



— BUREAU OF —
RECLAMATION

Glen Canyon Monthly Operations Call

Basin Hydrology and Operations

December 20, 2023

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.”

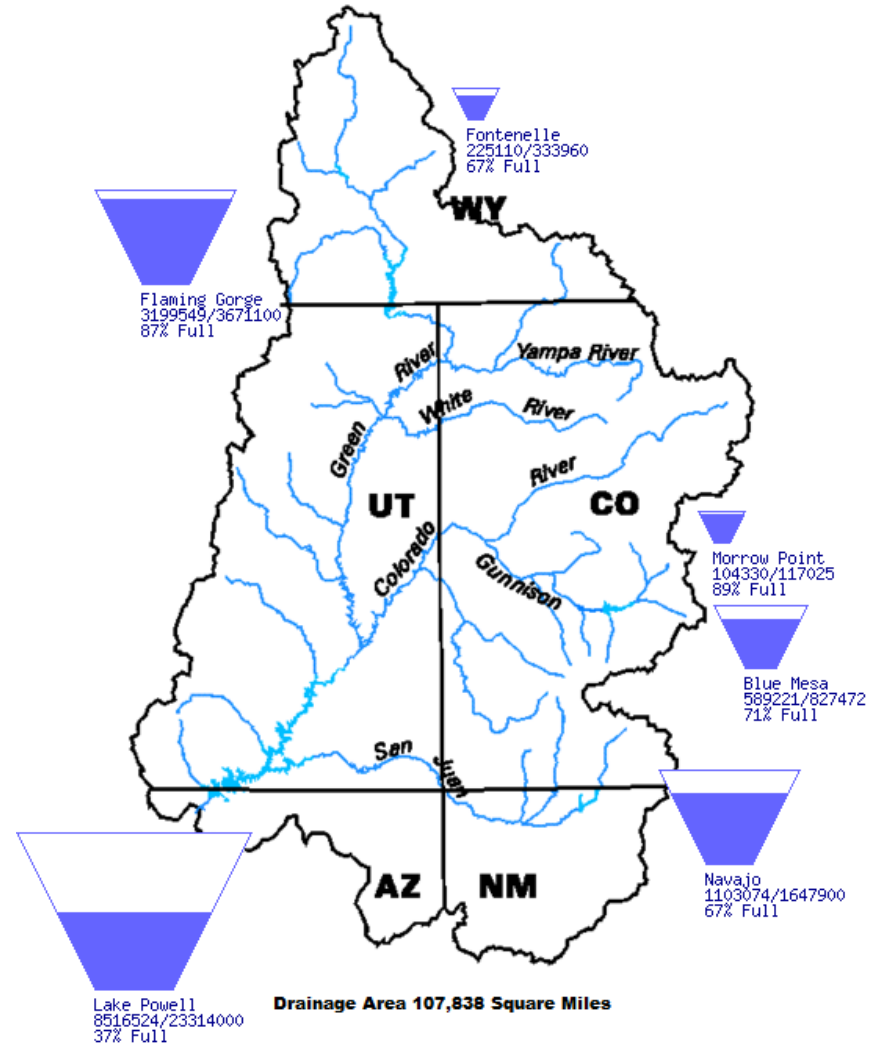


Upper Basin Storage (as of December 19, 2023)

Data Current as of:
12/18/2023

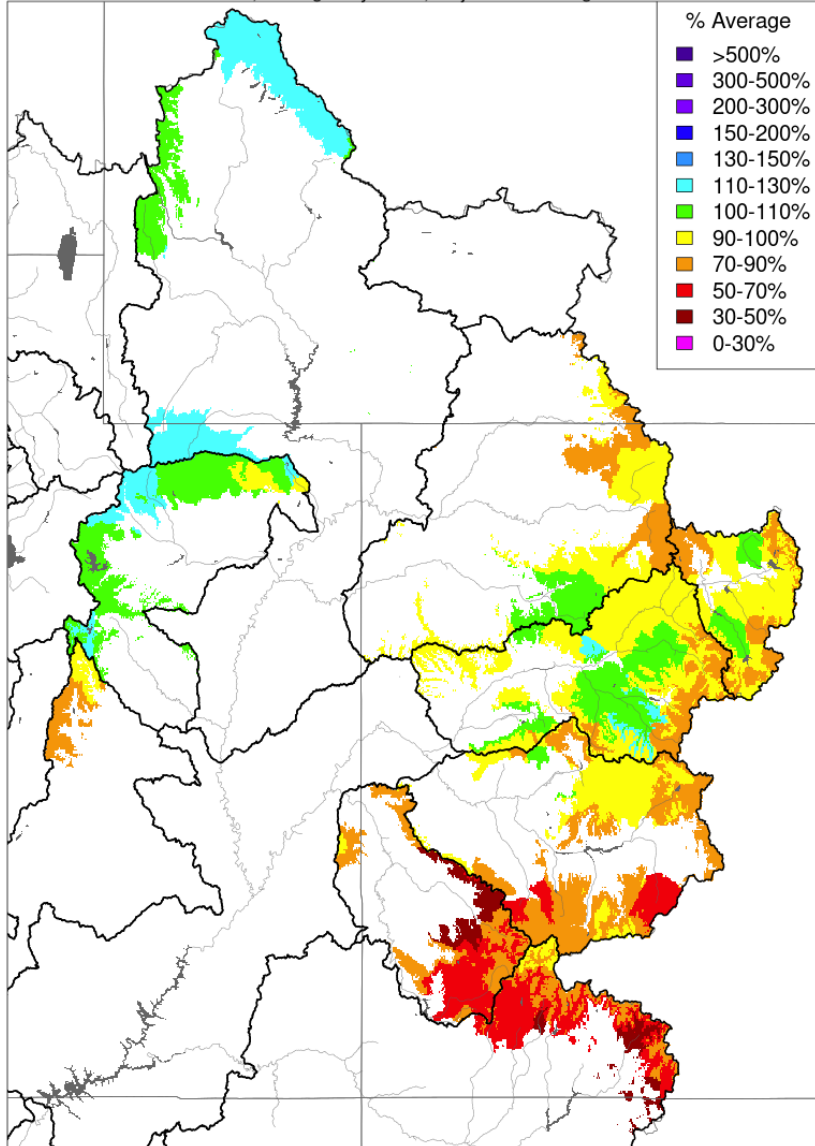
Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	67	0.23	0.33	6,491.03
Flaming Gorge	87	3.20	3.67	6,028.27
Blue Mesa	71	0.59	0.83	7,491.47
Navajo	67	1.10	1.65	6,043.96
Lake Powell	37	8.52	23.31	3,569.98
UC System Storage	46	13.75	29.93	
Total System Storage	43	24.93	58.48	

Upper Colorado River Drainage Basin



Soil Moisture - Fall - 2023 (November 15)

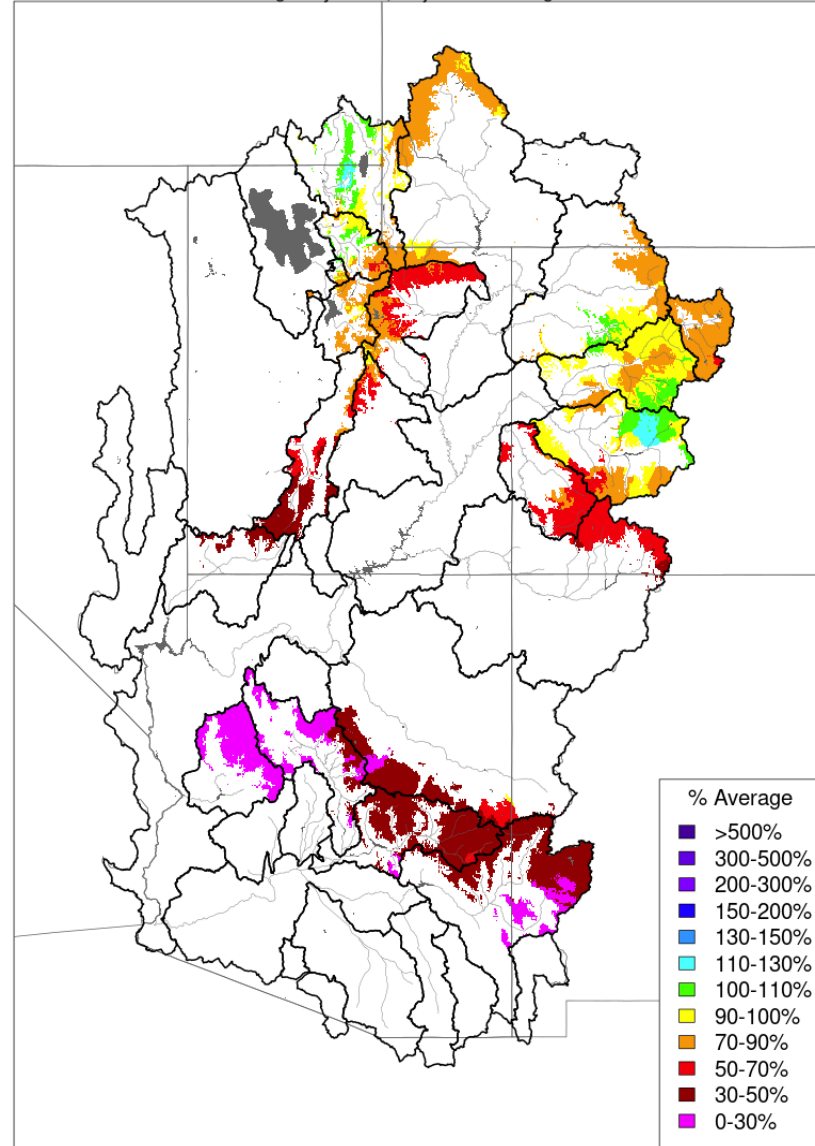
Modeled, Averaged by Basin, Major Contributing Areas



Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

Water Year to Date Precipitation, October 01 - December 19 2023

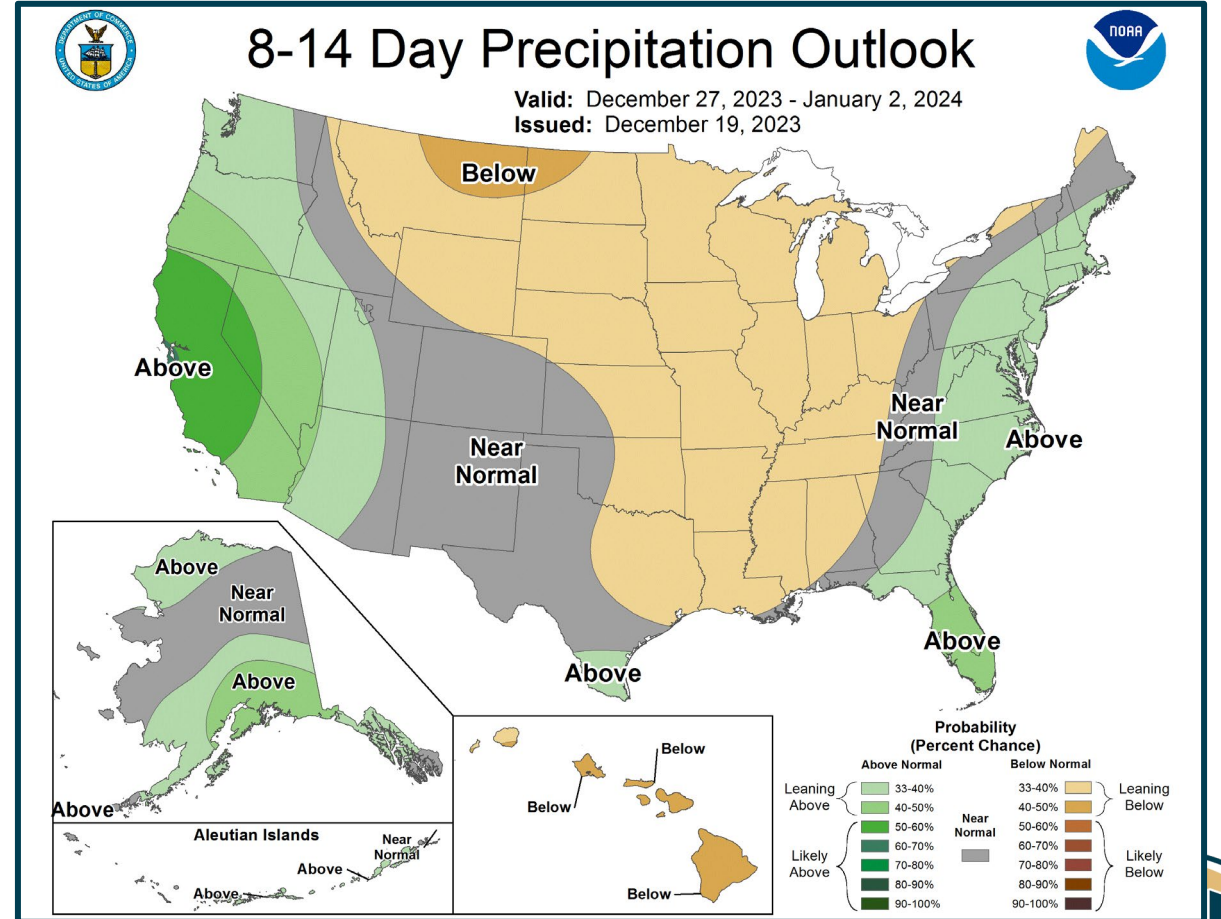
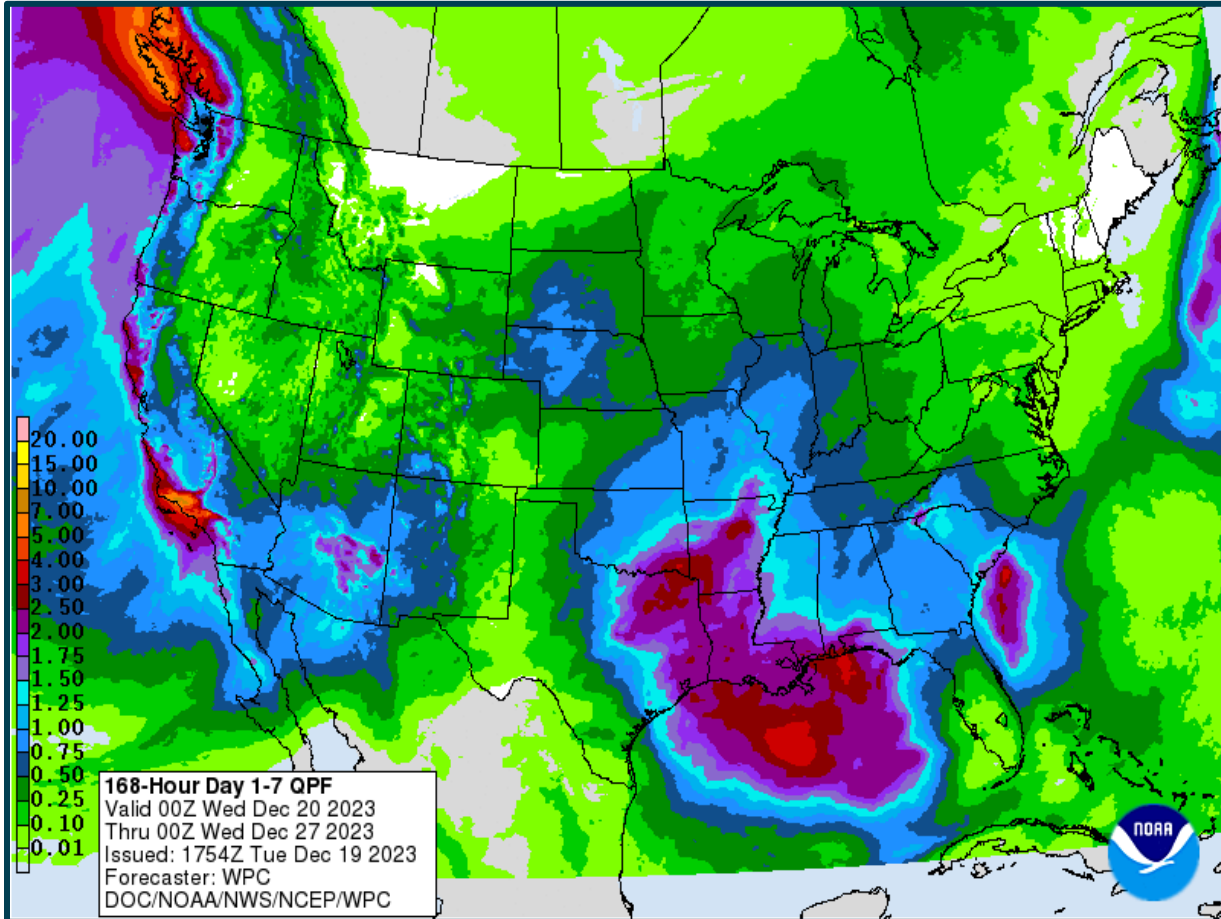
Averaged by Basin, Major Contributing Areas



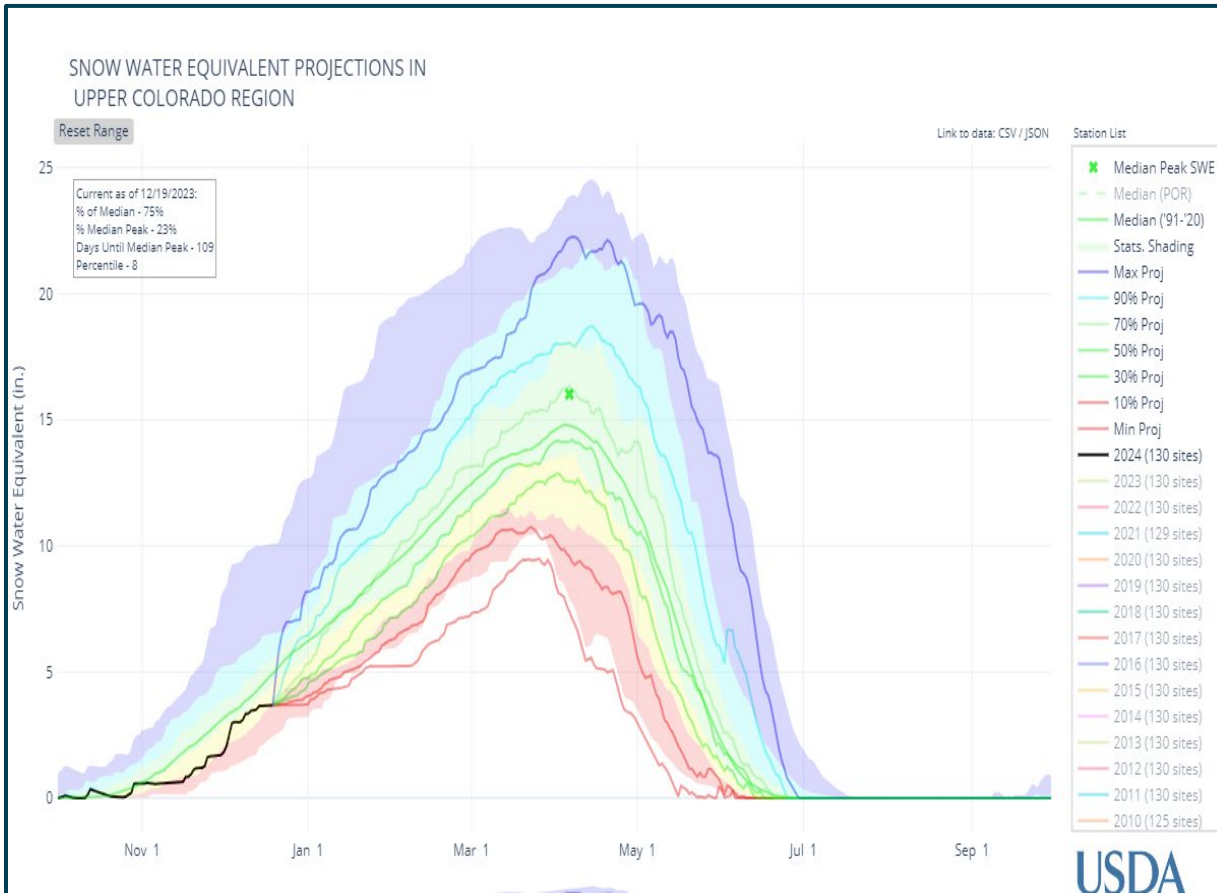
Prepared by NOAA, Colorado Basin River Forecast Center
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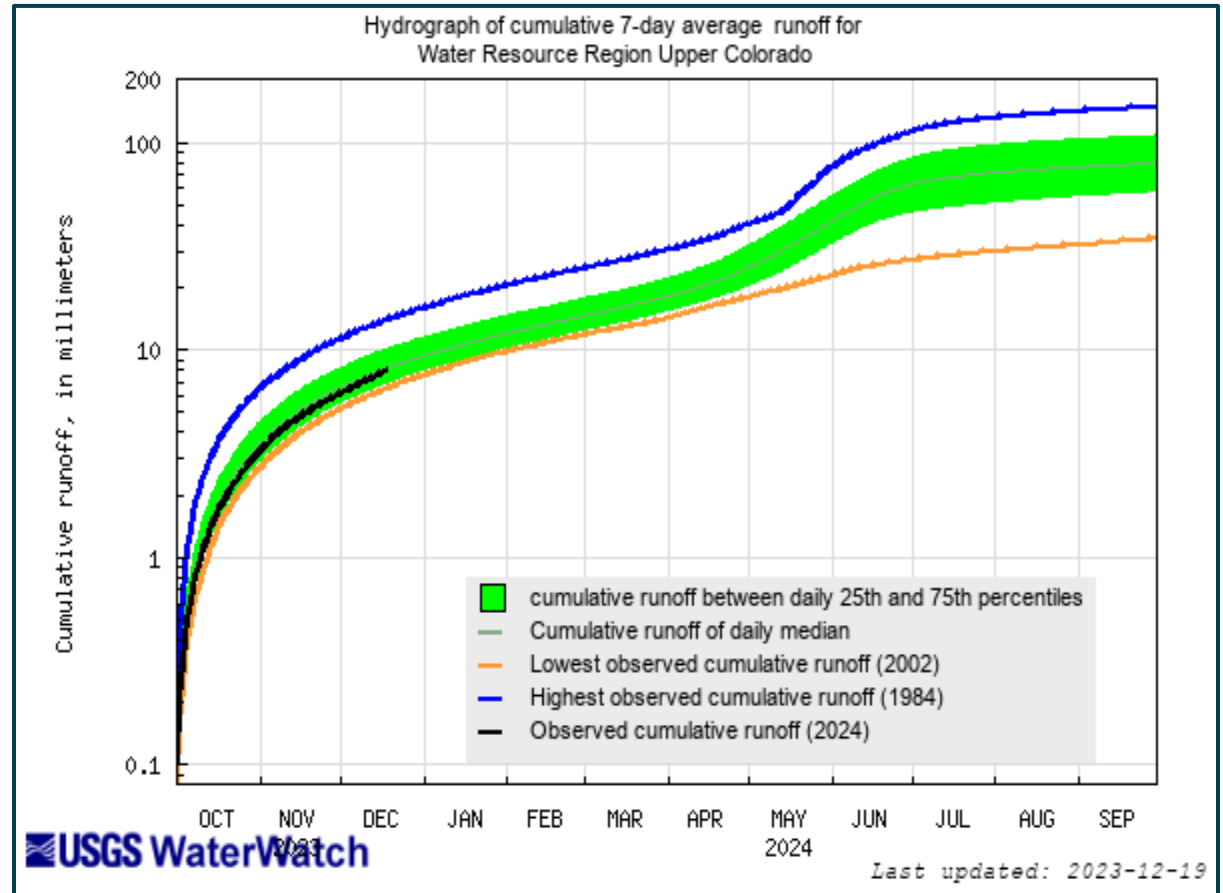
Weather Prediction Center and Climate Prediction Center Precipitation Forecasts



