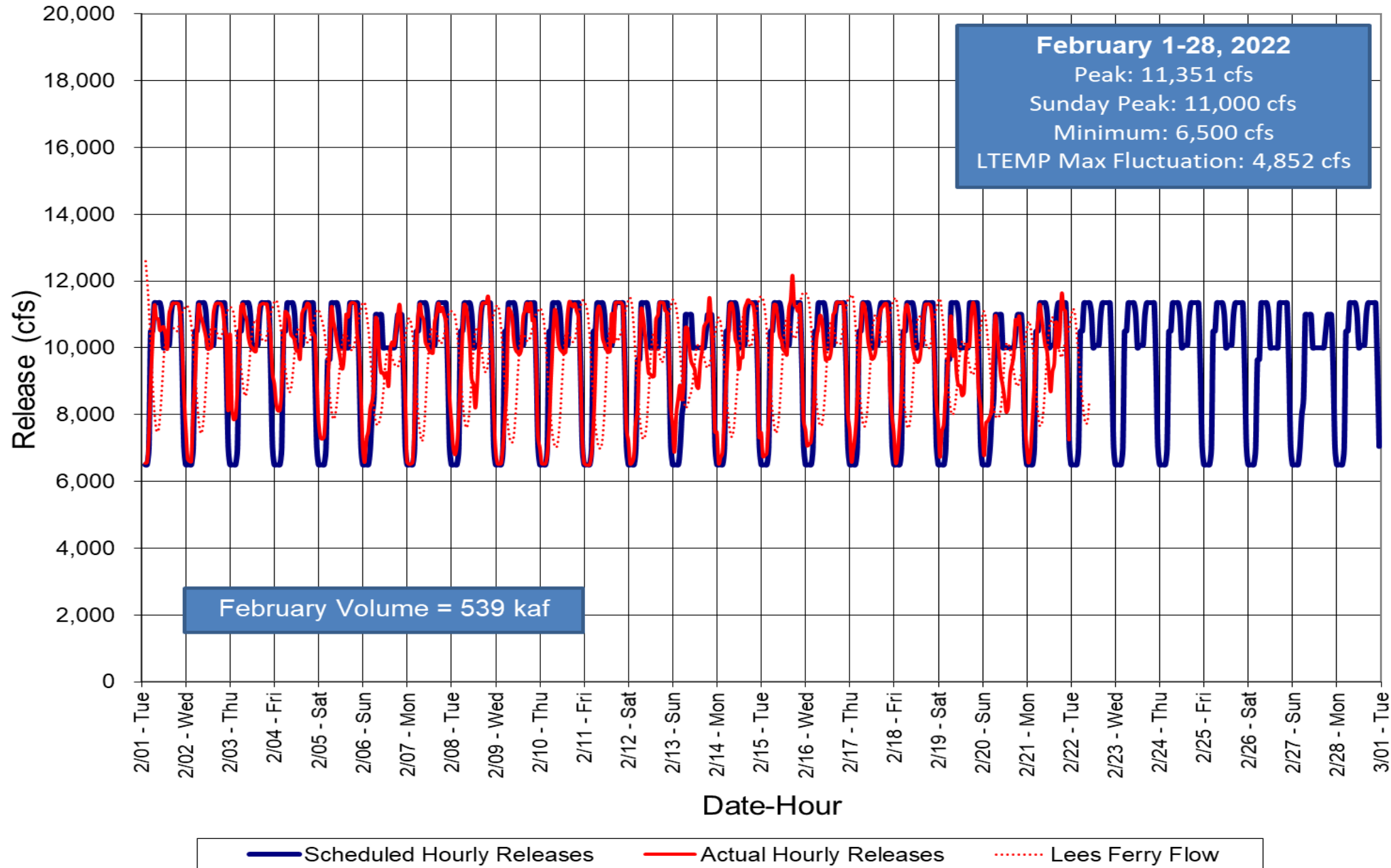
2 Dependent upon availability to shift contingency reserves, which will increase capacity by 30-40MW (3%) at current efficiency.



