BUREAU OF RECLAMATION

Glen Canyon Monthly Operations Call

Basin Hydrology and Operations

August 2024

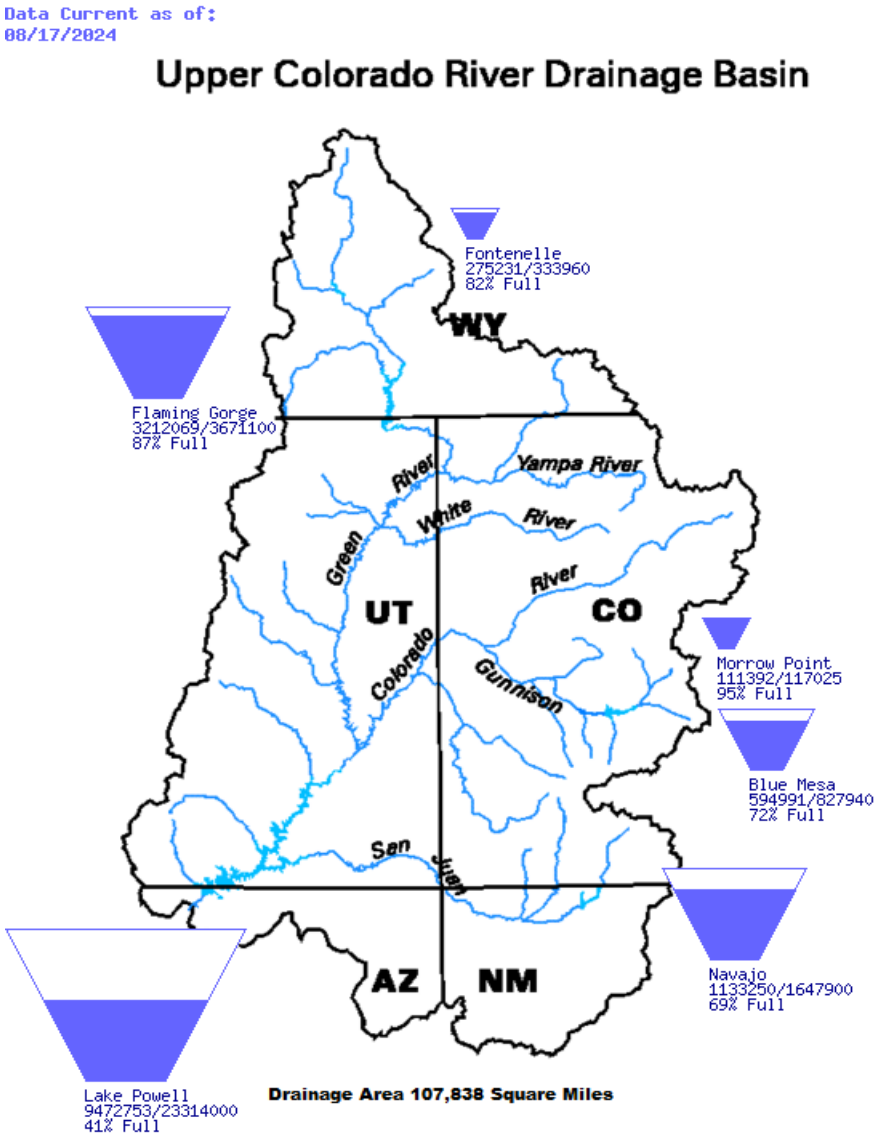
Background

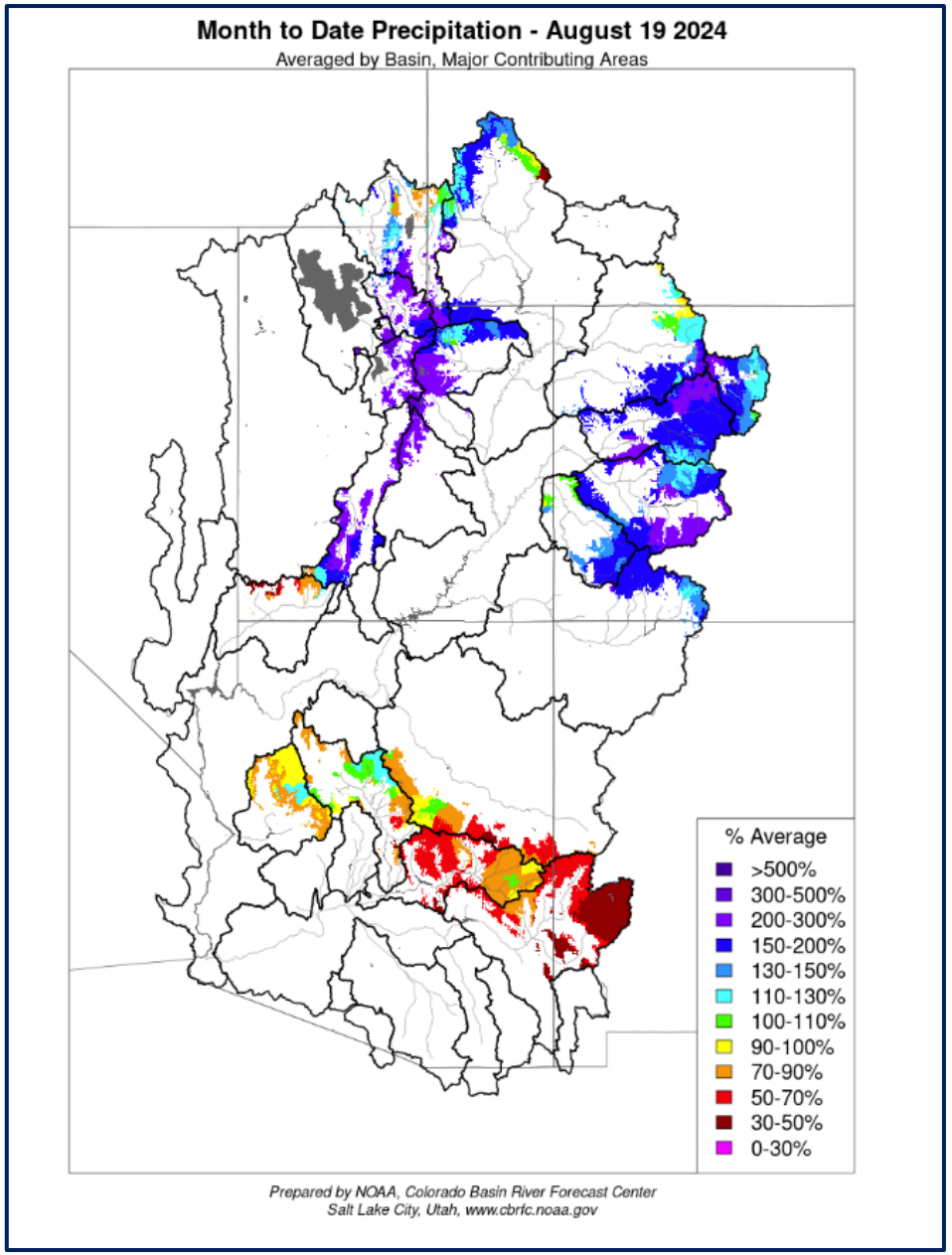
This briefing is being provided consistent with the provision in Attachment B - Section 1.1 of the LTEMP ROD which states:

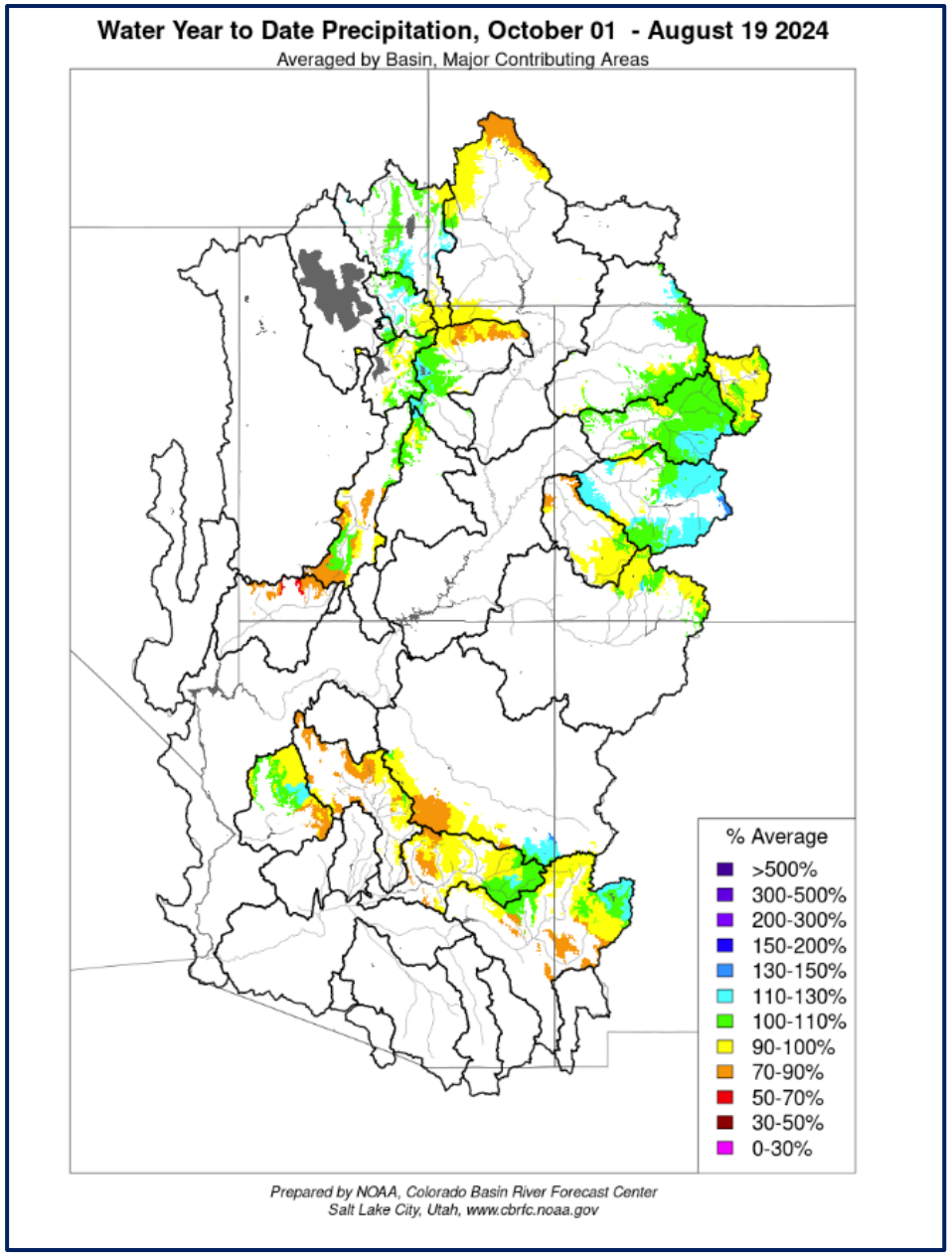
"Annually, Reclamation will develop a hydrograph based on the characteristics above. Reclamation will seek consensus on the annual hydrograph through monthly operational coordination calls with governmental entities, and regular meetings of the GCDAMP Technical Working Group (TWG) and AMWG. Reclamation 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 August 19, 2024)