Upper Colorado SWE and Observed Inflows



https://www.nrcs.usda.gov/Internet/WCIS/AWS_PLOTS/basinCharts/Proj/WTEQ/assocHUC2/14_Upper_Colorado_Region.html



<https://waterwatch.usgs.gov/index.php>



Most Probable December Forecast Water Year 2024

April – July 2024
Forecasted Unregulated Inflow
as of December 1, 2023

Reservoir	Inflow (kaf)	Change from Nov	Percent of Avg ¹
Fontenelle	615	-40	84
Flaming Gorge	805	-50	83
Blue Mesa	535	-60	84
Navajo	437	-36	59
Powell	4,800	-900	75

Water Year 2024
Unregulated Inflow Forecast
as of December 1, 2023

Reservoir	Inflow (kaf)	Change from Nov	Percent of Avg ¹
Fontenelle	961	-37	89
Flaming Gorge	1,289	-40	91
Blue Mesa	777	-64	86
Navajo	600	-68	66
Powell	7,619	-1,005	79

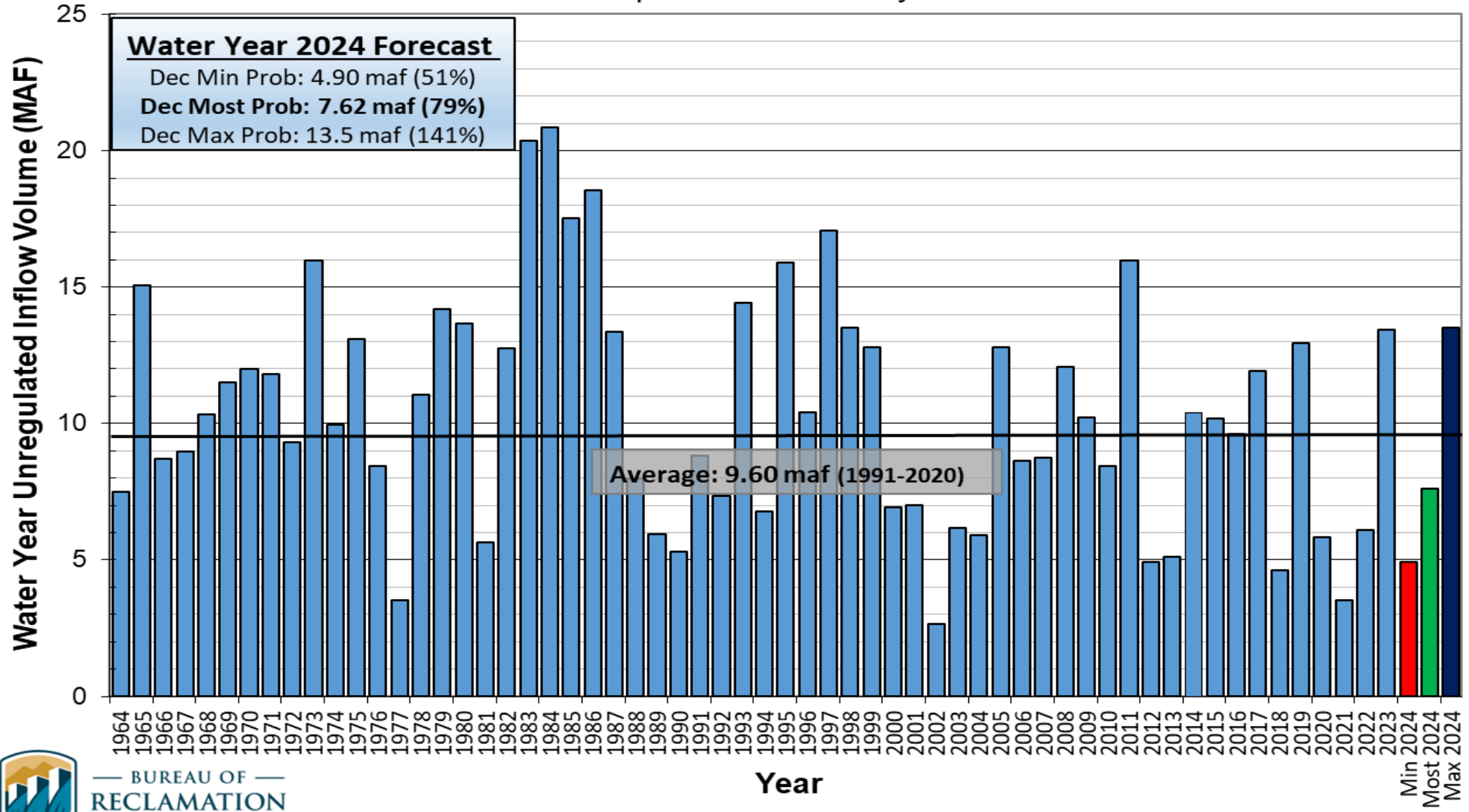
¹Averages are based on the 1991 through 2020 period of record.



Lake Powell Unregulated Inflow

Water Year 2024 Forecast *(issued December 1)*

Comparison with History





Upper Colorado Basin

Hydrology and Operations
Projections Based on
October and December 2023
24-Month Study



Upper Basin Reservoir Operations

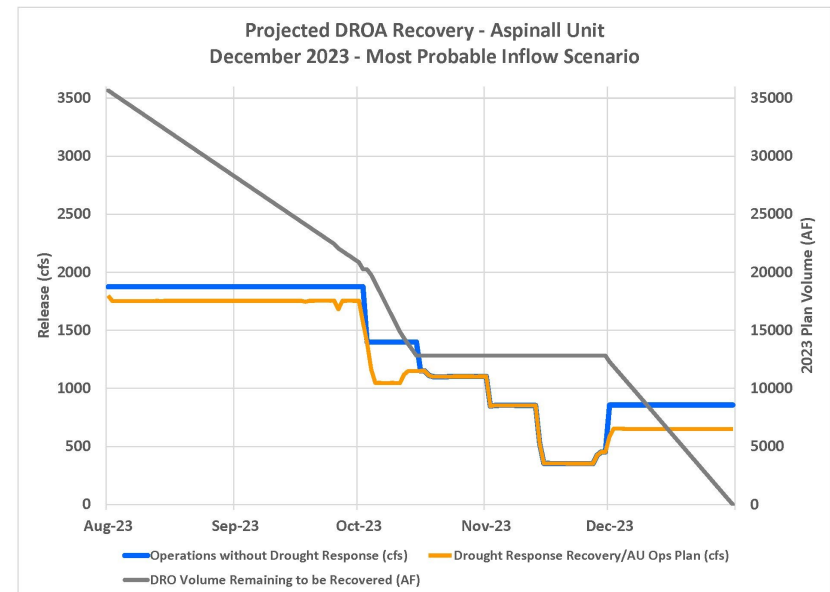
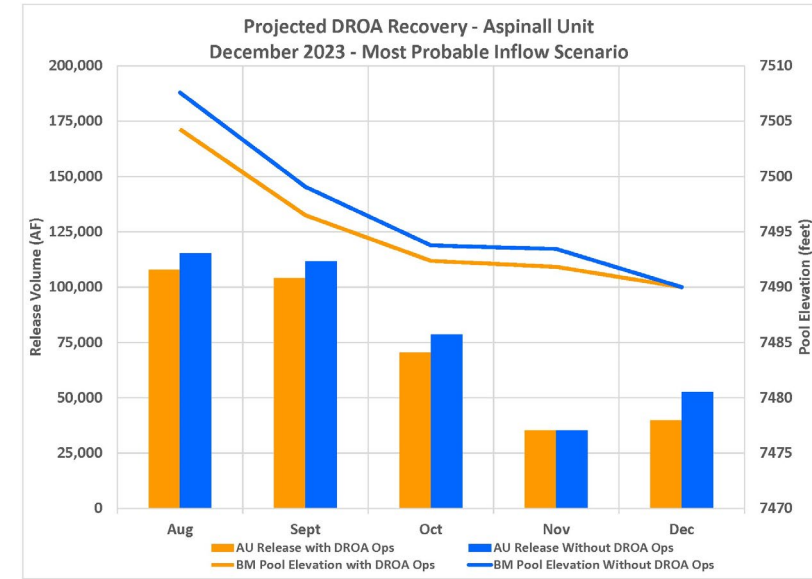
Water Years 2024 and 2025

- Lake Powell will be operated consistent with the 2007 Interim Guidelines, the Upper Basin Drought Response Operations Agreement and Upper Basin Records of Decision
- Lake Powell WY 2024 will operate in the Mid-Elevation Release Tier where Lake Powell will release 7.48 maf
- Reclamation will also ensure all appropriate consultation with Basin Tribes, the Republic of Mexico, other federal agencies, water users and non-governmental organizations with respect to implementation of these monthly and annual operations.



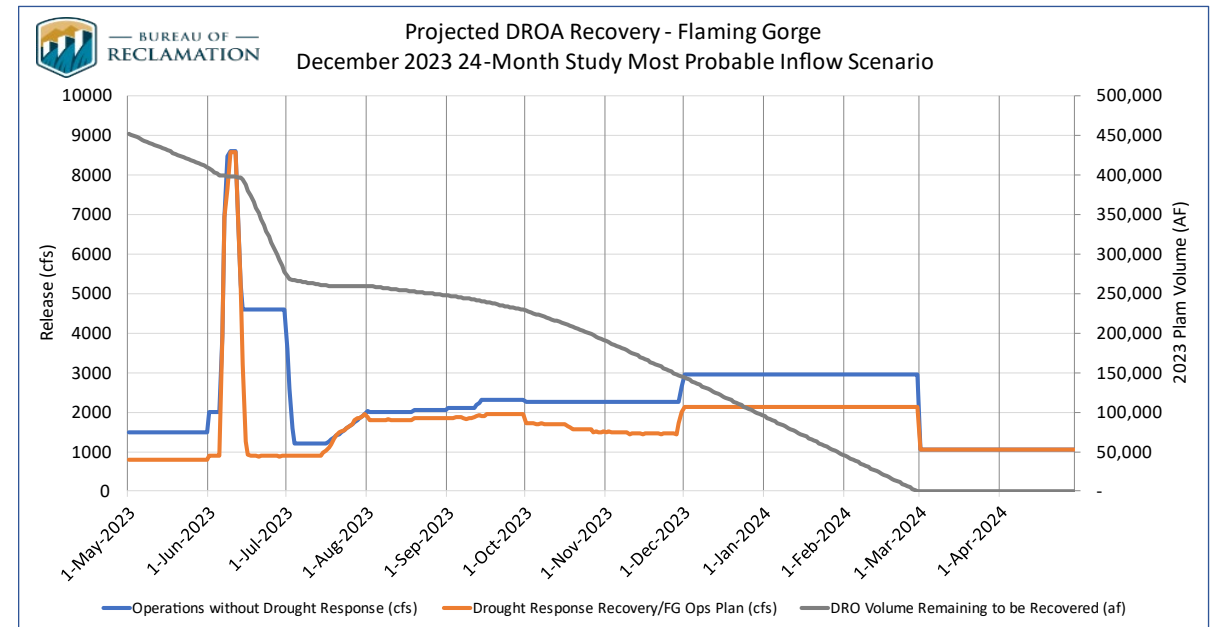
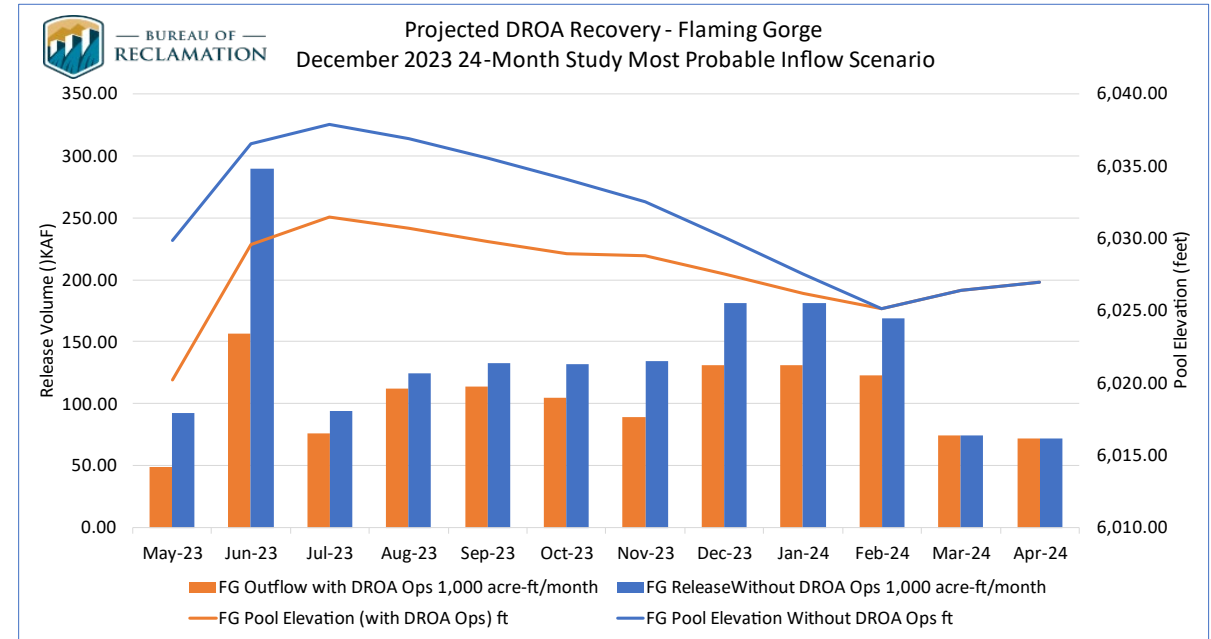
DROA Recovery - BM

