BUREAU OF RECLAMATION

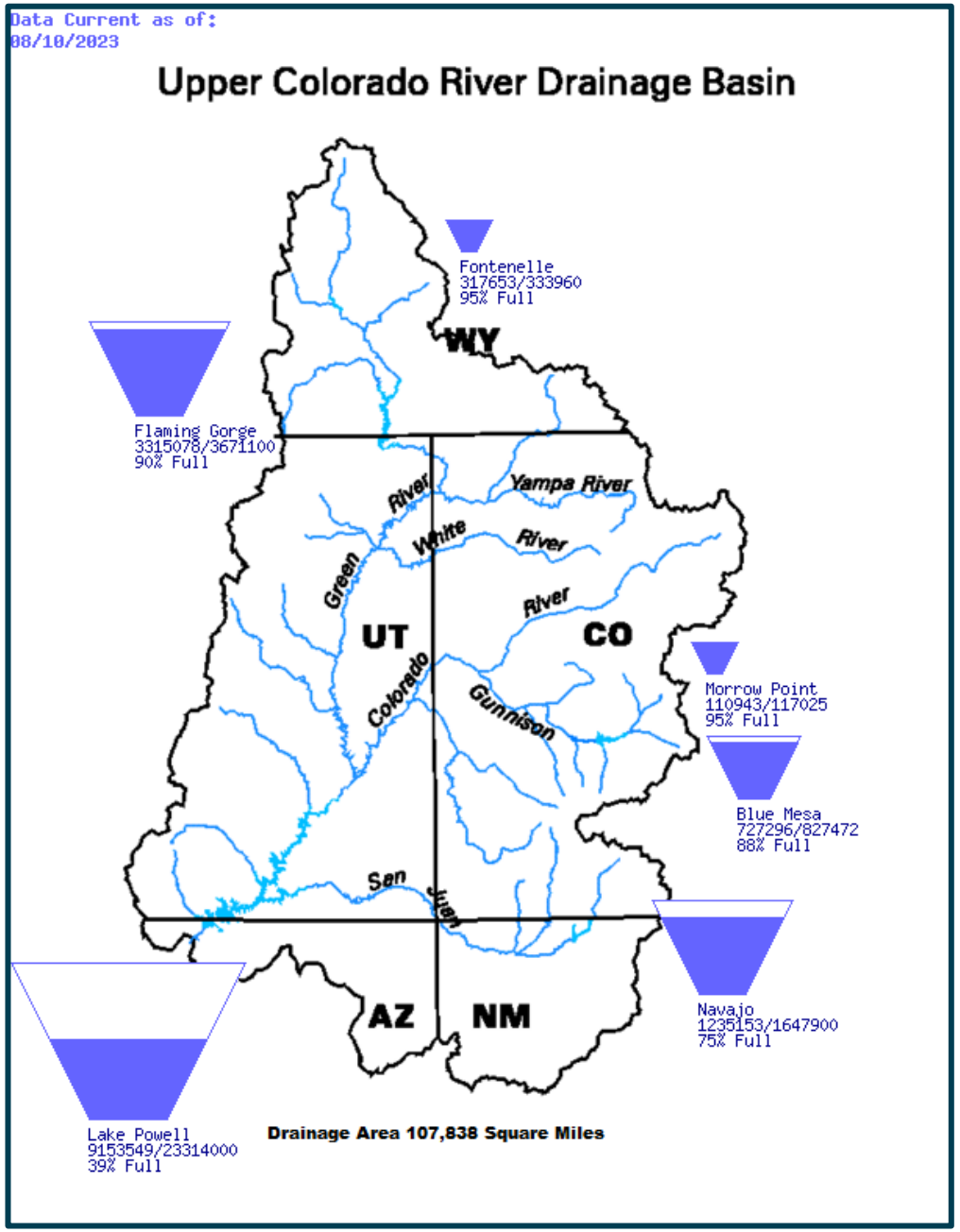
Glen Canyon AMWG

Basin Hydrology and Operations

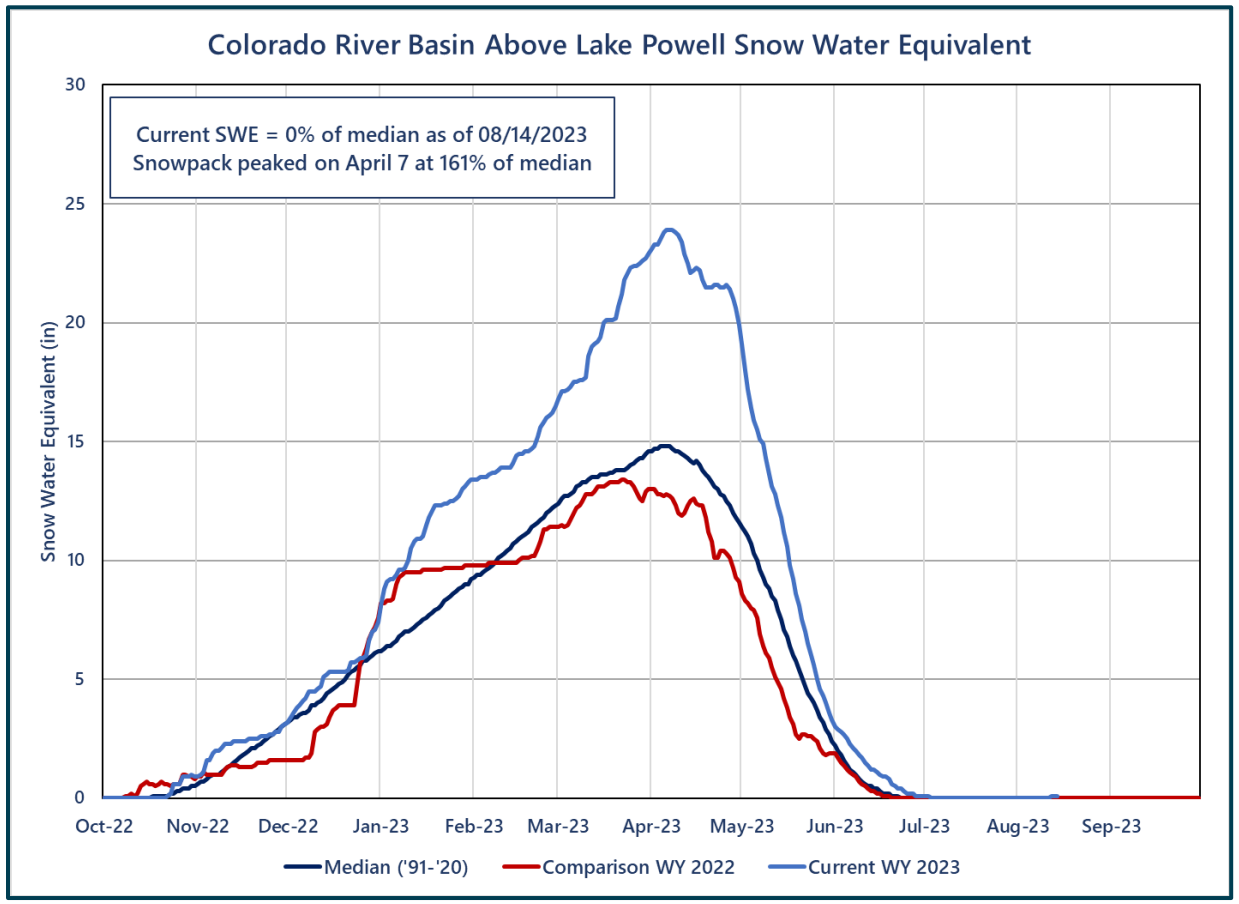
August 16, 2023

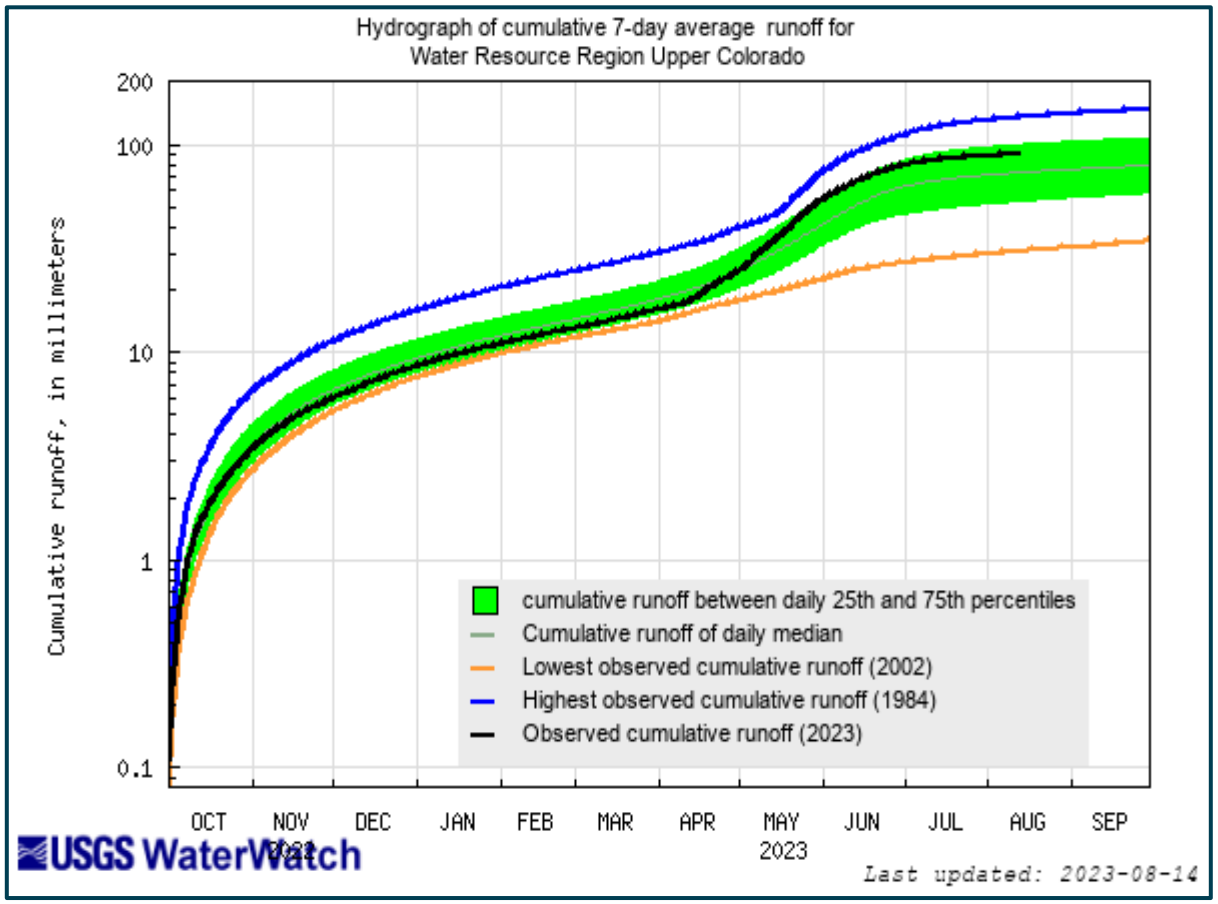
Upper Colorado Basin System Conditions (as of August 10, 2023)

Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	95	0.32	0.33	6,503.90
Flaming Gorge	90	3.32	3.67	6,031.29
Blue Mesa	88	0.73	0.83	7,508.15
Navajo	75	1.24	1.65	6,055.39
Lake Powell	39	9.15	23.31	3,578.23
UC System Storage	50	14.87	29.93	