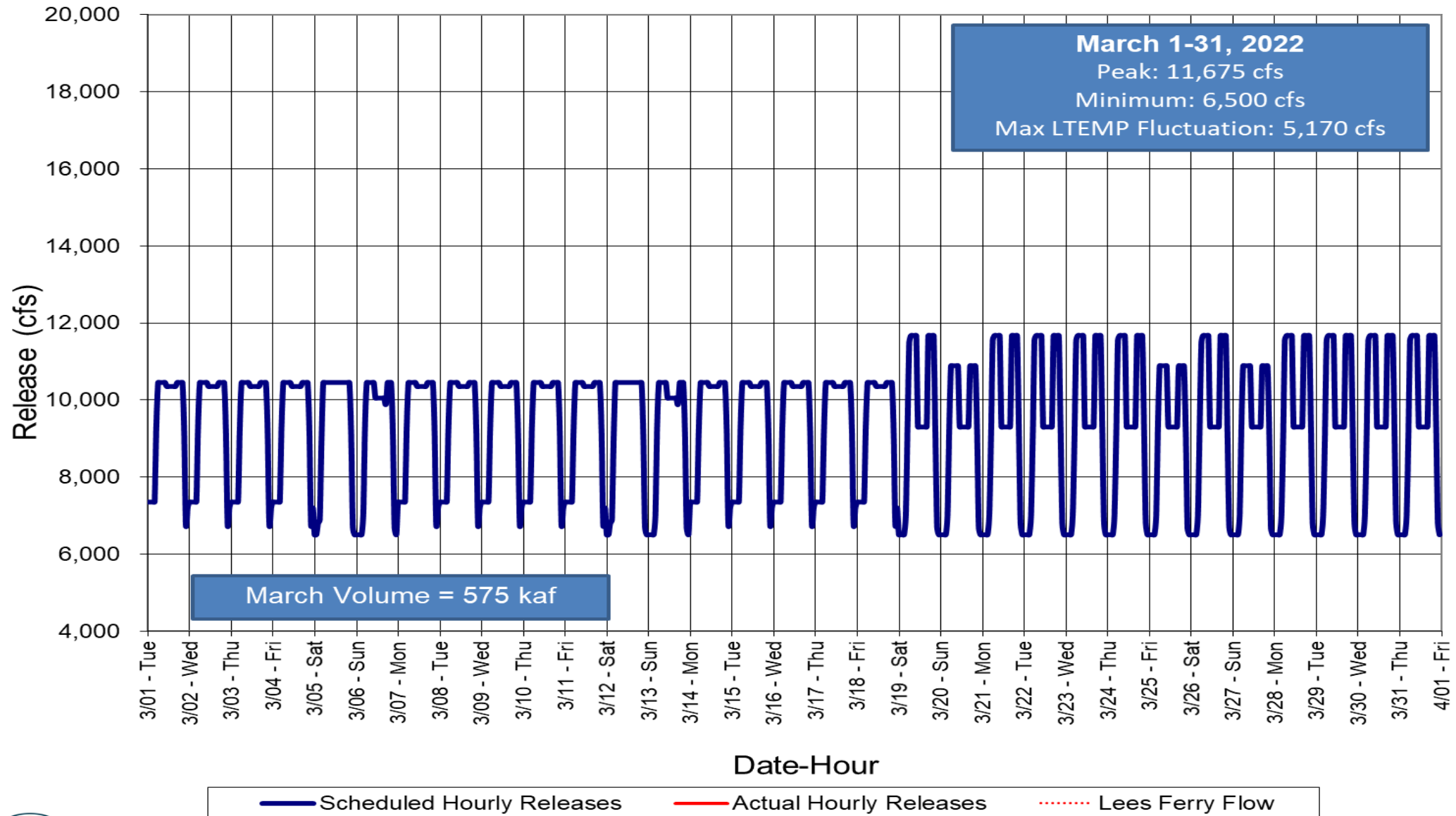
Glen Canyon Dam Hourly Release Pattern January 2022