- October 2023 recovery amount of 8.3 KAF
- November 2023 recovery amount of 0.0 KAF
- Projected to achieve incremental recovery and icing target by the end of Dec



DROA Recovery - FG

- October 2023 recovery amount of 38 KAF
- November 2023 recovery amount of 46 KAF
- Projected to achieve incremental recovery in February 2024 and the May 1 Drawdown Target of 6,027



Drought Response Operations Agreement (DROA)

Completed DROA Volumes^{1,2}

Reservoir	2021 DROA Volume (kaf)	2022 DROA Volume (kaf)	2023 DROA Volume (kaf) ⁴	Total DROA Volume (kaf)
Flaming Gorge	125	328 ³	-308	145
Blue Mesa	36	0	-23	13
Navajo	0	0	0	0
Total DROA Volume (kaf)	161	328	-331	158

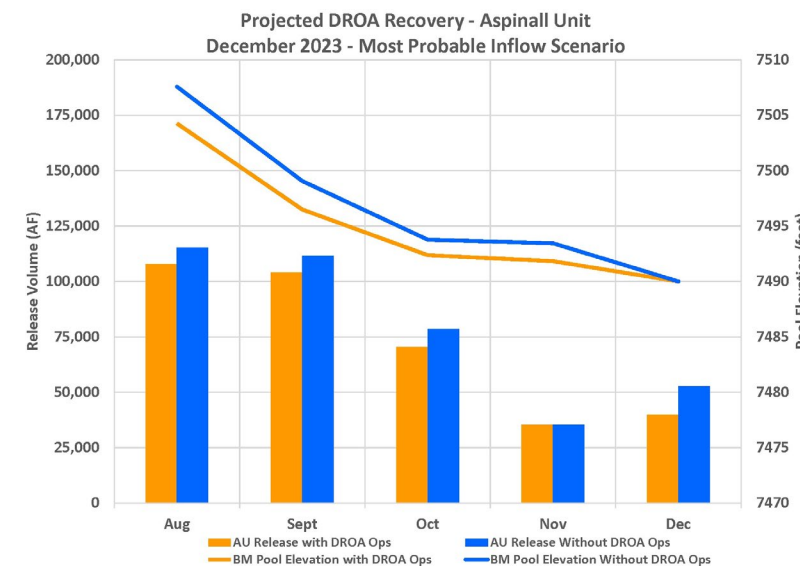
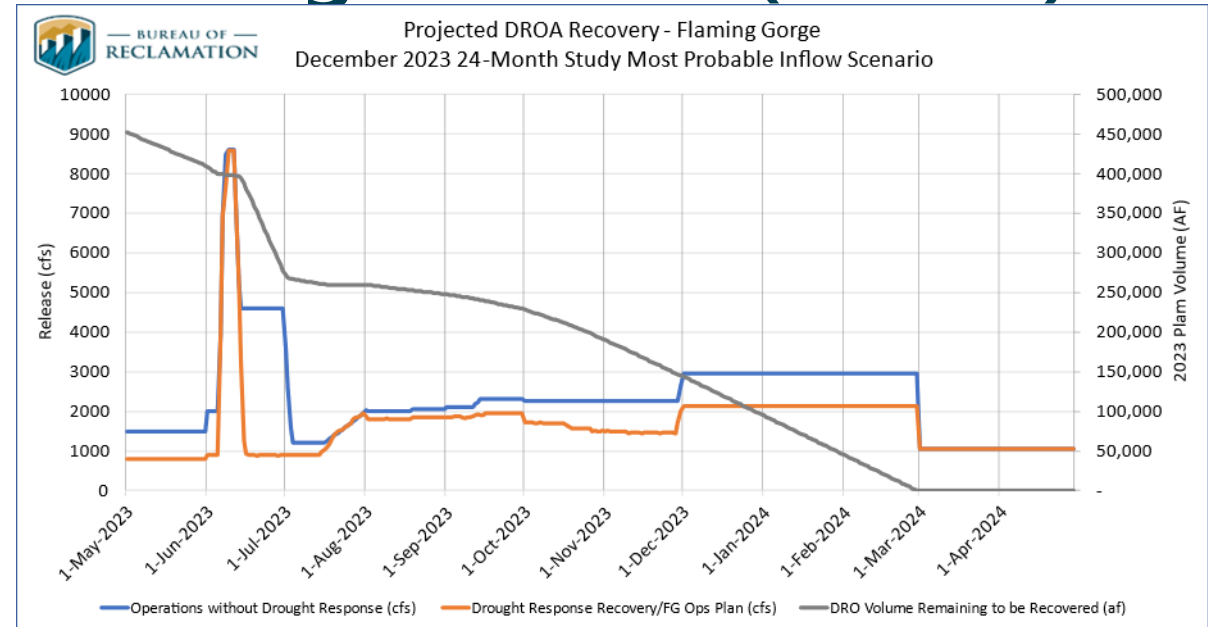
¹DROA operational year is from May through April.

²Positive values indicate Drought Response Operations Releases and negative values indicate Drought Response Operations Recovery

³ 463 kaf of DROA releases prior to DROA release suspension on March 6, 2023.