Upper Colorado SWE and Observed Inflows



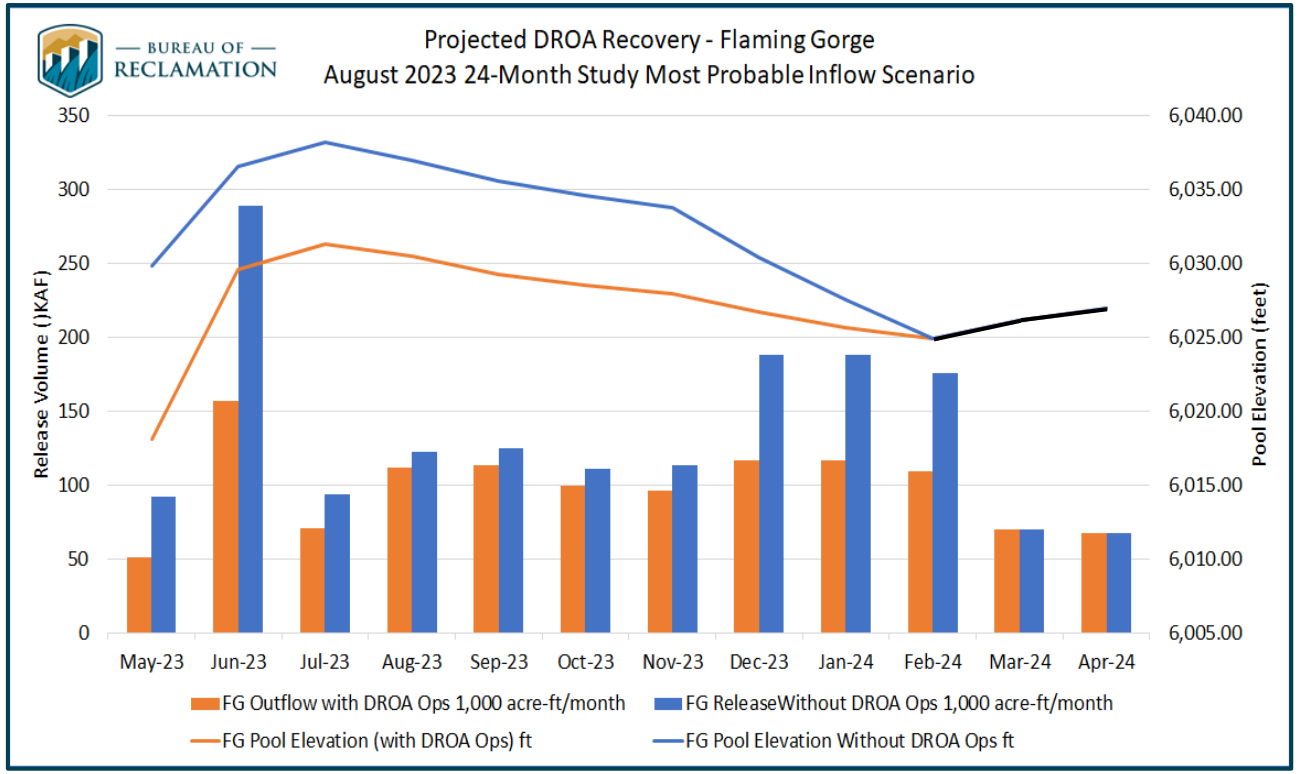


https://waterwatch.usgs.gov/index.php

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]	-193	260
Blue Mesa	36	0	0	36
Navajo	0	0	0	0
Total DROA Volume (kaf)	161	328	-193	296



[1]DROA operational year is from May through April.
[2]Positive 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
[4]DROA recovery through June 2023

Most Probable August Preliminary Observed and Forecast Water Year 2023

April – July 2023 Preliminary Observed Unregulated Inflow

as of August 1, 2023

Reservoir	Inflow (kaf)	Percent of Avg[1]
Fontenelle	951	129
Flaming Gorge	1,457	151
Blue Mesa	833	131
Navajo	1,028	163
Powell	10,619	166

Water Year 2023 Unregulated Inflow Forecast

as of August 1, 2023

Reservoir	Inflow (kaf)	Percent of Avg[1]
Fontenelle	1,251	116
Flaming Gorge	1,810	128
Blue Mesa	1,083	120
Navajo	1,265	139
Powell	13,750	143

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

Most Probable August Forecast
Water Year 2024

April – July 2024
Forecasted Unregulated Inflow

as of August 1, 2023

Reservoir	Inflow (kaf)	Percent of Avg[1]
Fontenelle	690	94
Flaming Gorge	920	95
Blue Mesa	620	97
Navajo	577	92
Powell	6,420	100

Water Year 2024
Unregulated Inflow Forecast

as of August 1, 2023

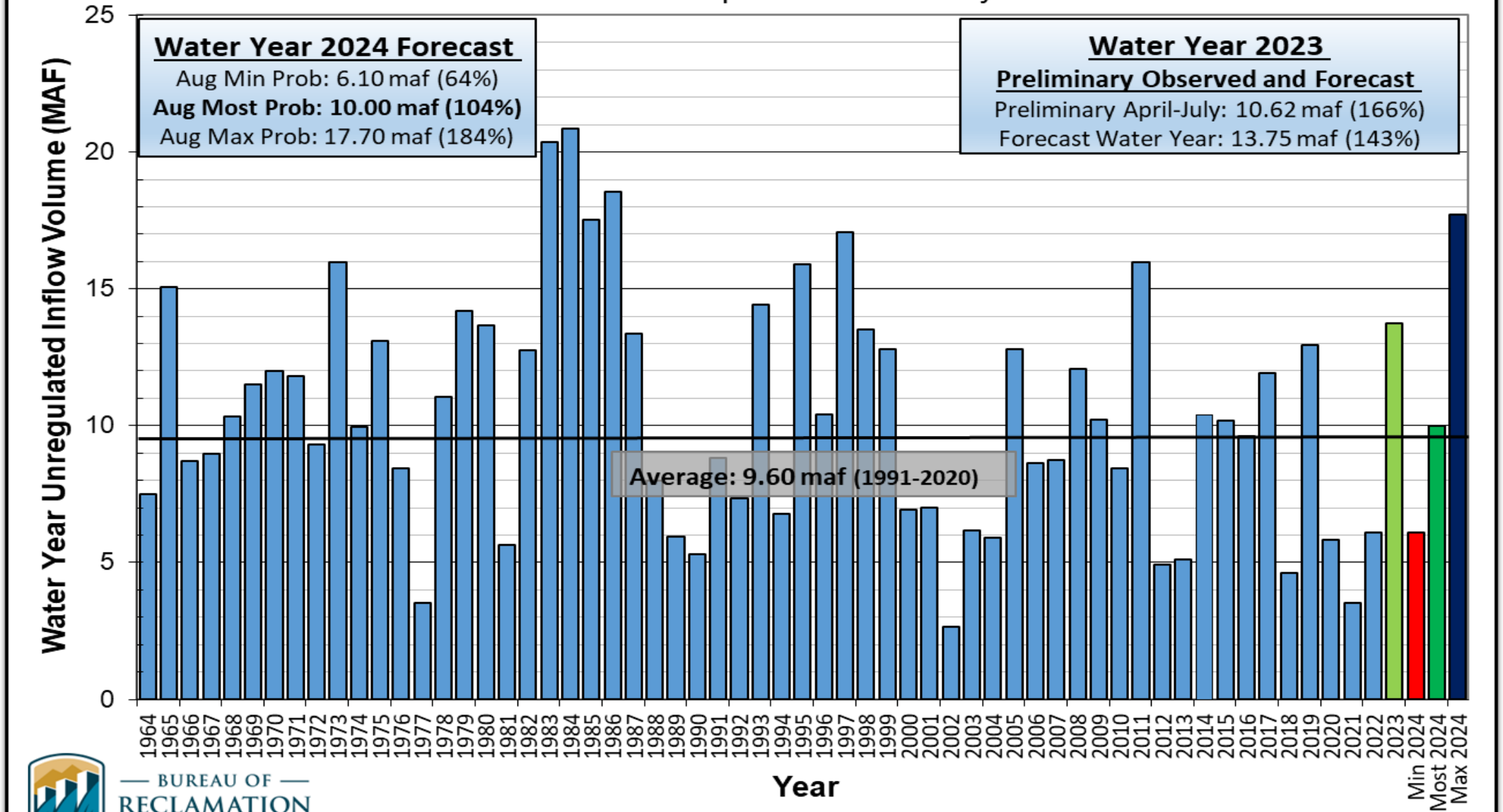
Reservoir	Inflow (kaf)	Percent of Avg[1]
Fontenelle	1,030	96
Flaming Gorge	1,380	98
Blue Mesa	895	99
Navajo	845	93
Powell	10,000	104