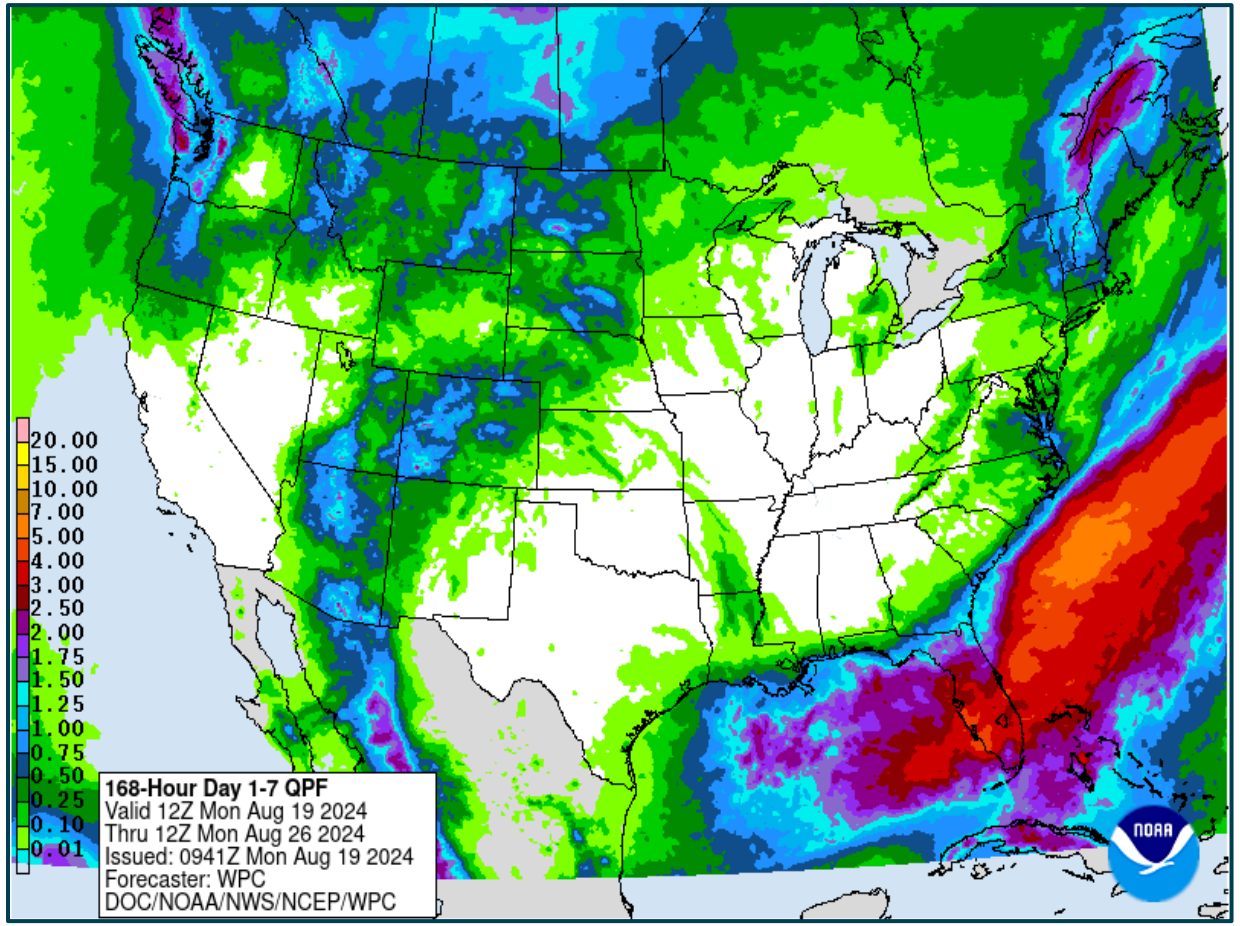
Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	82	0.27	0.33	6,498.07
Flaming Gorge	88	3.22	3.67	6,028.75
Blue Mesa	72	0.59	0.83	7,492.03
Navajo	69	1.13	1.65	6,749.94
Lake Powell	41	9.45	23.31	3,581.96
UC System Storage	49	14.80	29.79	
Total System Storage	44	25.67	58.48	