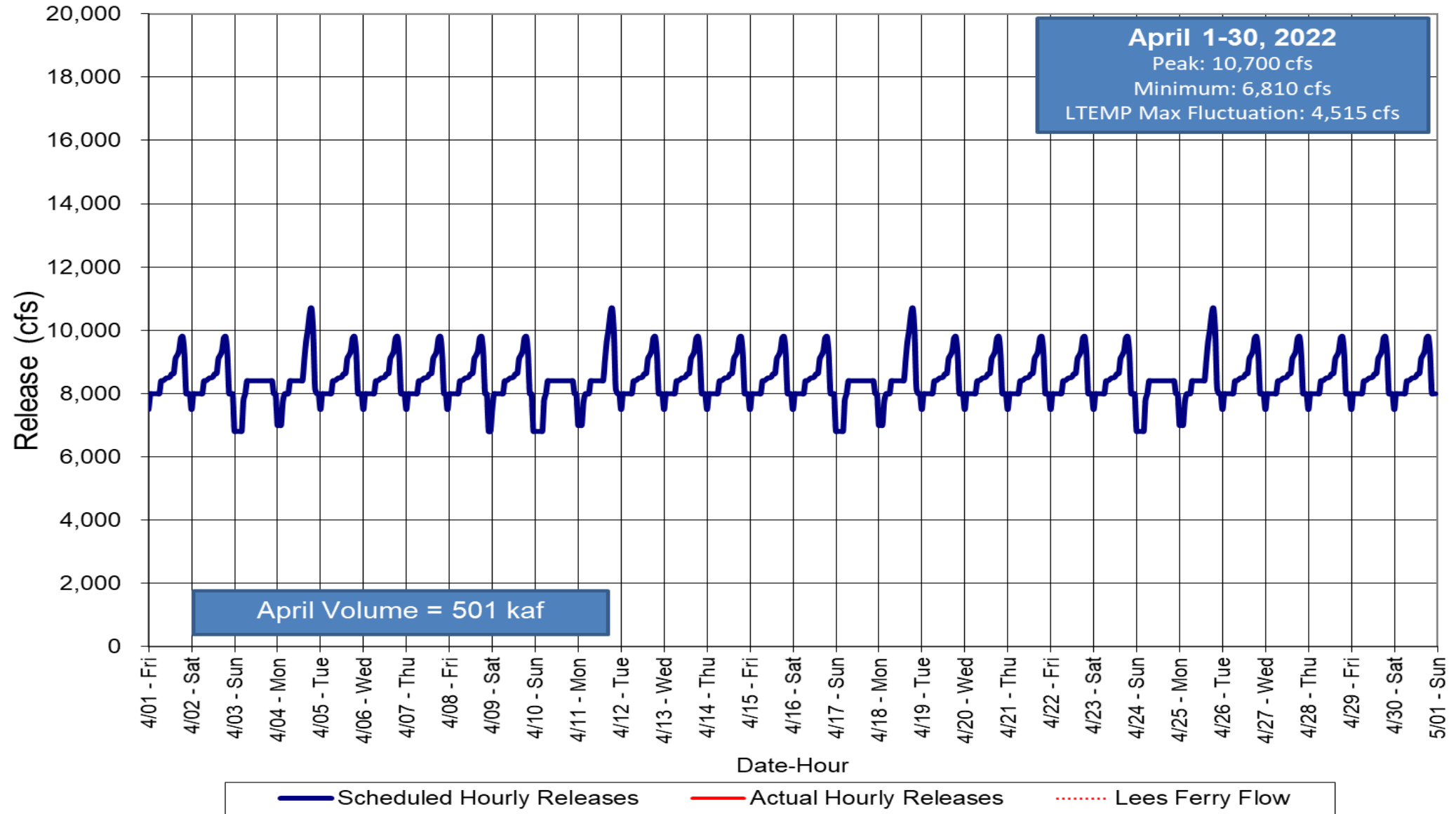
Glen Canyon Dam Hourly Release Pattern February 2022