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

Lake Powell Unregulated Inflow

Water Year 2023 and 2024 Forecast *(issued August 1)*

Comparison with History



— BUREAU OF —
RECLAMATION

Upper Colorado Basin

Hydrology and Operations Projections Based on August 2023 24-Month Study

Upper Basin Reservoir Operations
Water Years 2023 and 2024

- 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 water year (WY) 2023 will operate in the Lower Elevation Balancing Tier where Lake Powell and Lake Mead will balance contents with Glen Canyon Dam release volumes no less than 7.0 maf and no more than 9.5 maf
- Lake Powell WY 2024 will operate in the Mid-Elevation Release Tier where Lake Powell will release 7.48 maf
- Consistent with the provisions of the 2007 Interim Guidelines, and to preserve the benefits to Glen Canyon Dam facilities from 2022 Operations into 2023 and 2024, Reclamation will consult with the Basin States on monthly and annual operations. 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.

Lake Powell & Lake Mead Operational Table

Lake Powell Operational Tier Determination Run (aka "Exhibit Run") with an 8.23 maf Release[1]

3,568.57 ft
Jan 1, 2024
Projection

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]
			1,145		15.9
			1,105	**Normal or ICS Surplus Condition** Deliver ≥ 7.5 maf	11.9
3,575		9.5	1,075		9.4
	Mid-Elevation Release Tier Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf			**Shortage Condition** Deliver 7.167[4] maf	
			1,050		7.5
				Shortage Condition Deliver 7.083[5] maf	
3,525		5.9	1,025		5.8
3,490	**Lower Elevation Balancing Tier** Balance contents with a min/max release of 7.0 and 9.5 maf	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

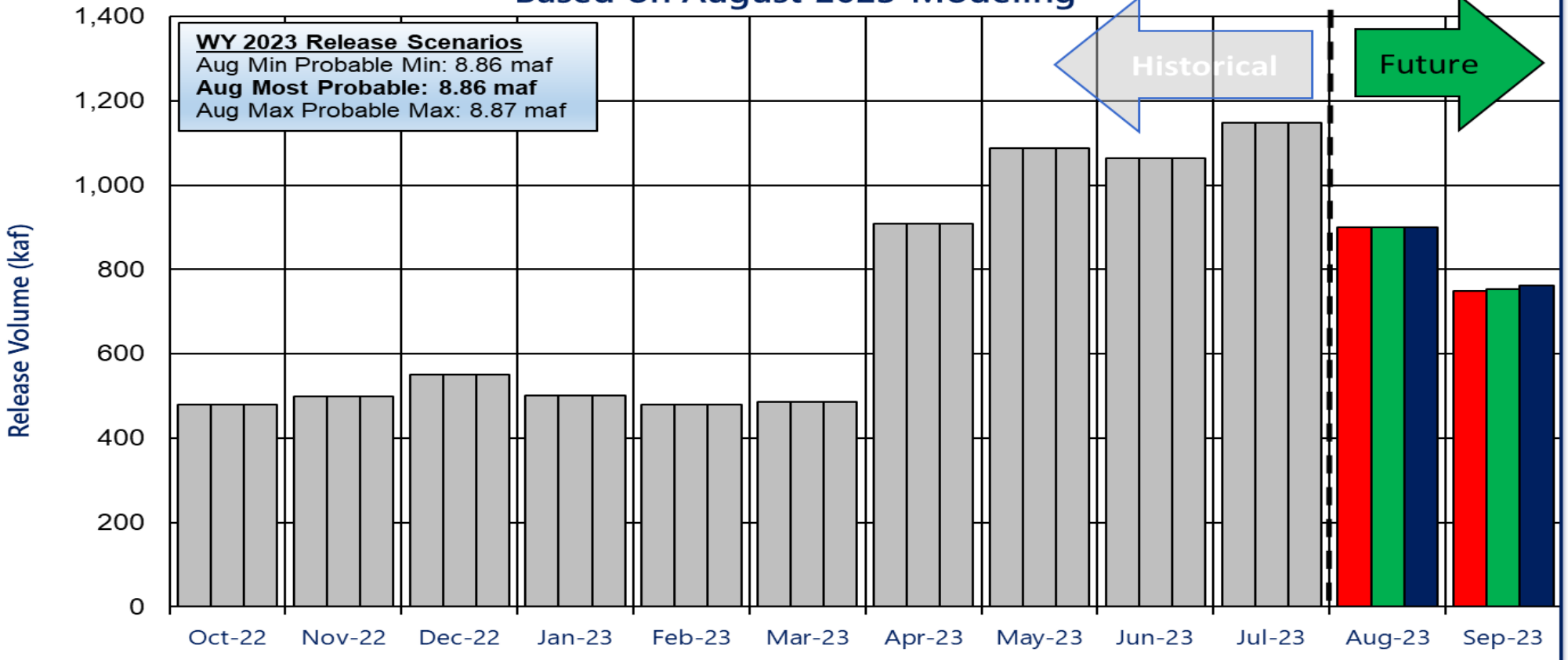
[7] Whenever Lake Mead is below elevation 1,025 feet, the Secretary shall consider whether hydrologic conditions together with anticipated deliveries to the Lower Division States and Mexico is likely to cause the elevation at Lake Mead to fall below 1,000 feet. Such consideration, in consultation with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

[1] Lake Powell and Lake Mead operational tier determinations will be documented in the draft 2024 AOP.

Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2023

Based on August 2023 Modeling



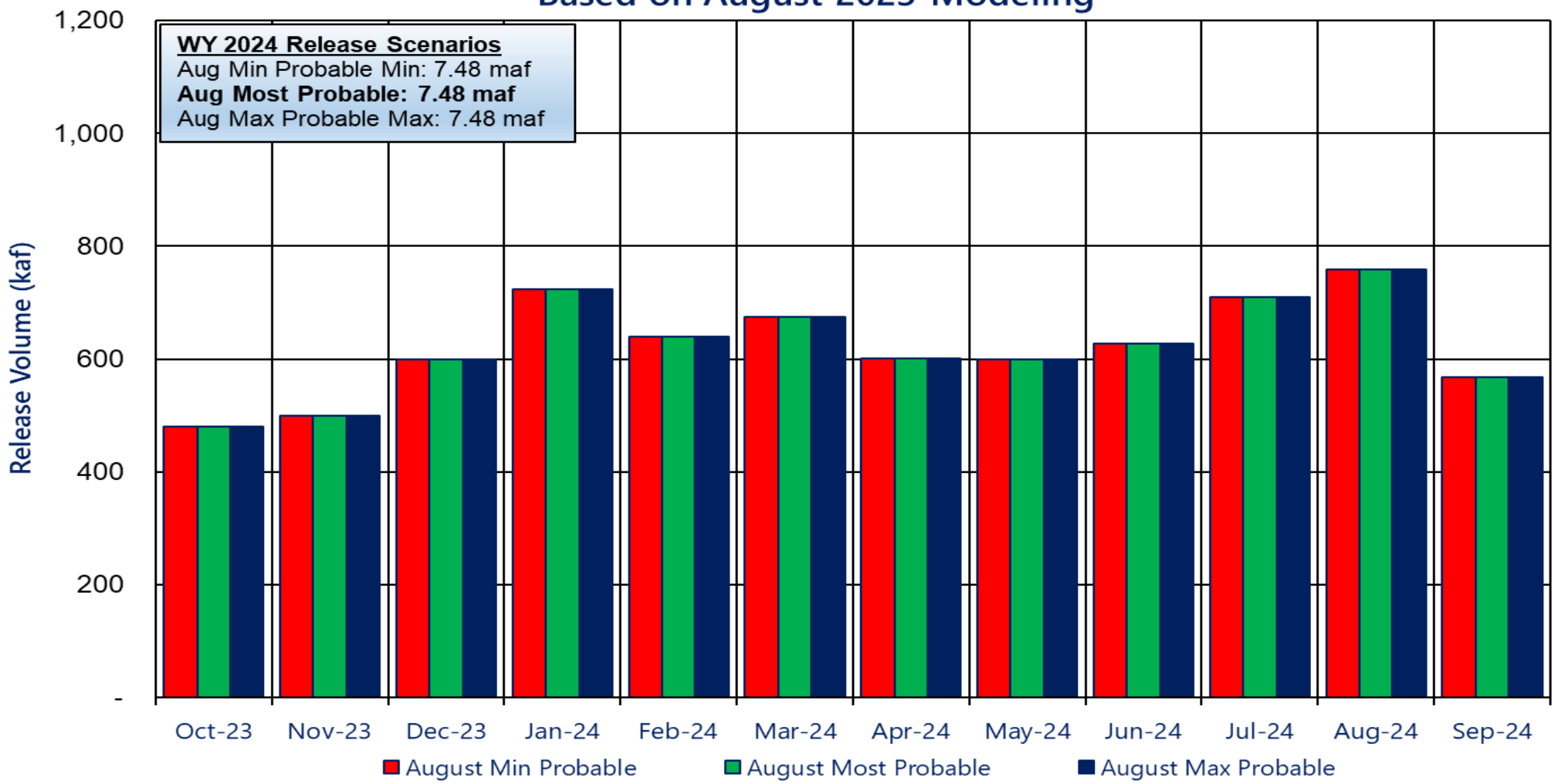
	10/1/2022	11/1/2022	12/1/2022	1/1/2023	2/1/2023	3/1/2023	4/1/2023	5/1/2023	6/1/2023	7/1/2023	8/1/2023	9/1/2023
August Min Probable	480.052	498.343	549.767	500.681	480.408	486.044	909.310	1,088.254	1,063.574	1,149.012	900.000	750.075
August Most Probable	480.052	498.343	549.767	500.681	480.408	486.044	909.310	1,088.254	1,063.574	1,149.012	900.000	753.025
August Max Probable	480.052	498.343	549.767	500.681	480.408	486.044	909.310	1,088.254	1,063.574	1,149.012	900.000	761.938

Consistent with the provisions of the 2007 Interim Guidelines, and to preserve the benefits to Glen Canyon Dam facilities from 2022 Operations into 2023 and 2024, Reclamation will consult with the Basin States on monthly and annual operations. 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.

Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2024

Based on August 2023 Modeling



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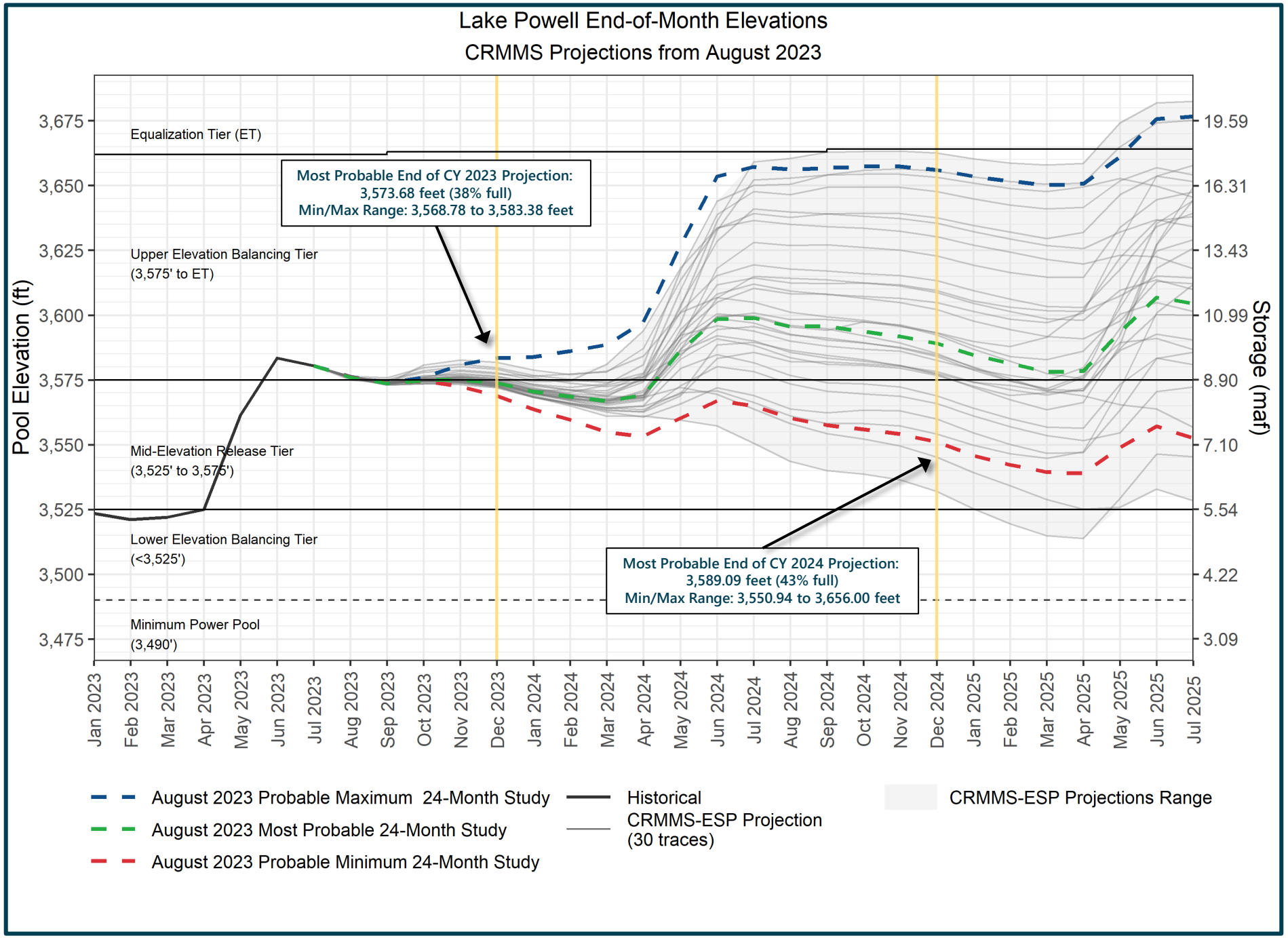
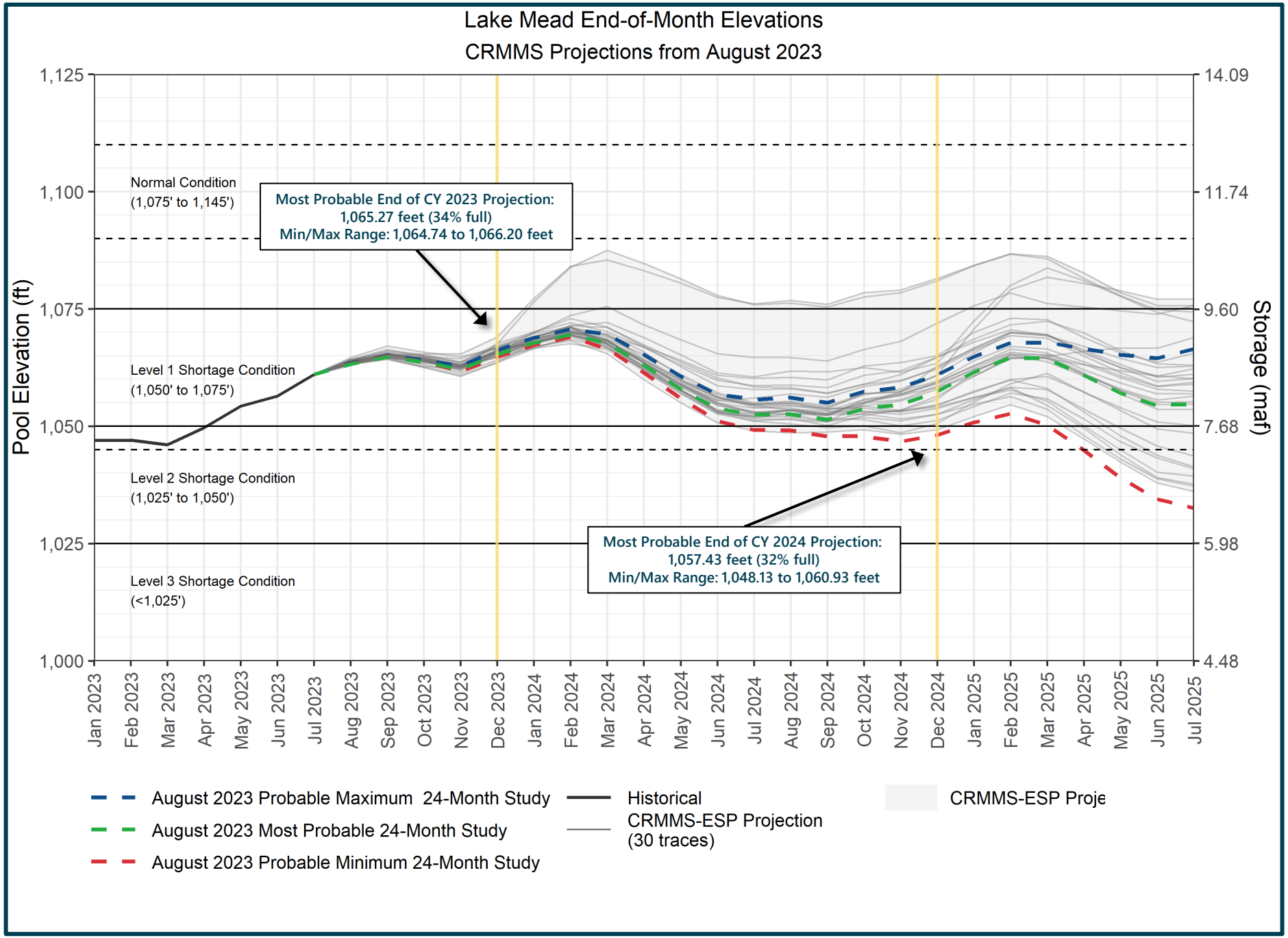
Reclamation Operational Modeling
Model Comparison