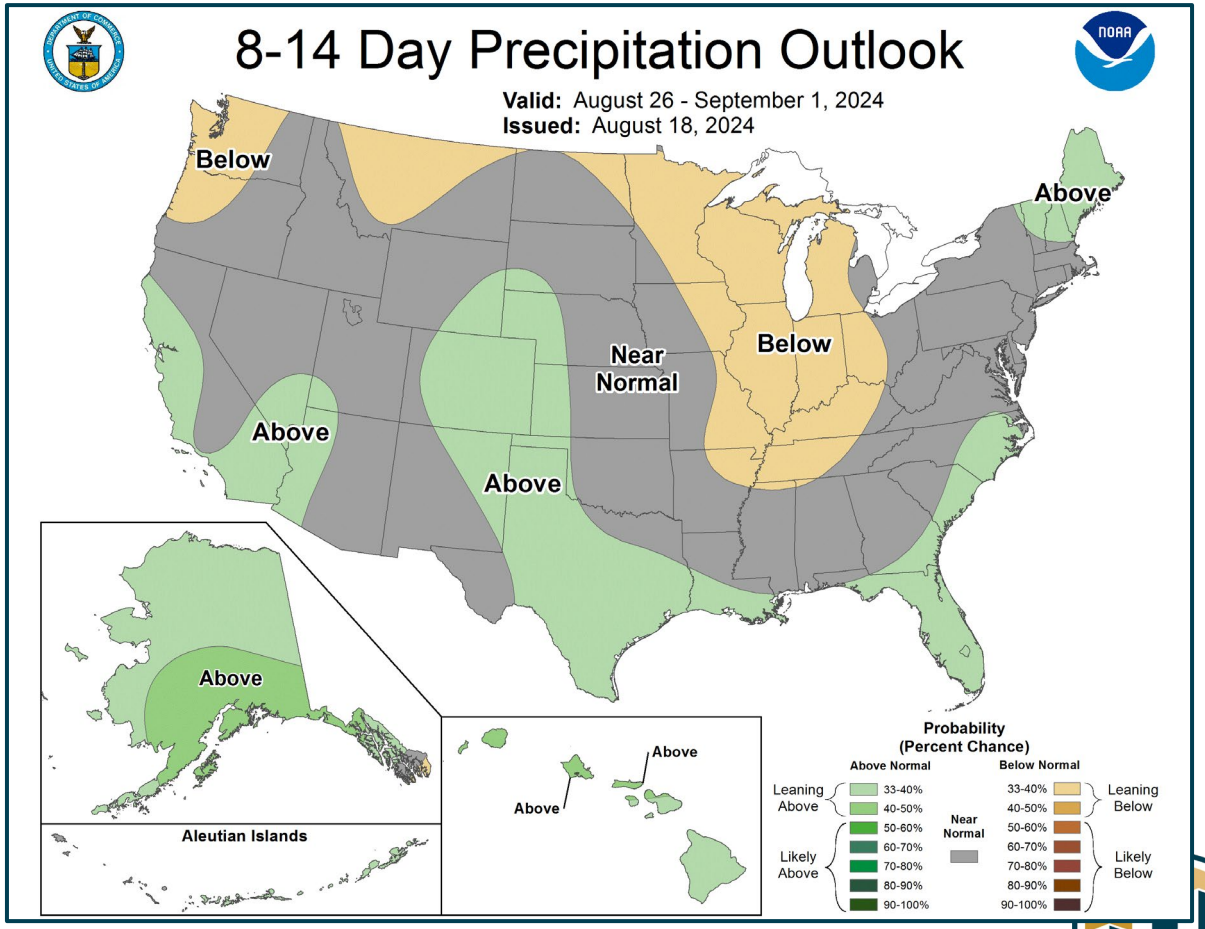



Month to Date Precipitation - August 19 2024
Averaged by Basin, Major Contributing Areas
% Average
>500%
300-500%
200-300%
150-200%
130-150%
110-130%
100-110%
90-100%
70-90%
50-70%
30-50%
0-30%
Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

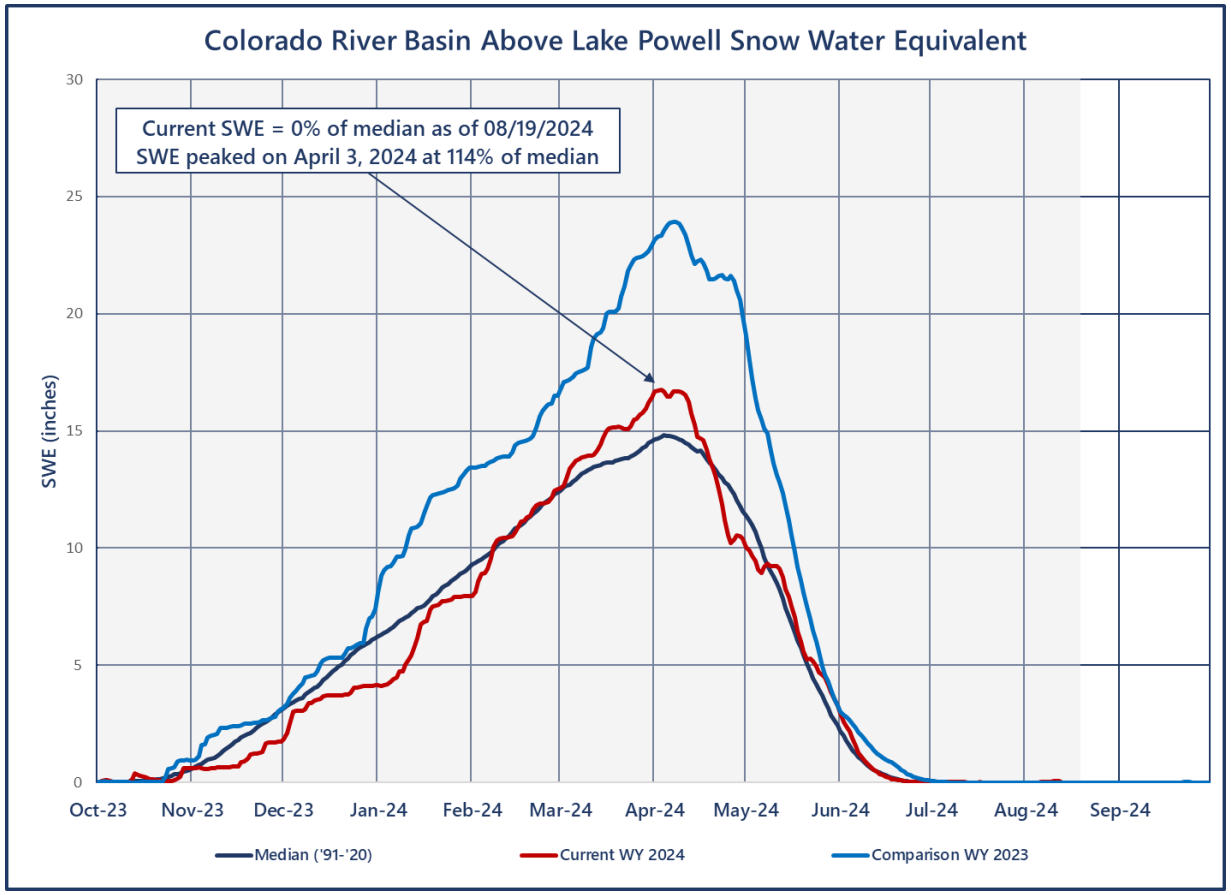

Water Year to Date Precipitation, October 01 - August 19 2024
Averaged by Basin, Major Contributing Areas
% Average
>500%
300-500%
200-300%
150-200%
130-150%
110-130%
100-110%
90-100%
70-90%
50-70%
30-50%
0-30%
Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