Glen Canyon Dam Hourly Release Pattern March 2022



Glen Canyon Dam Hourly Release Pattern April 2022

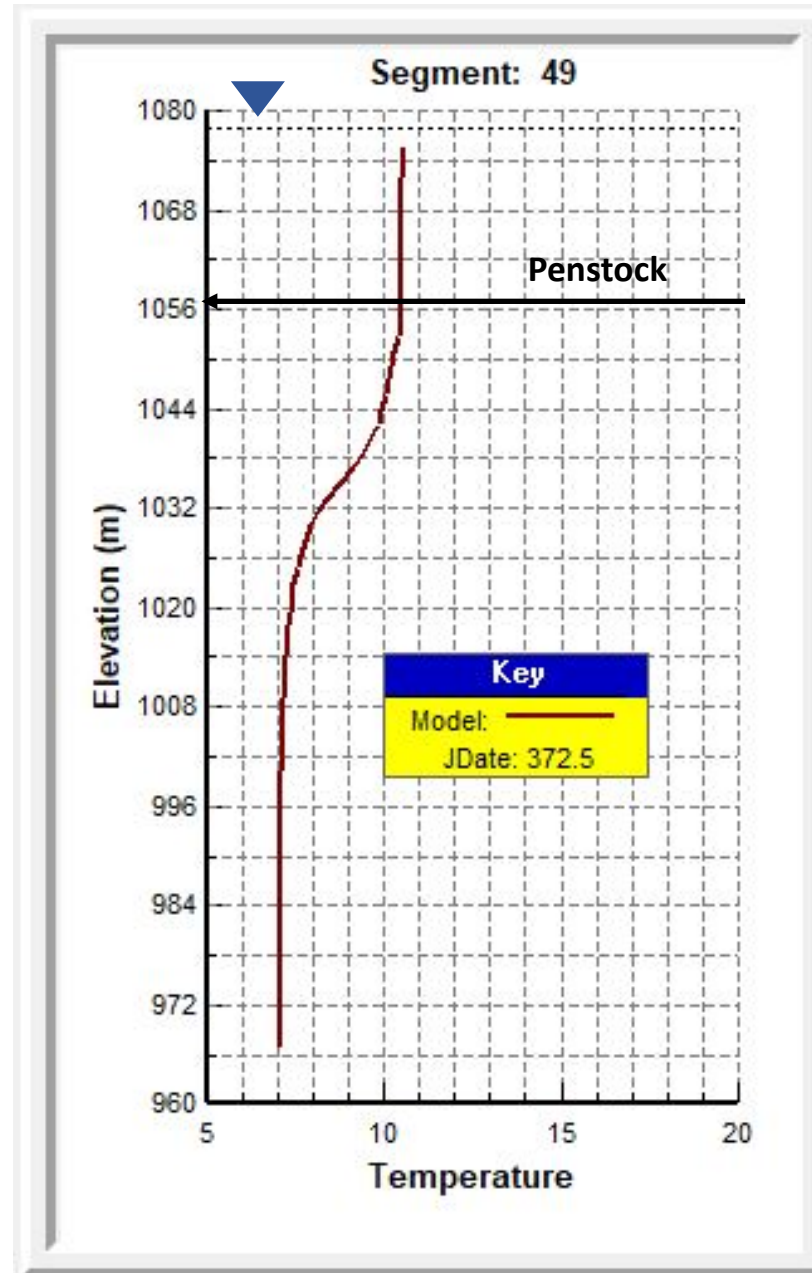