-135 kaf of DROA recovery from March 7, 2023 through April 30, 2023

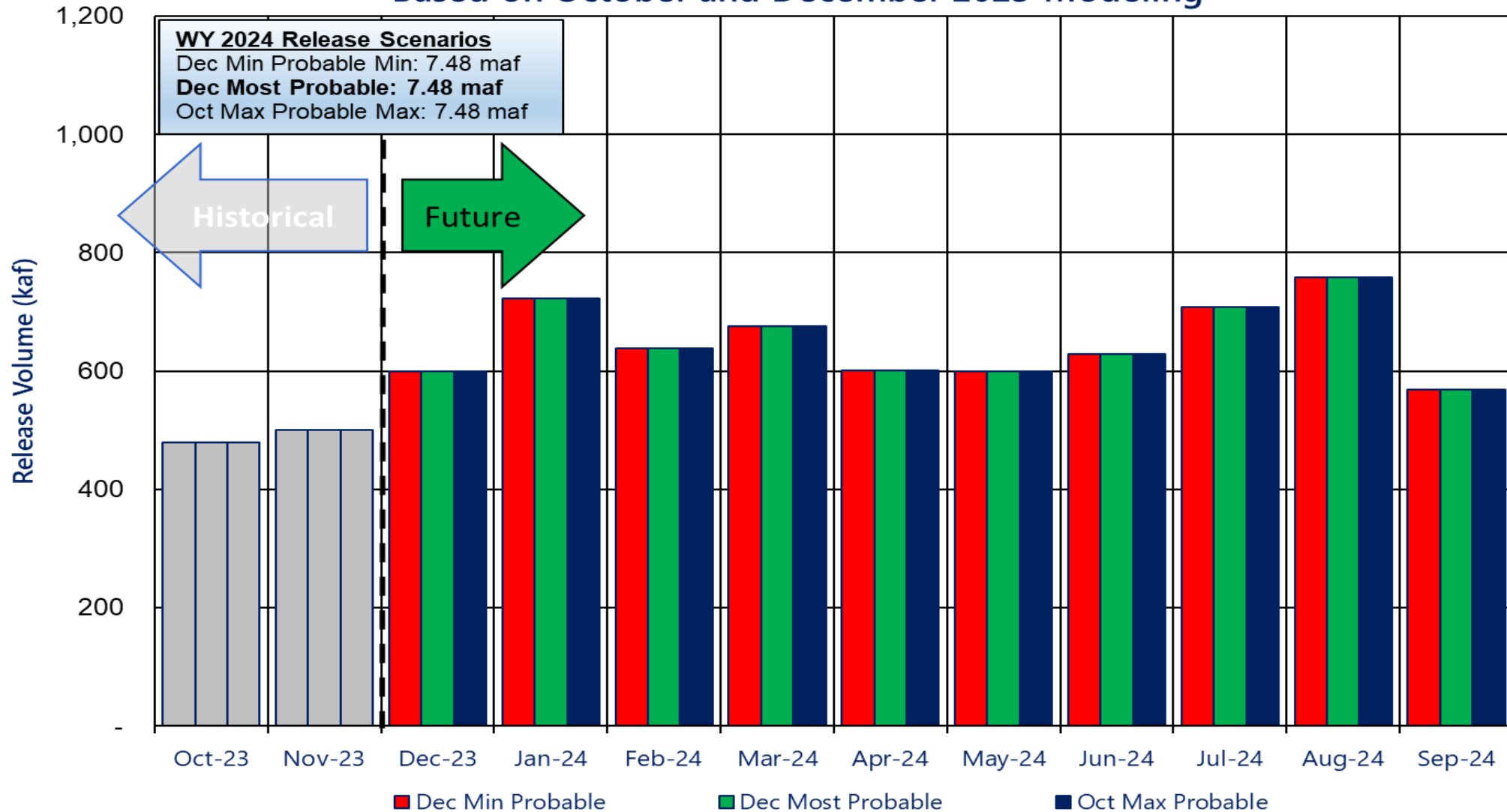
⁴DROA volumes through November 2023



Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2024

Based on October and December 2023 Modeling

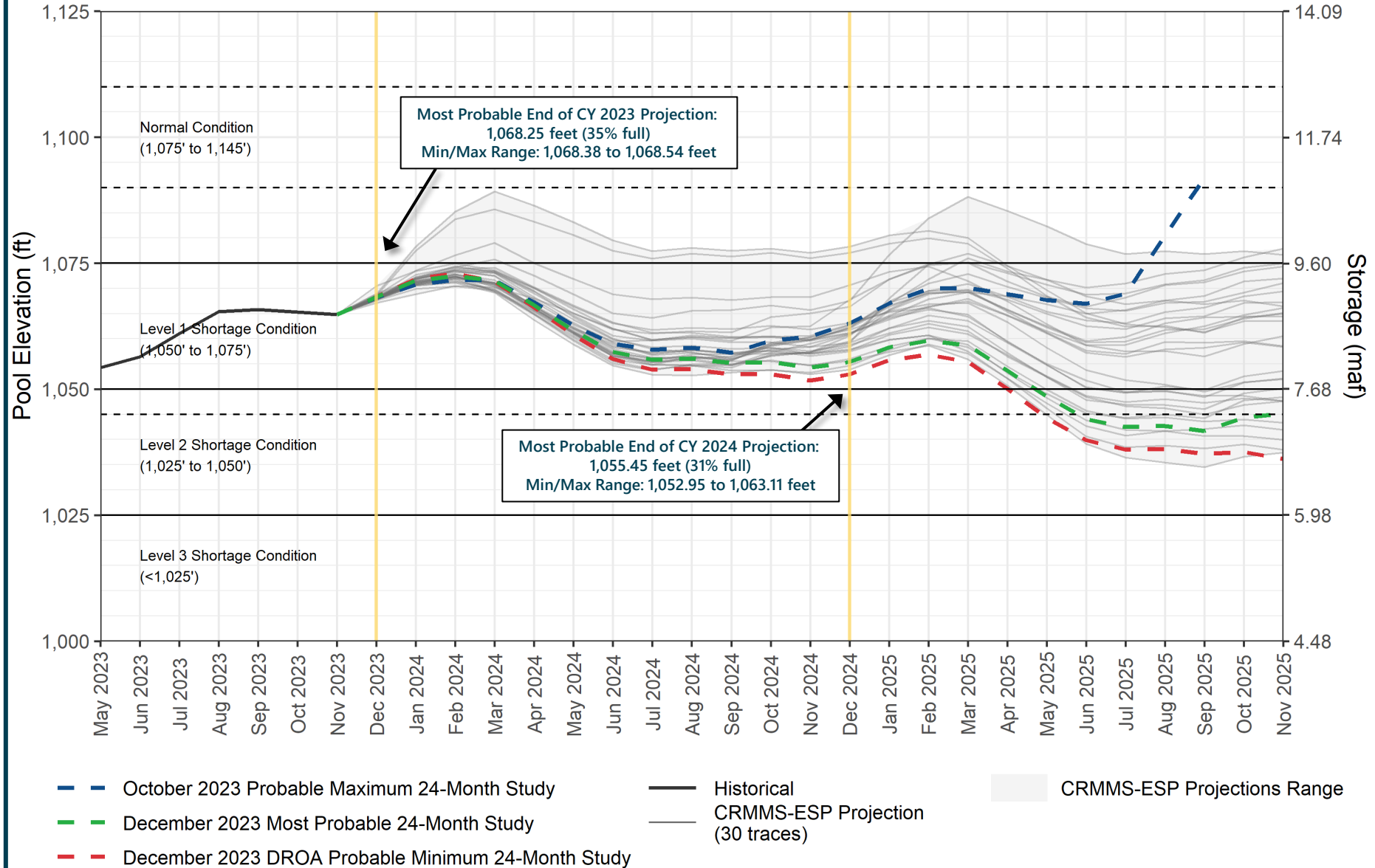


Reclamation Operational Modeling Model Comparison

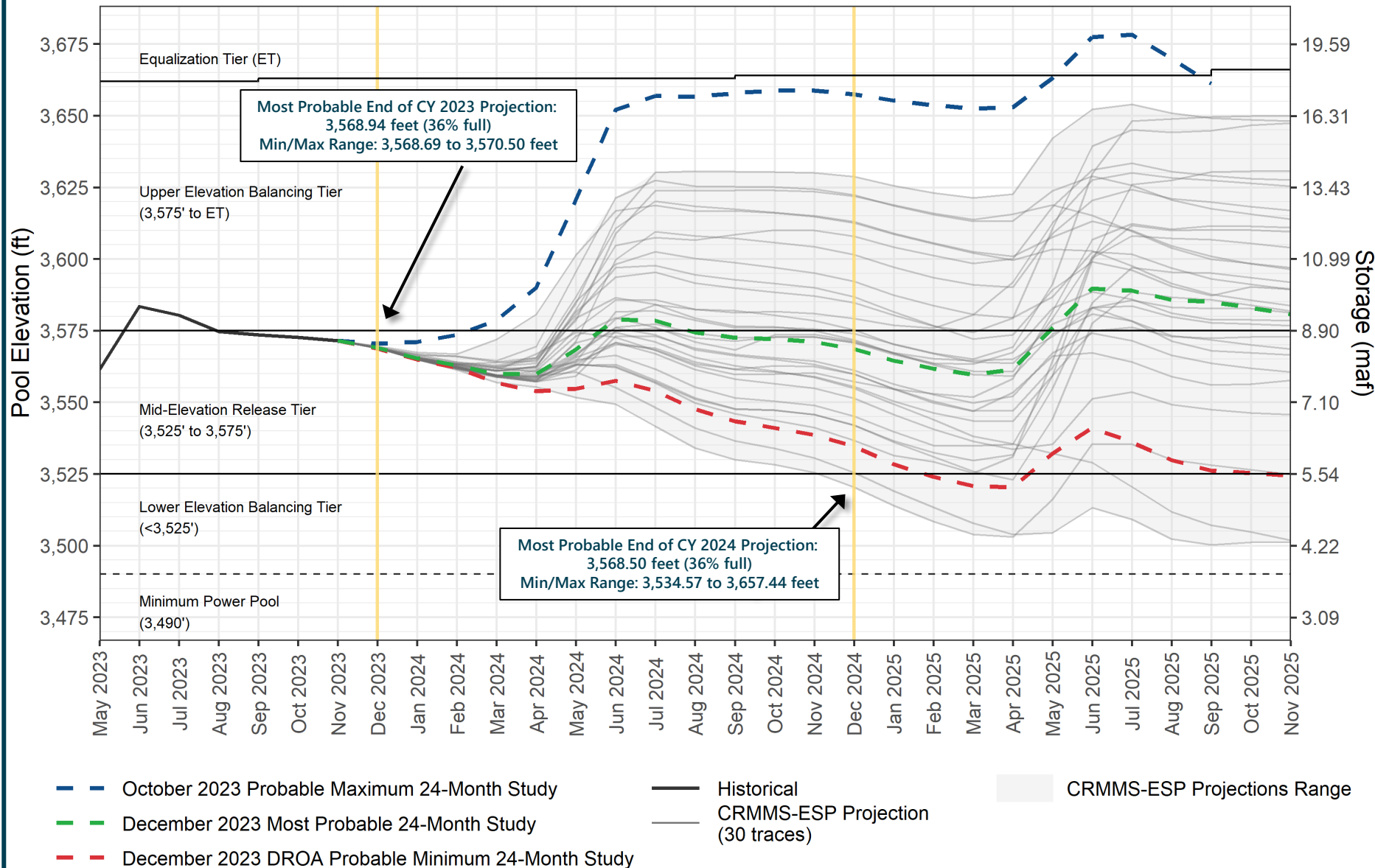
	Colorado River Mid-term Modeling System (CRMMS)		CRSS
	24-Month Study Mode (Manual Mode)	Ensemble Mode (Rule-based Mode)	
Primary Use	AOP tier determinations and projections of current conditions	Risk-based operational planning and analysis	Long-term planning, comparison of alternatives
Simulated Reservoir 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, 30 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 Mead End-of-Month Elevations CRMMS Projections from October and December 2023



Lake Powell End-of-Month Elevations CRMMS Projections from October and December 2023





Upper Colorado Basin

Hydropower Maintenance



Glen Canyon Dam Power Plant Unit Outage Schedule for 2024

Unit Number	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024
1	[Outage]								[Outage]			
2	[Outage]											
3	[Outage]											
4	[Outage]											
5								[Outage]				
6								[Outage]				
7						[Outage]						
8						[Outage]						
Units Available	4	4	6	6	6	6	6	6	7	8	8	8
Capacity (cfs)	12,400	19,450	19,400	19,300	19,200	19,200	19,150	19,400	23,300	23,250	26,700	26,700
Capacity (kaf/month)	770	1,030	1,190	1,190	1,110	1,160	1,080	1,110	1,280	1,630	1,640	1,590
Max (kaf) ¹	480	500	600	723	639	675	601	599	628	709	758	568
Most (kaf) ¹	480	500	600	723	639	675	601	599	628	709	758	568
Min (kaf) ¹	480	500	600	723	639	675	601	599	628	709	758	568

DEC MOST²

DEC MOST

7.48 maf

7.48 maf

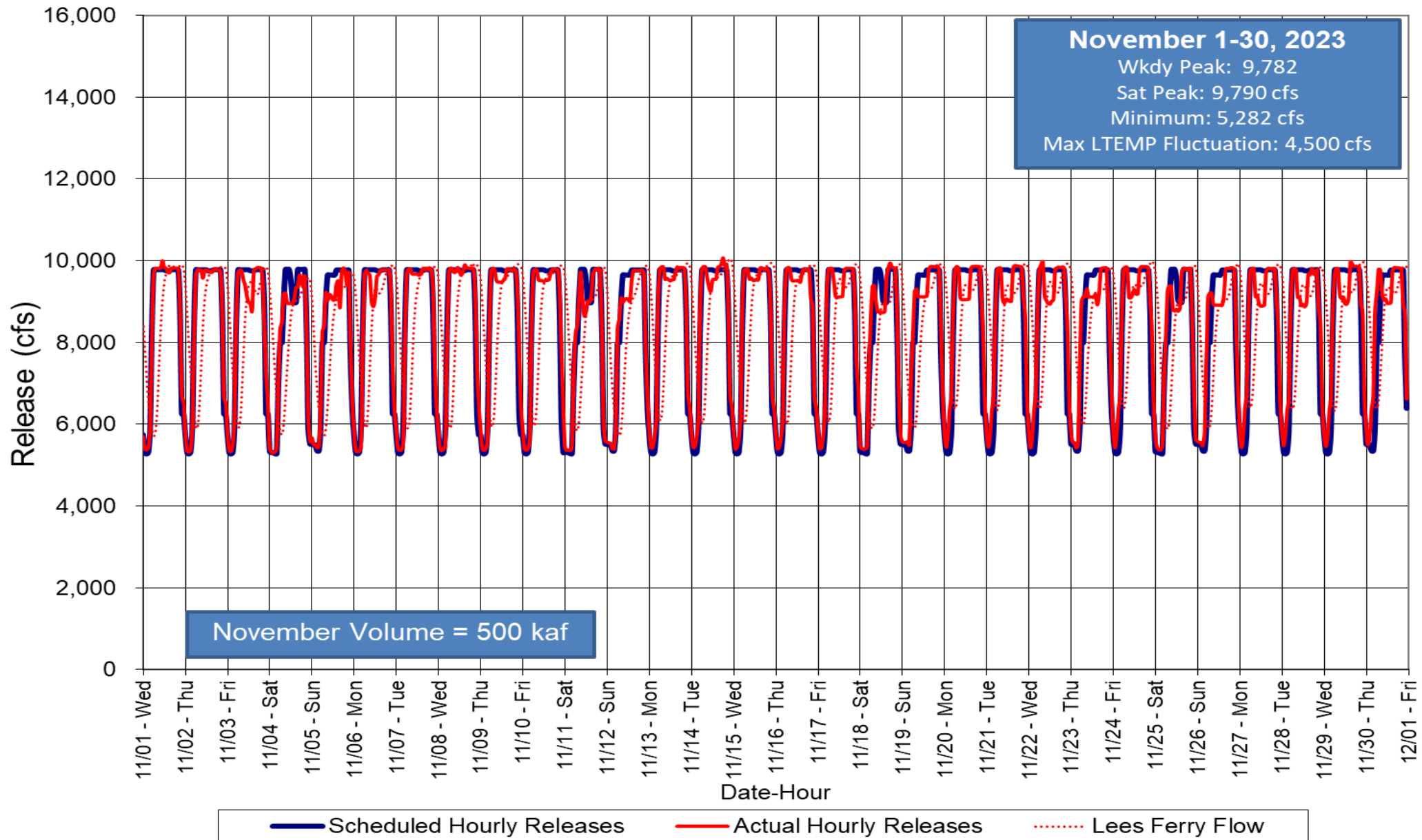
7.48 maf

1 Projected release, based on December 2023 24MS for the minimum and most probable and the October 23 24MS for the maximum probable 24-Month Study model runs.