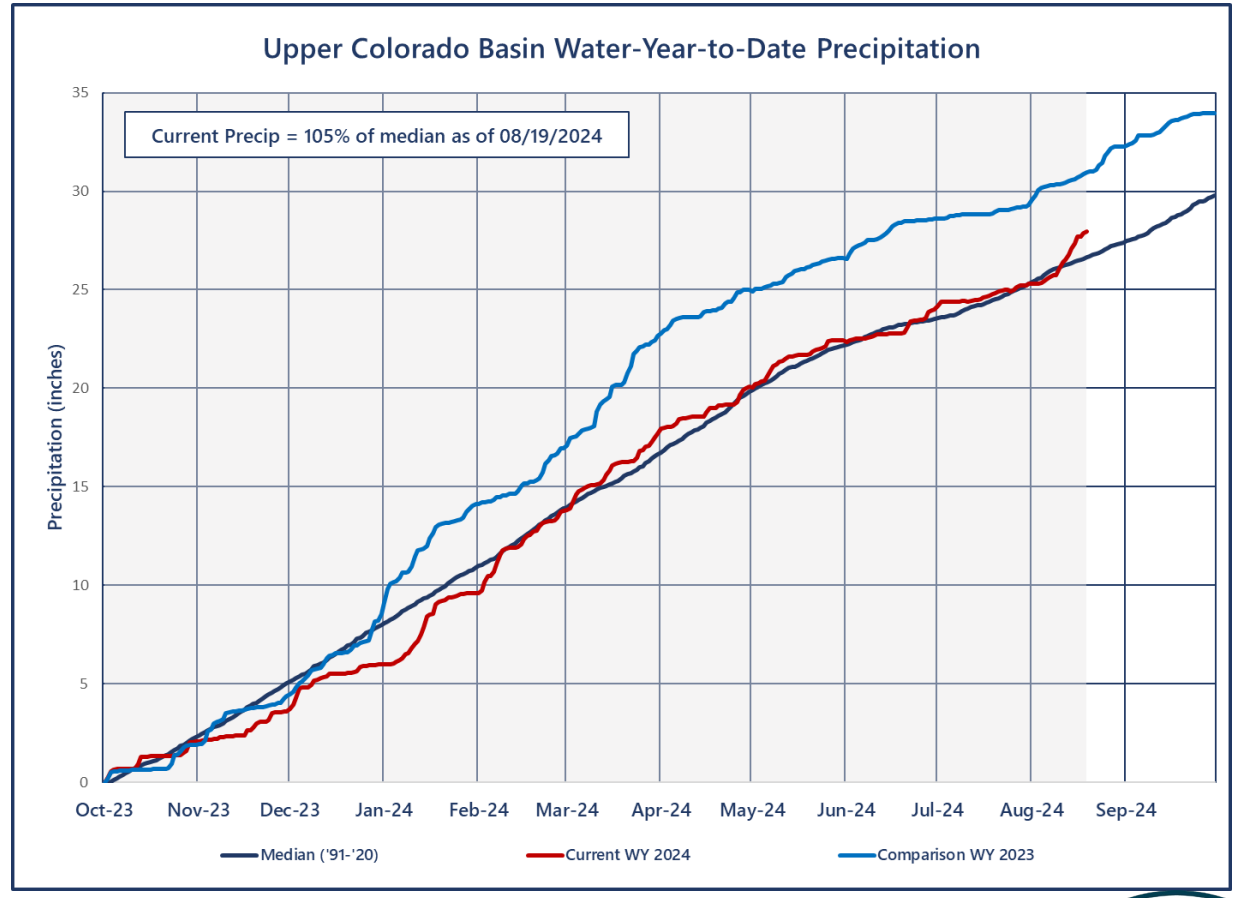
Weather Prediction Center and Climate Prediction Center Precipitation Forecasts





Upper Colorado SWE and Precipitation





Most Probable August Forecast
Water Year 2024

April – July 2024 Preliminary Observed Unregulated Inflow
as of August 1, 2024

Reservoir	Inflow (kaf)	Percent of Avg[1]
Fontenelle	516	70
Flaming Gorge	713	70
Blue Mesa	653	103
Navajo	448	71
Powell	5,328	83

Water Year 2024 Unregulated Inflow Forecast
as of August 1, 2024

Reservoir	Inflow (kaf)	Percent of Avg[1]
Fontenelle	836	78
Flaming Gorge	1,163	82
Blue Mesa	893	99
Navajo	566	62
Powell	7,944	83

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

Most Probable August Forecast
Water Year 2025

April – July 2025
Forecasted Unregulated Inflow

as of August 1, 2024

Reservoir	Inflow (kaf)	Percent of Avg[1]
Fontenelle	640	87
Flaming Gorge	815	84
Blue Mesa	617	97
Navajo	565	90
Powell	5,940	93