	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 Powell End-of-Month Elevations
CRMMS Projections from August 2023
Pool Elevation (ft)
Storage (maf)
3,675
3,650
3,625
3,600
3,575
3,550
3,525
3,500
3,475
19.59
16.31
13.43
10.99
8.90
7.10
5.54
4.22
3.09
Equalization Tier (ET)
Upper Elevation Balancing Tier
(3,575' to ET)
Mid-Elevation Release Tier
(3,525' to 3,575')
Lower Elevation Balancing Tier
(<3,525')
Minimum Power Pool
(3,490')
Most Probable End of CY 2023 Projection:
3,573.68 feet (38% full)
Min/Max Range: 3,568.78 to 3,583.38 feet
Most Probable End of CY 2024 Projection:
3,589.09 feet (43% full)
Min/Max Range: 3,550.94 to 3,656.00 feet
Jan 2023
Feb 2023
Mar 2023
Apr 2023
May 2023
Jun 2023
Jul 2023
Aug 2023
Sep 2023
Oct 2023
Nov 2023
Dec 2023
Jan 2024
Feb 2024
Mar 2024
Apr 2024
May 2024
Jun 2024
Jul 2024
Aug 2024
Sep 2024
Oct 2024
Nov 2024
Dec 2024
Jan 2025
Feb 2025
Mar 2025
Apr 2025
May 2025
Jun 2025
Jul 2025
August 2023 Probable Maximum 24-Month Study
August 2023 Most Probable 24-Month Study
August 2023 Probable Minimum 24-Month Study
Historical
CRMMS-ESP Projection
(30 traces)
CRMMS-ESP Projections Range