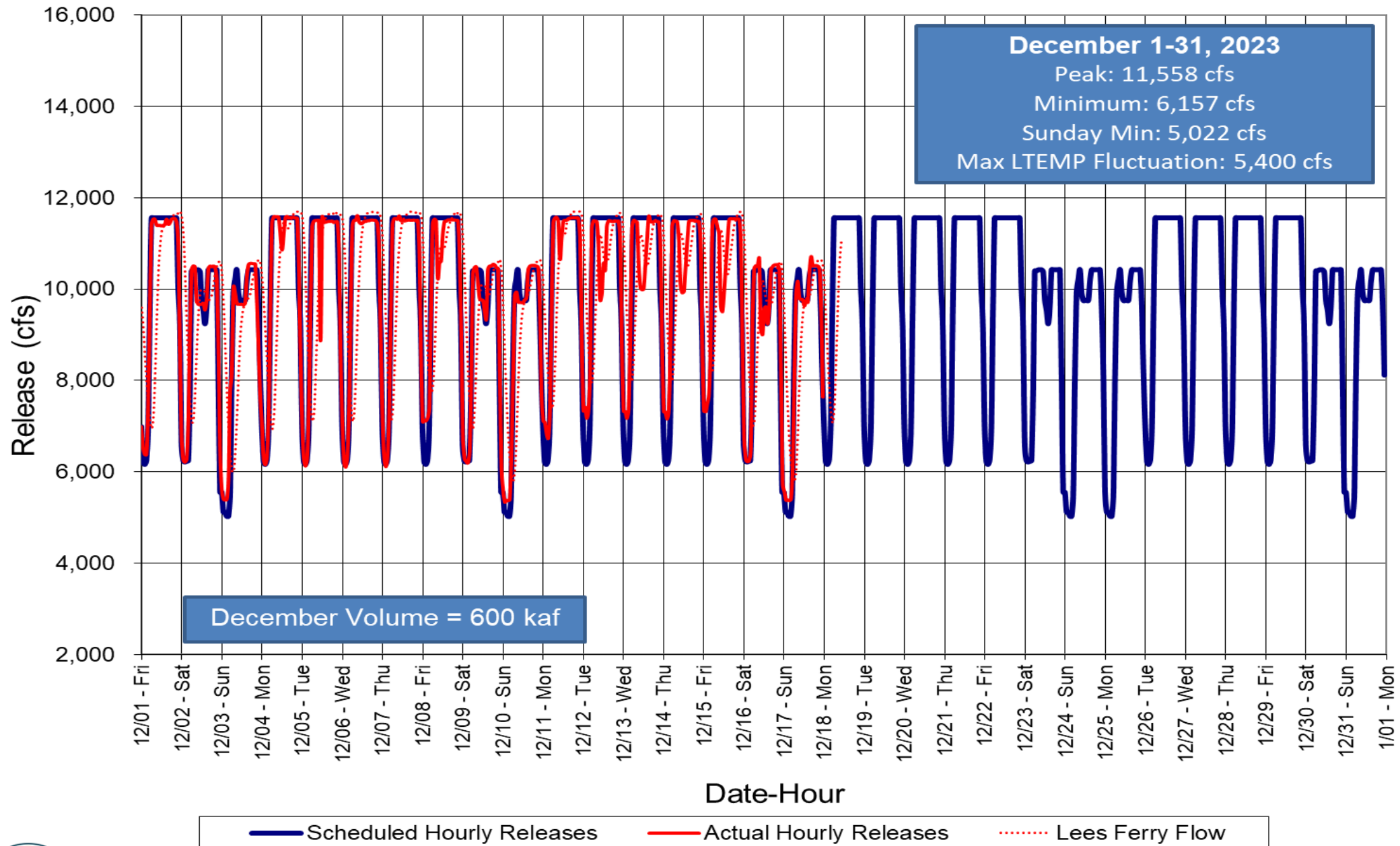
2 Dependent upon availability to shift contingency regulation, which will increase capacity by 30-40MW (3%) at current efficiency.



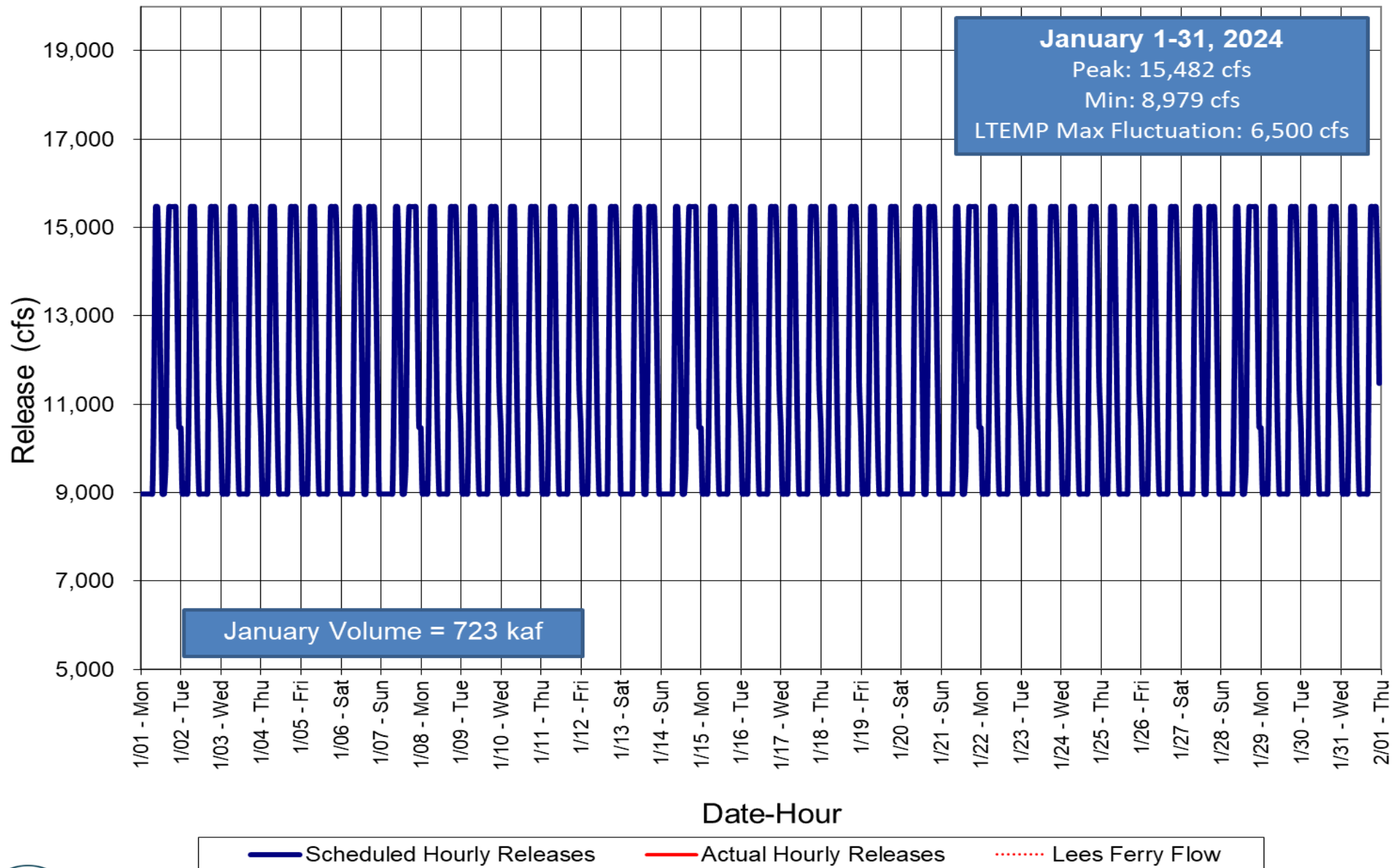
Glen Canyon Dam Hourly Release Pattern November 2023



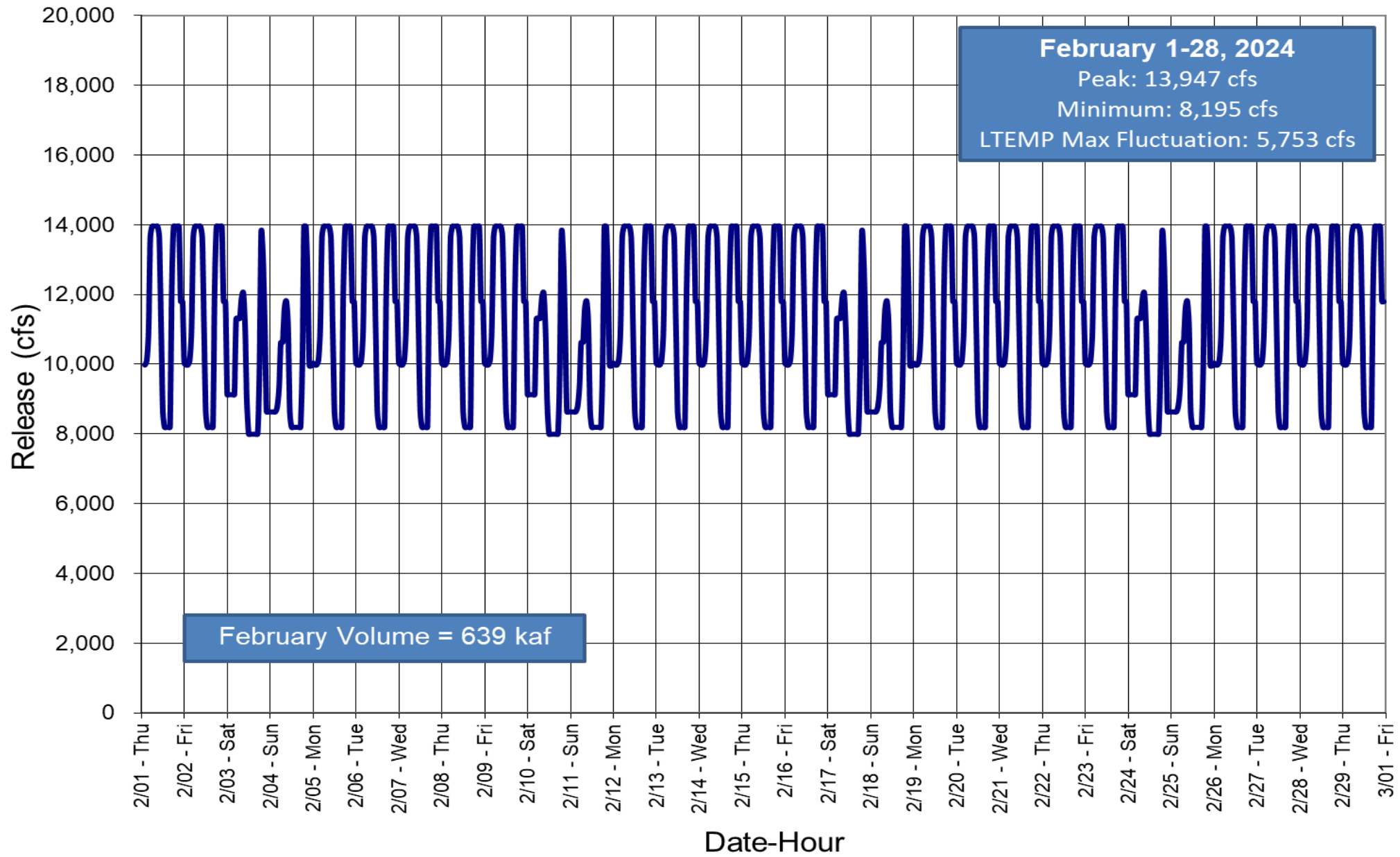
Glen Canyon Dam Hourly Release Pattern December 2023