Water Year 2025
Unregulated Inflow Forecast

as of August 1, 2024

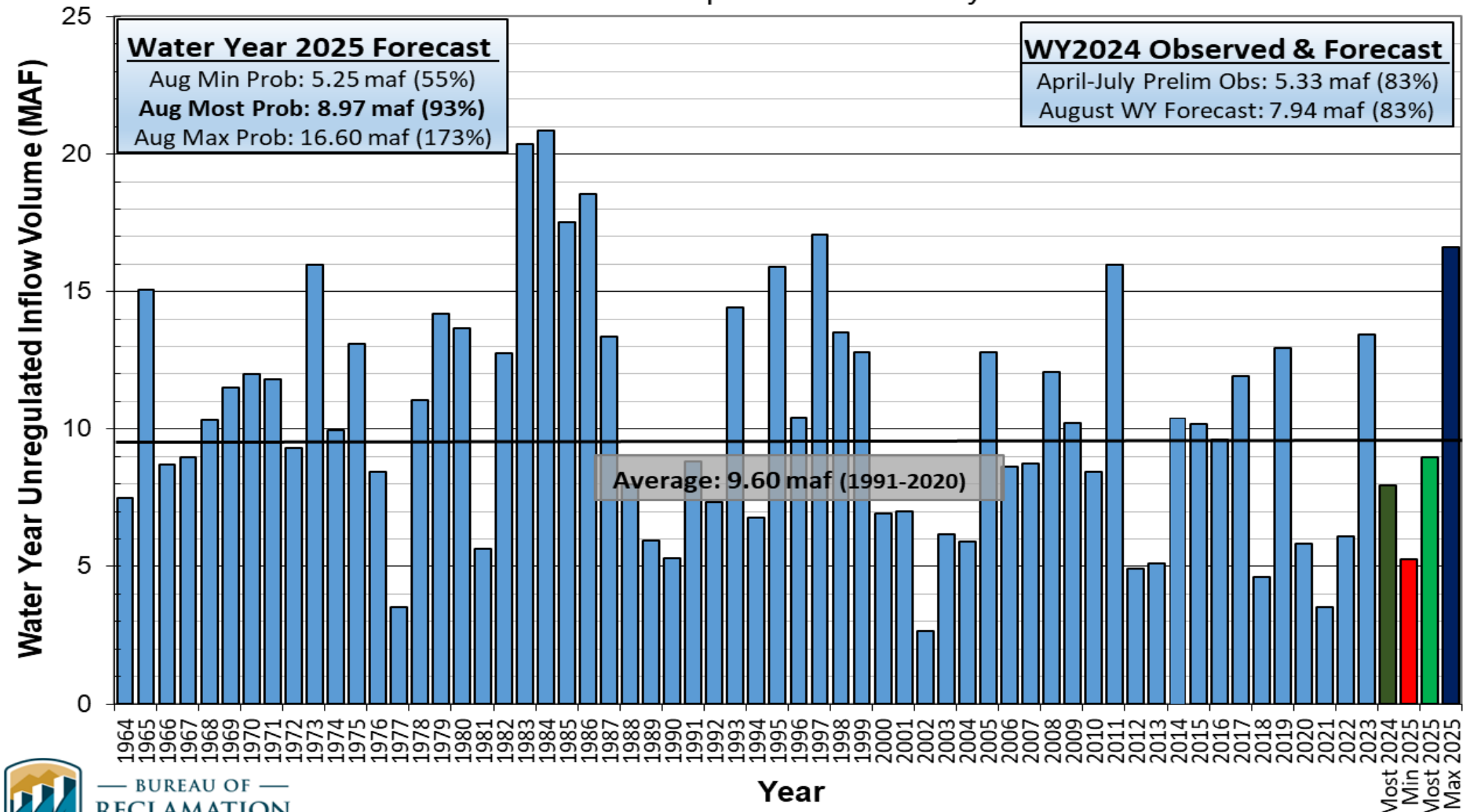
Reservoir	Inflow (kaf)	Percent of Avg[1]
Fontenelle	943	88
Flaming Gorge	1,210	86
Blue Mesa	875	97
Navajo	802	88
Powell	8,970	93

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

Lake Powell Unregulated Inflow

Water Year 2024 and 2025 Forecast *(issued August 1)*

Comparison with History



— BUREAU OF —
RECLAMATION

Upper Colorado Basin

Hydrology and Operations Projections Based on August 2024 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
- Includes the Supplemental Environmental Impact Statement for Near-term Colorado River Operations Record of Decision (2024 Near-term SEIS, signed May 6, 2024) https://www.usbr.gov/ColoradoRiverBasin/interimguidelines/seis/index.html
- July operations and 24-Month Study will include Glen Canyon Dam Long-Term Experimental and Management Plan Final Supplemental Environmental Impact Statement (2024 LTEMP SEIS ROD, signed July 3, 2024) https://www.usbr.gov/uc/DocLibrary/EnvironmentalImpactStatements/GlenCanyonDamLong-TermExperimentalManagementPlan/20240703-GCDLTEMP-FinalSEIS-RecordofDecision-508-AMWD.pdf
- 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]

Lake Powell

Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf)
3,700	**Equilization Tier** Equalize, avoid spills, or release 8.23 maf	23.31
3,636-3,666 (2008-2026)	**Upper Elevation Balancing Tier** Release 8.23 maf If Lake Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf	14.65-18.36 (2008-2026)
3,575	**Mid-Elevation Release Tier** Release 7.48 maf; if Lake Mead < 1,025 feet; release 8.23 maf If any minimum probable Lake Powell elevation projection shows Lake Powell <3,500 feet, begin planning to reduce releases to no less than 6.0 maf	8.90
3,525	**Lower Elevation Balancing Tier** Balance contents with a min/max release of 7.0 and 9.5 maf If any minimum probable Lake Powell elevation projection shows Lake Powell <3,500 feet, begin planning to reduce releases to no less than 6.0 maf	5.55
3,500	The Secretary reserves the right to operate Reclamation facilities to protect the Colorado River system if hydrologic conditions require such action as described in Sections 6 and 7(D) in the 2007 Interim Guidelines ROD	4.22
3,370		0