Water Quality



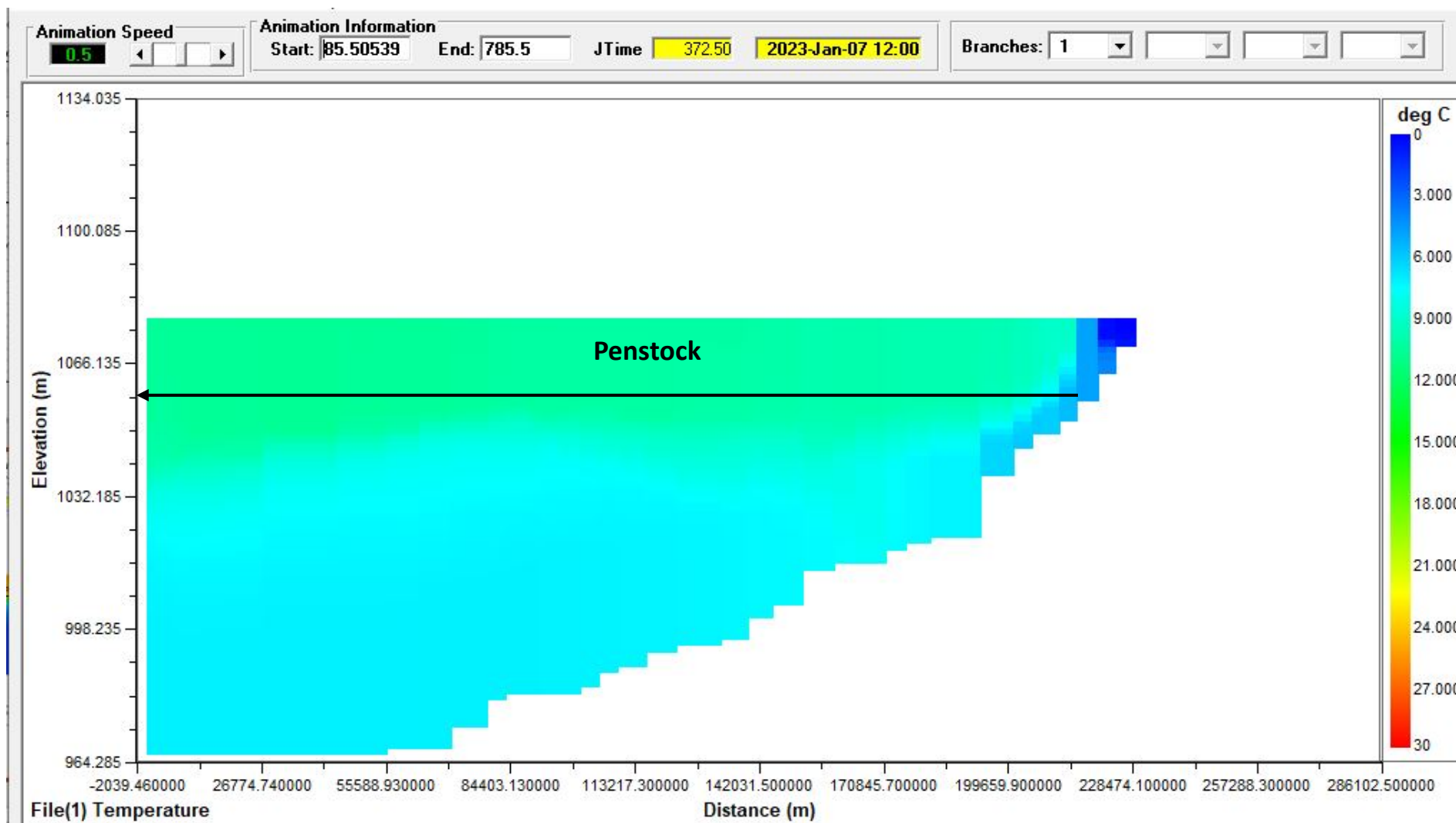
Temperature Profile of Lake Powell near Glen Canyon Dam