Glen Canyon Dam Hourly Release Pattern January 2024



Glen Canyon Dam Hourly Release Pattern February 2024



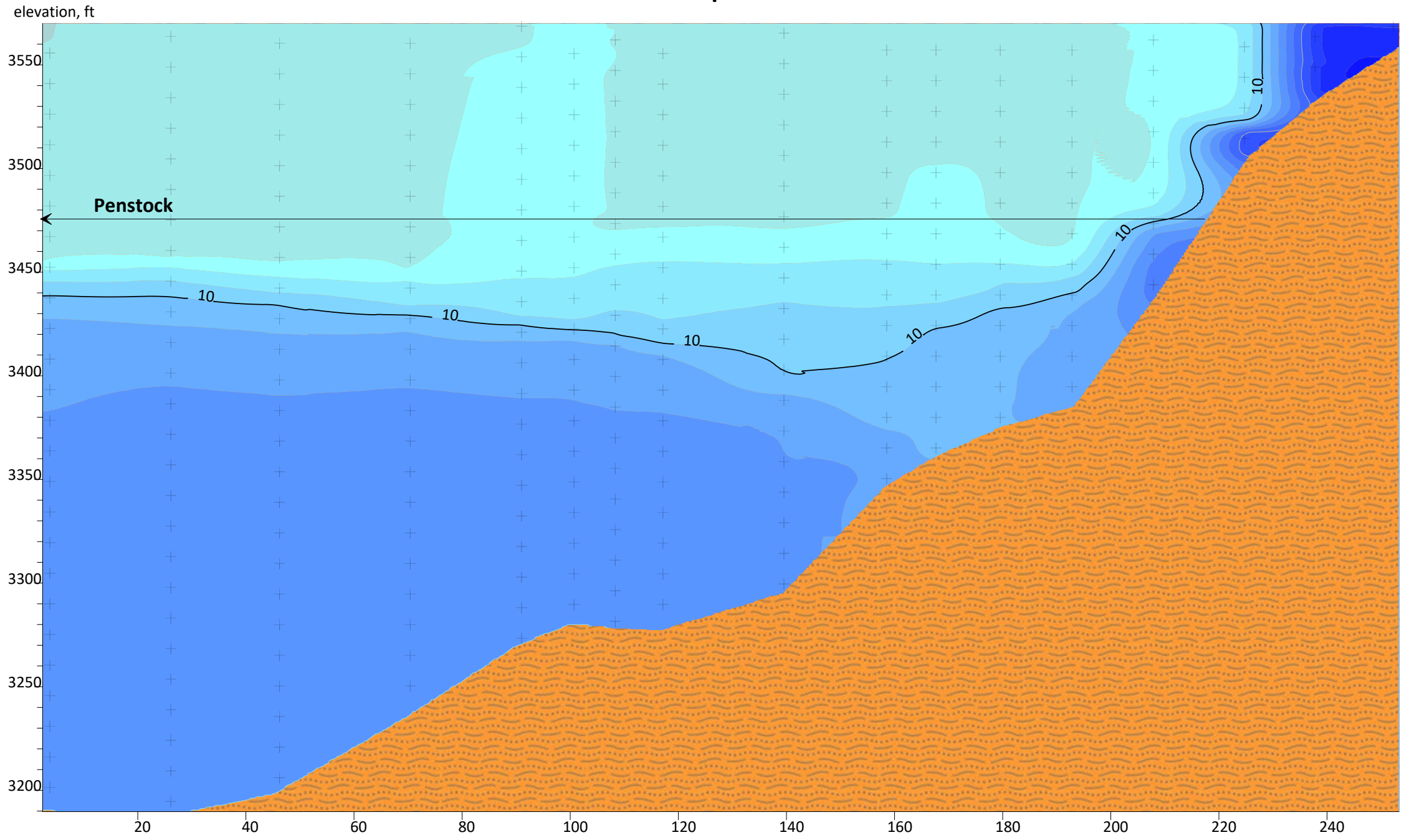
— Scheduled Hourly Releases — Actual Hourly Releases Lees Ferry Flow



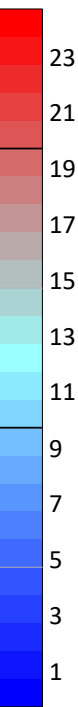
Water Quality



Lake Powell Temperature Dec 2023



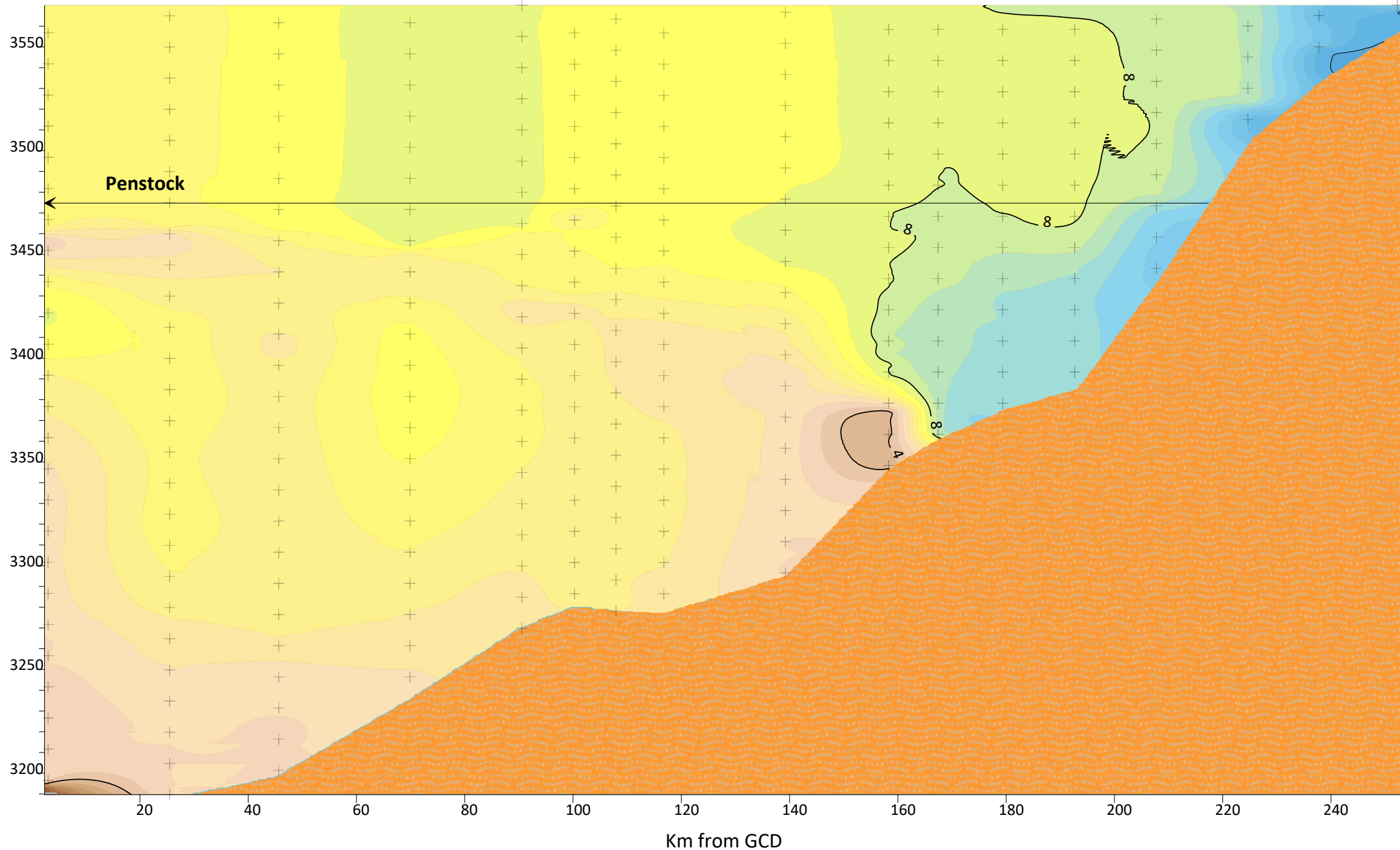
Deg F



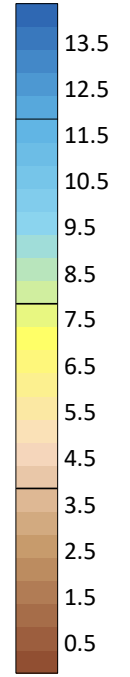
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Lake Powell Dissolved Oxygen Dec 2023