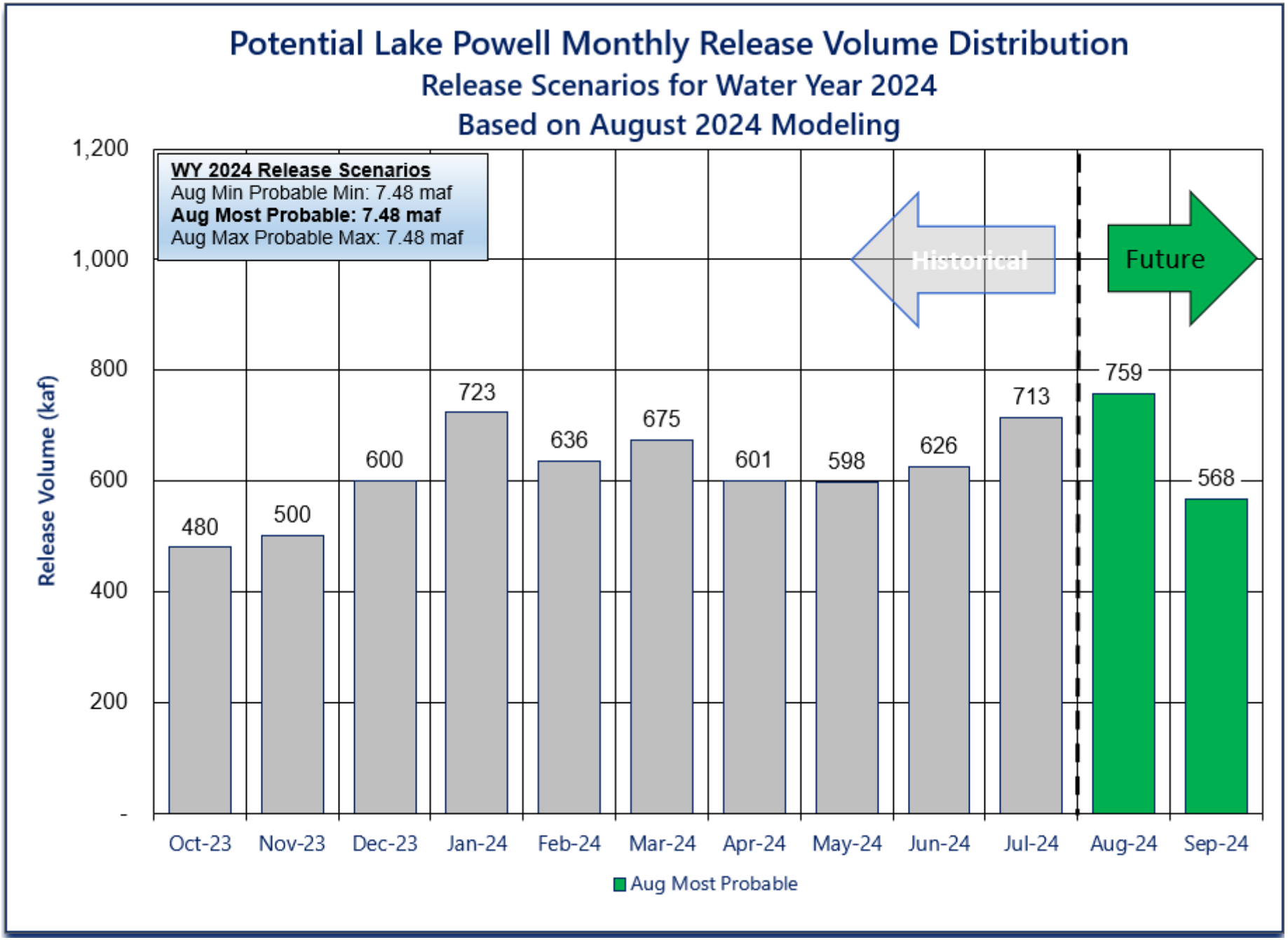
3,568.99 ft Jan 1, 2025 Projection

Lake Mead

Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf)
1,220	**Flood Control Surplus or Quantified Surplus Condition** Deliver > 7.5 maf	26.18
1,200 (approx.)	**Domestic Surplus or ICS Surplus Condition** Deliver > 7.5 maf	23.14 (approx.)
1,145	**Normal or ICS Surplus Condition** Deliver ≥ 7.5 maf	16.18
1,075	**Shortage Condition** Deliver 7.167 maf	
1,050	**Shortage Condition** Deliver 7.083 maf	
1,025		5.98
1,000	**Shortage Condition** Deliver 7.0 maf Further measures may be undertaken	4.48
895		0

1,062.32 ft Jan 1, 2025 Projection

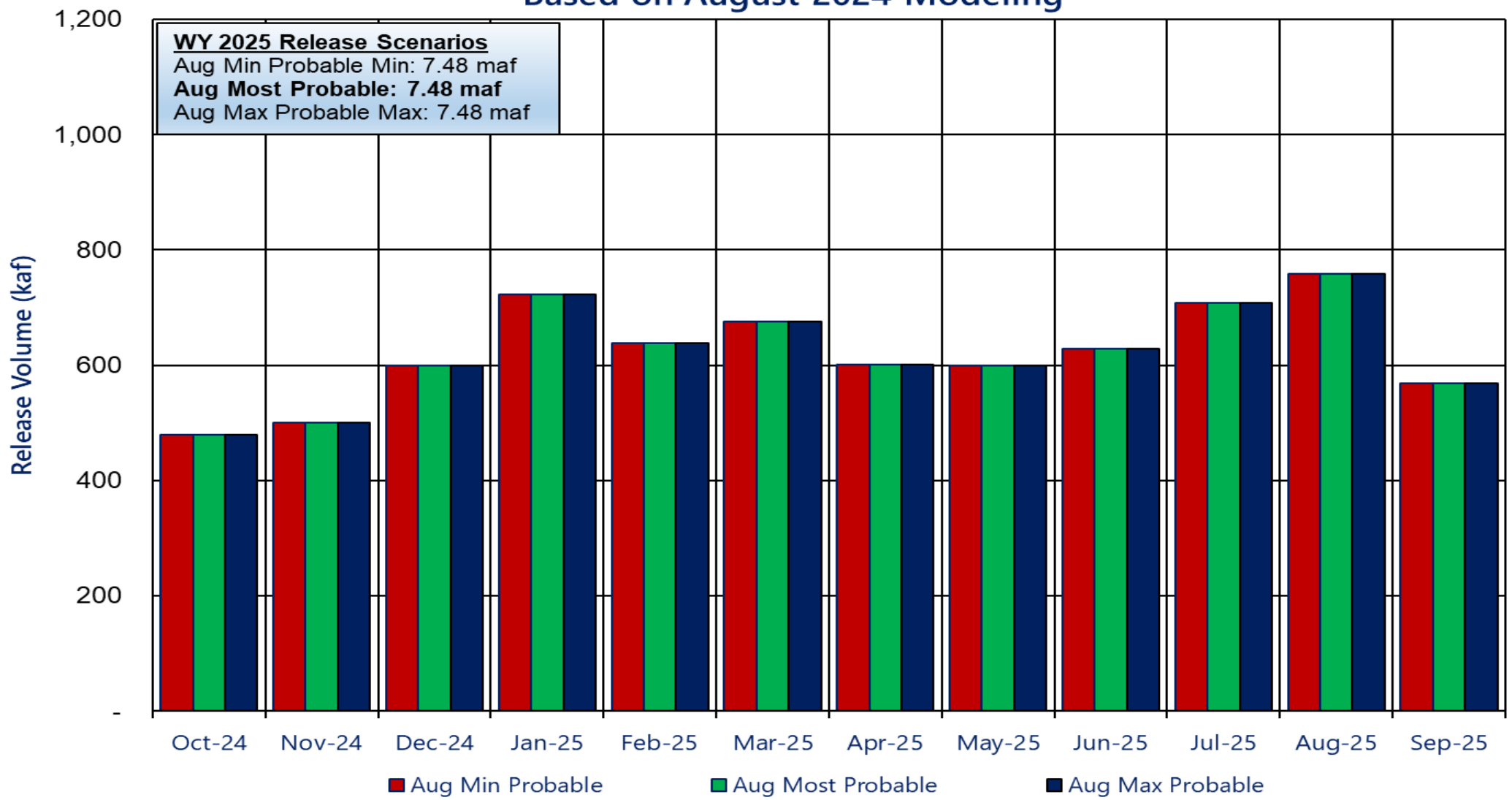
[1] Lake Powell and Lake Mead operational tier determinations will be documented in the draft 2025 AOP.