Lake Mead End-of-Month Elevations
CRMMS Projections from August 2023
Pool Elevation (ft)
Storage (maf)
1,125
1,100
1,075
1,050
1,025
1,000
14.09
11.74
9.60
7.68
5.98
4.48
Normal Condition
(1,075' to 1,145')
Level 1 Shortage Condition
(1,050' to 1,075')
Level 2 Shortage Condition
(1,025' to 1,050')
Level 3 Shortage Condition
(<1,025')
Most Probable End of CY 2023 Projection:
1,065.27 feet (34% full)
Min/Max Range: 1,064.74 to 1,066.20 feet
Most Probable End of CY 2024 Projection:
1,057.43 feet (32% full)
Min/Max Range: 1,048.13 to 1,060.93 feet
Jan 2023
Feb 2023
Mar 2023
Apr 2023
May 2023
Jun 2023
Jul 2023
Aug 2023
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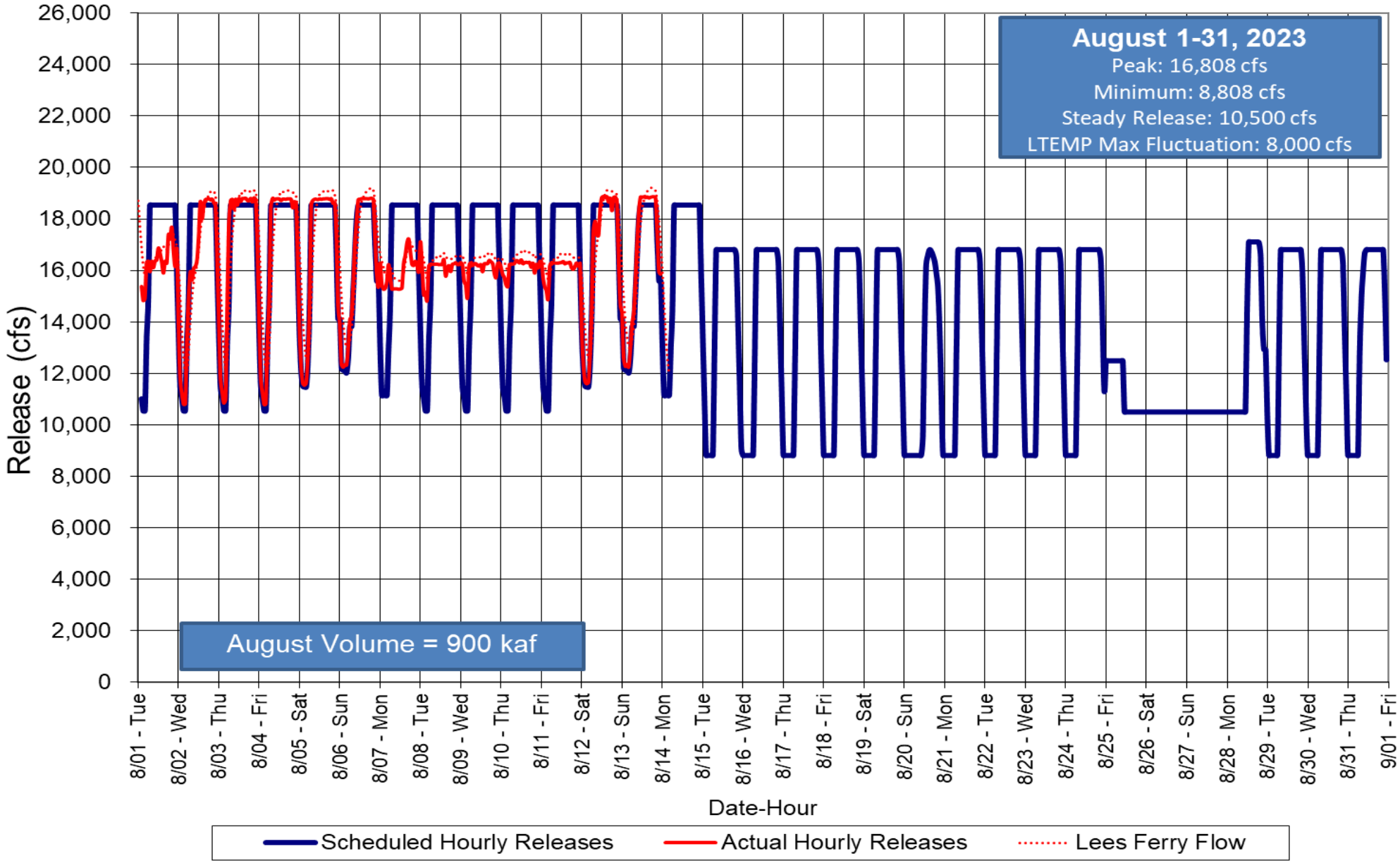
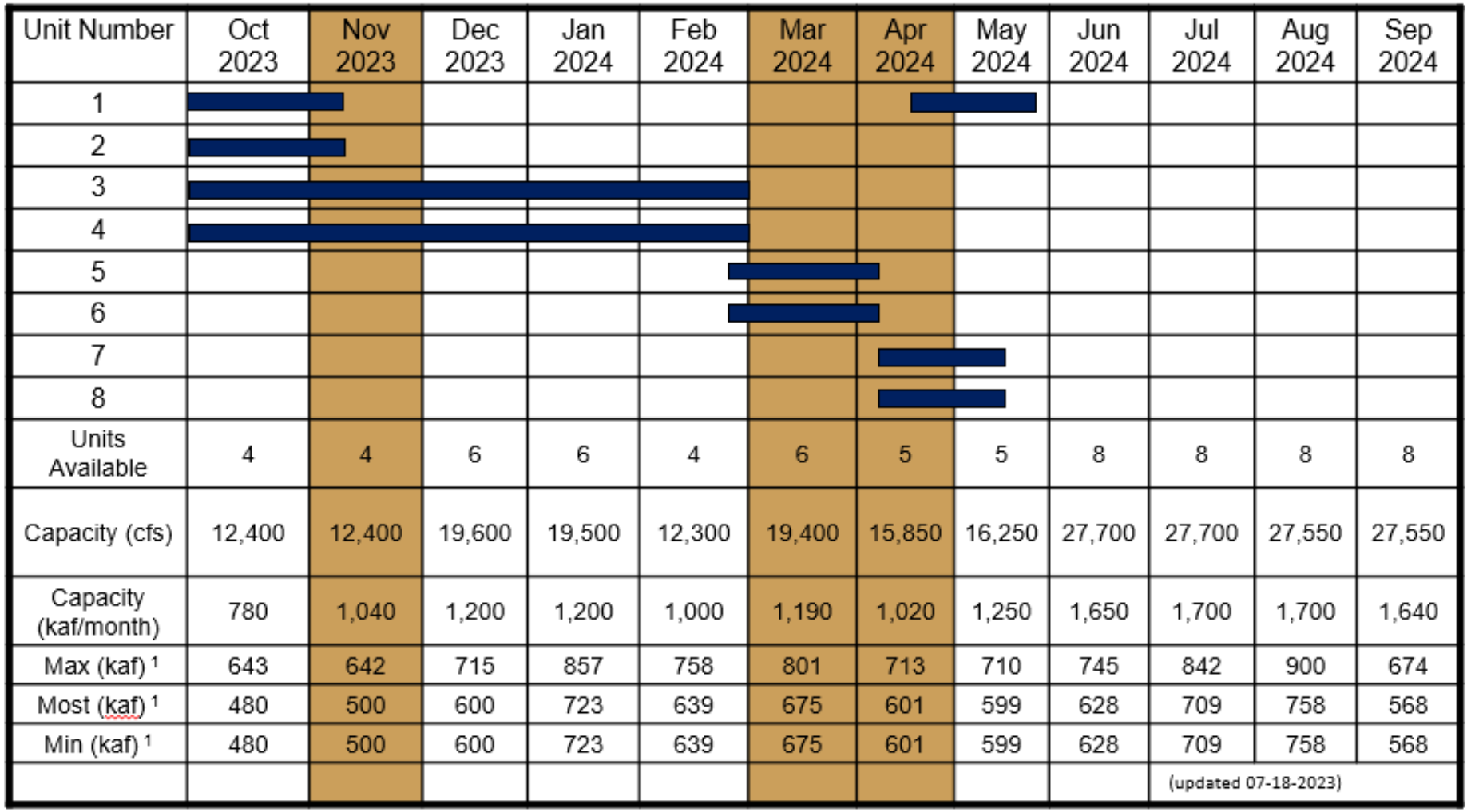
Apr 2025
May 2025
Jun 2025
Jul 2025
August 2023 Probable Maximum 24-Month Study
August 2023 Most Probable 24-Month Study
August 2023 Probable Minimum 24-Month Study
Historical
CRMMS-ESP Projection
(30 traces)
CRMMS-ESP Proje

Glen Canyon Dam Hourly Release Pattern August 2023



BUREAU OF RECLAMATION

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													
2													
3													
4													
5													
6													
7													
8													
Units Available	4	4	6	6	4	6	5	5	8	8	8	8	
Capacity (cfs)	12,400	12,400	19,600	19,500	12,300	19,400	15,850	16,250	27,700	27,700	27,550	27,550	JUL MOST[2]
Capacity (kaf/month)	780	1,040	1,200	1,200	1,000	1,190	1,020	1,250	1,650	1,700	1,700	1,640	JUL MOST
Max (kaf) [1]	643	642	715	857	758	801	713	710	745	842	900	674	9.00 maf
Most (kaf) [1]	480	500	600	723	639	675	601	599	628	709	758	568	7.48 maf
Min (kaf) [1]	480	500	600	723	639	675	601	599	628	709	758	568	7.48 maf
										(updated 07-18-2023)			

1 Projected release, based on April 2023 24MS for the maximum probable and July 2023 24MS for the minimum and most 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.


Questions?
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