elevation, ft



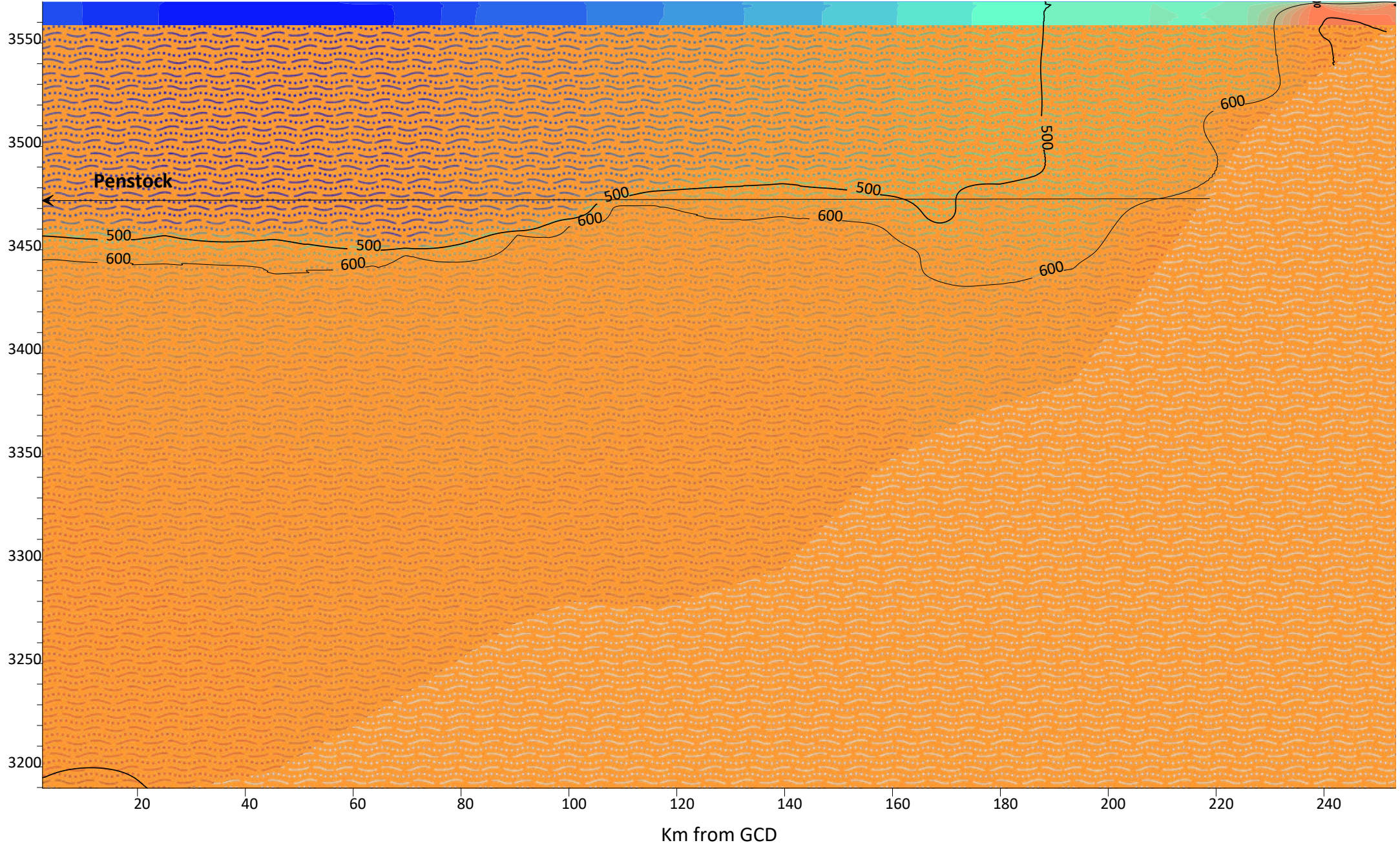
mg/L



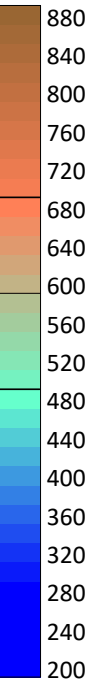
BUREAU OF RECLAMATION

Lake Powell TDS December 2023

elevation, ft



mg/l



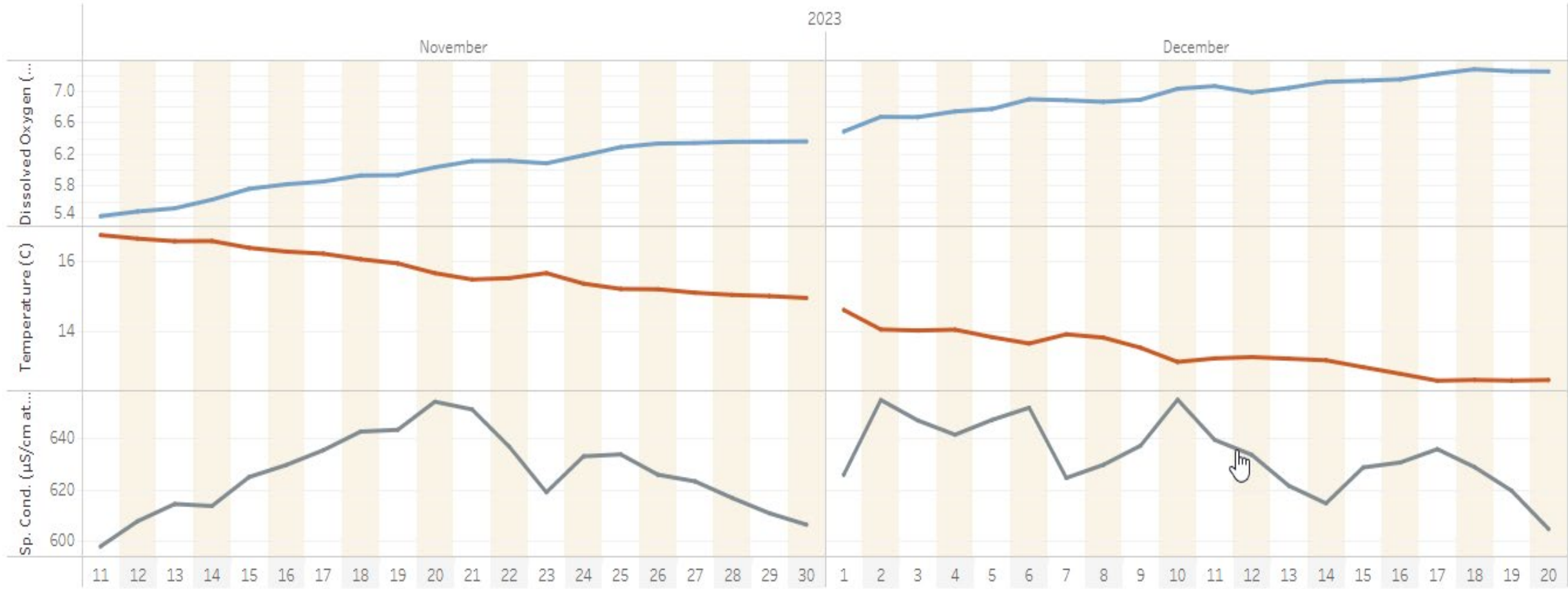
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Daily Water Quality Data at Glen Canyon Dam

[Download PDF](#)

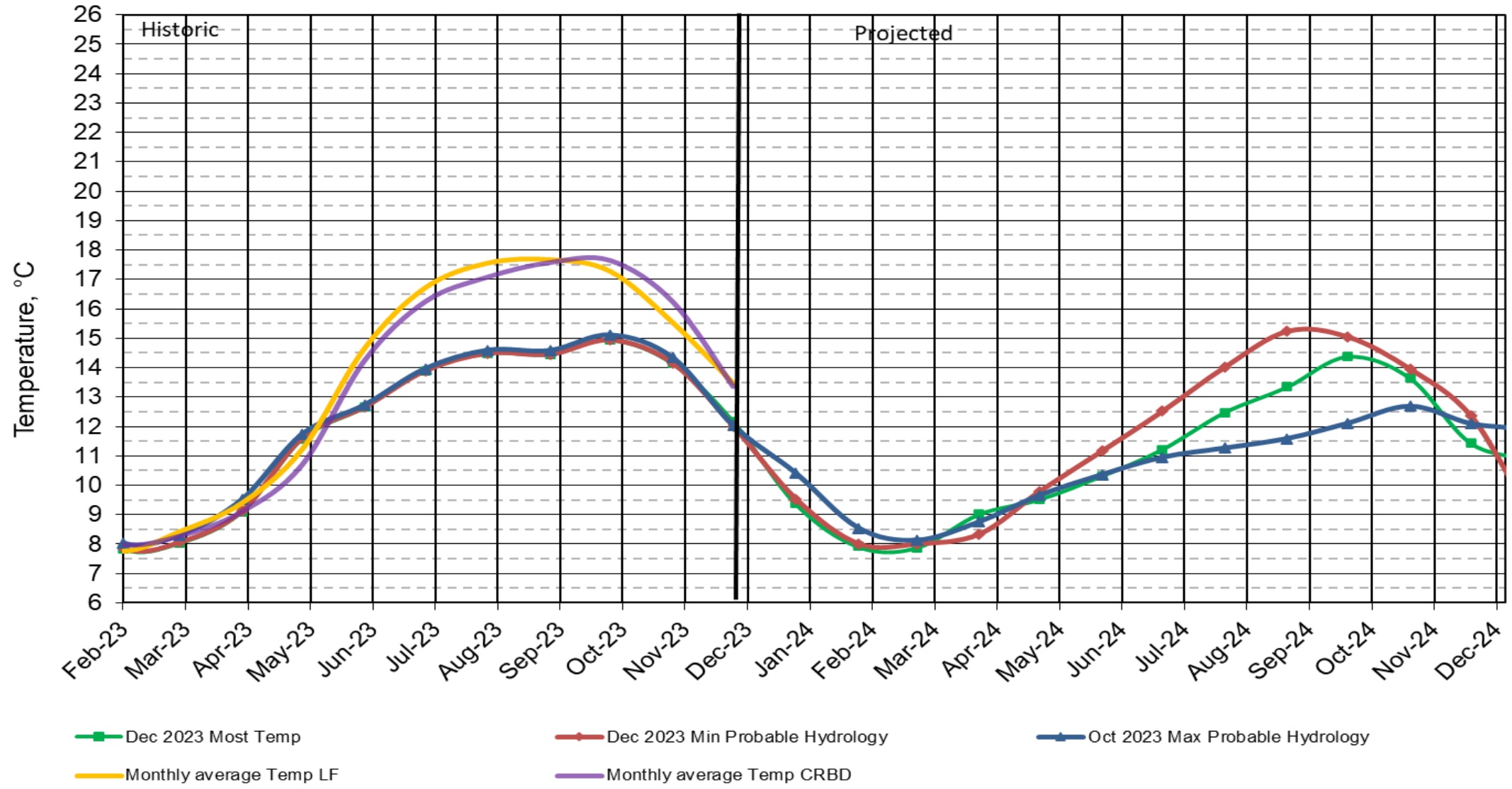


Daily Dissolved Oxygen & Temperature Values



Lake Powell Release Temperature

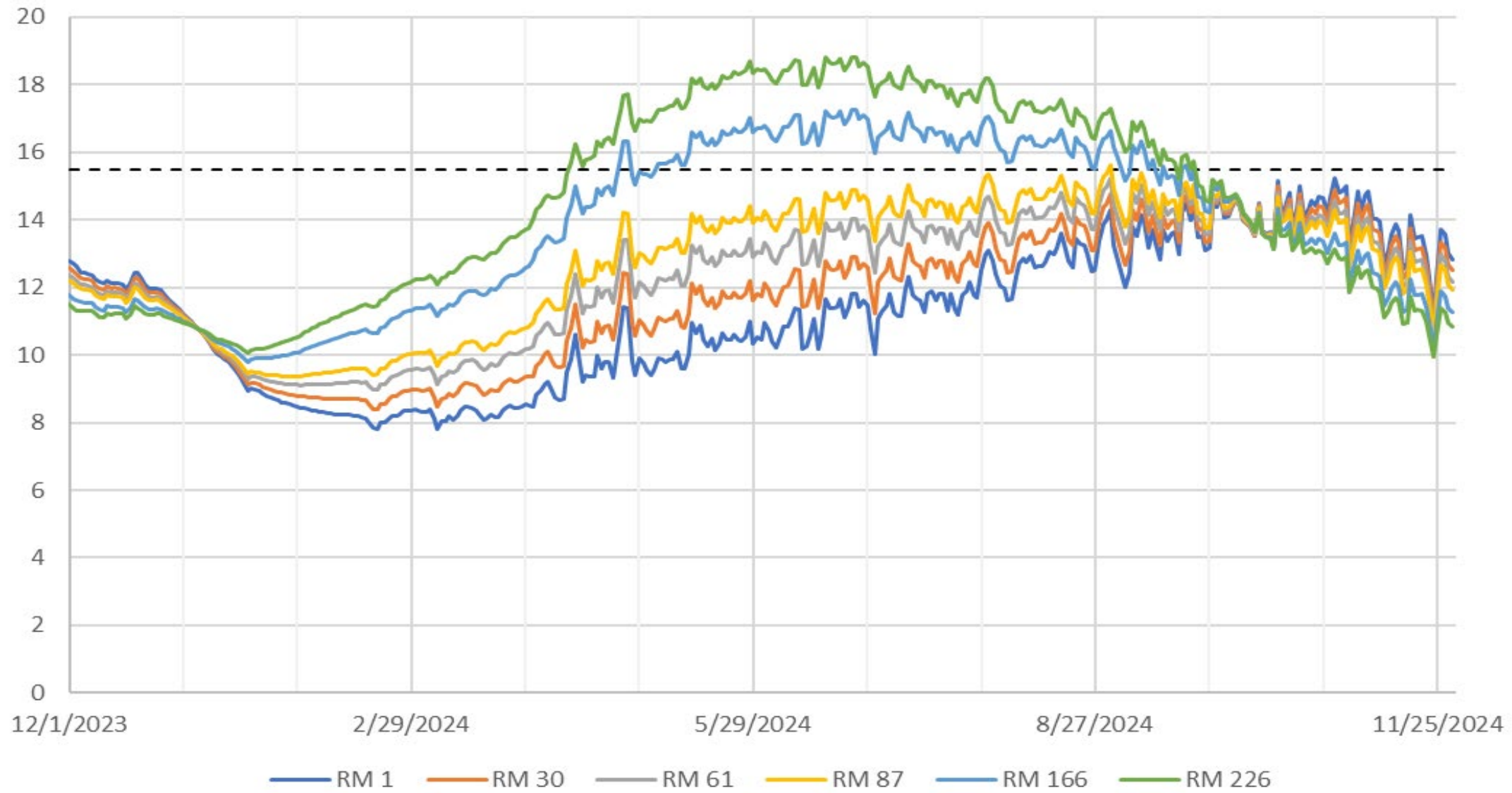
Projected Temperature based on December 2023 Forecast



#Projection start date is based on initial conditions (March 2021)



Dec 2023 Most Dibble et al. Grand Canyon Temperature Projections



Questions?



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