1/7/2022

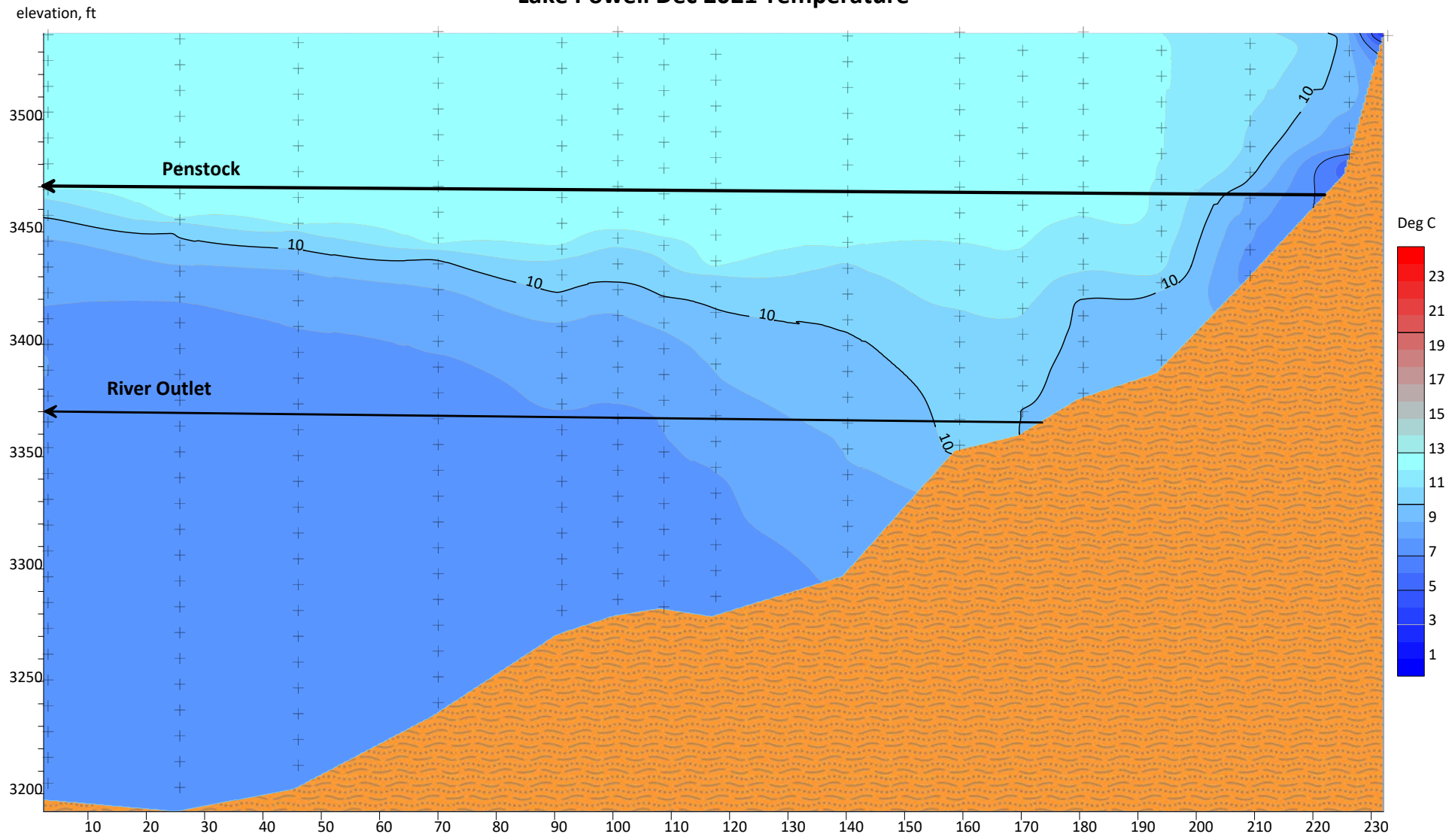


Cross Sectional Temperature Profile of Lake Powell

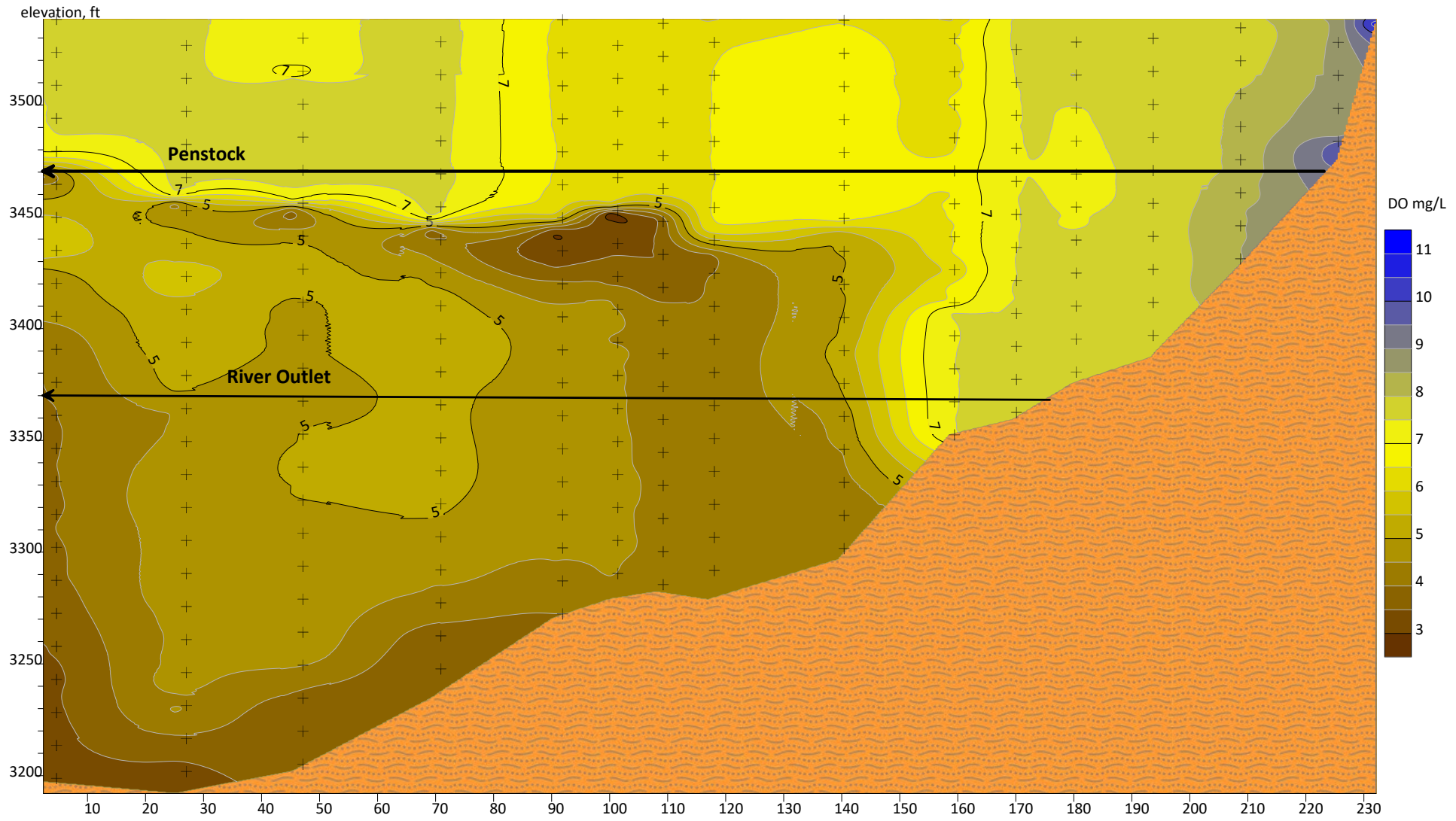
1/7/2022



Lake Powell Dec 2021 Temperature



Lake Powell Dec 2021 Dissolved Oxygen



Questions?



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