Potential Lake Powell Monthly Release Volume Distribution
Release Scenarios for Water Year 2024
Based on August 2024 Modeling
WY 2024 Release Scenarios
Aug Min Probable Min: 7.48 maf
Aug Most Probable: 7.48 maf
Aug Max Probable Max: 7.48 maf
Historical
Future
Release Volume (kaf)
1,200
1,000
800
600
400
200
-
480
500
600
723
636
675
601
598
626
713
759
568
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Aug Most Probable

Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2025

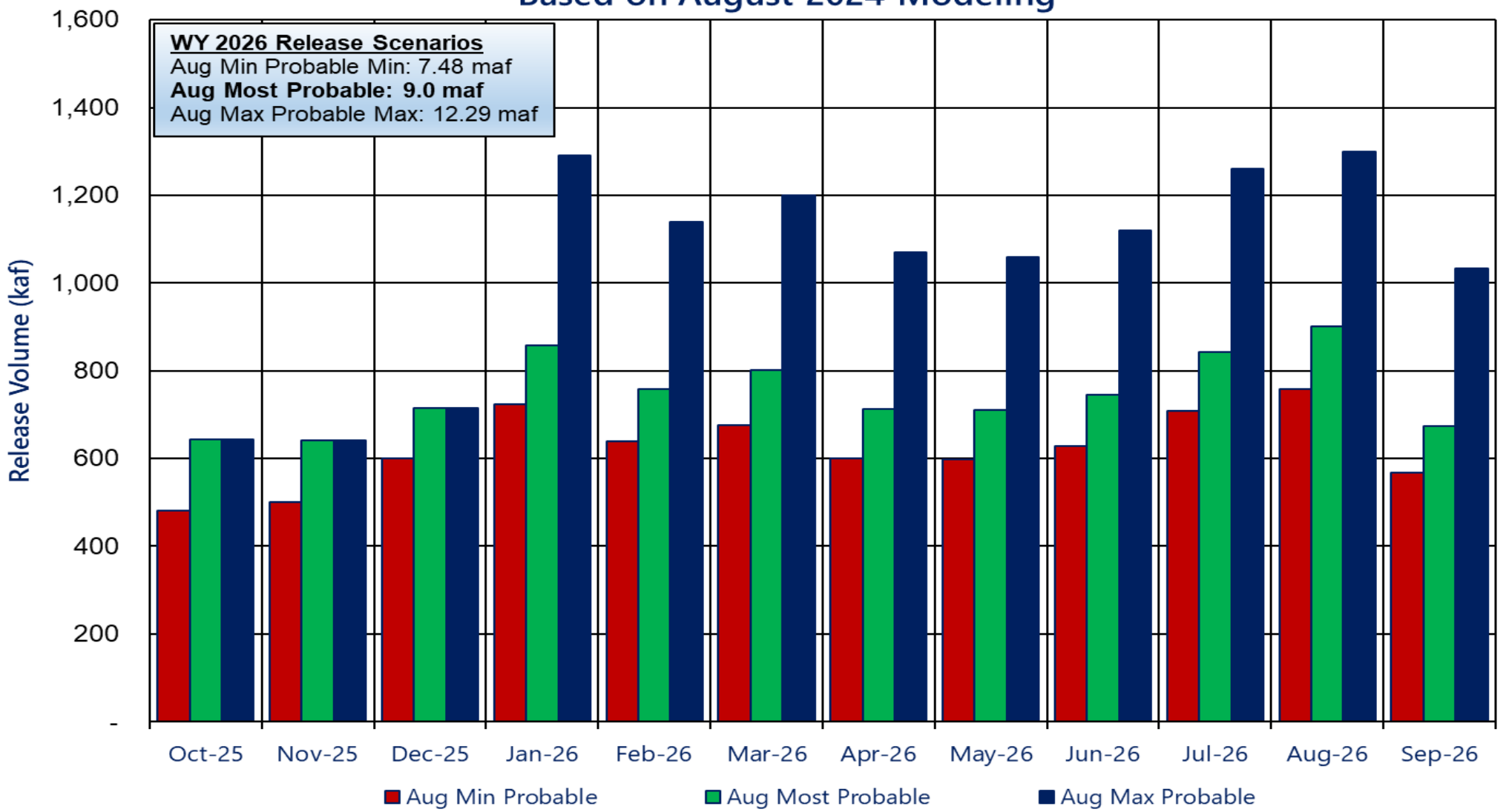
Based on August 2024 Modeling



Potential Lake Powell Monthly Release Volume Distribution

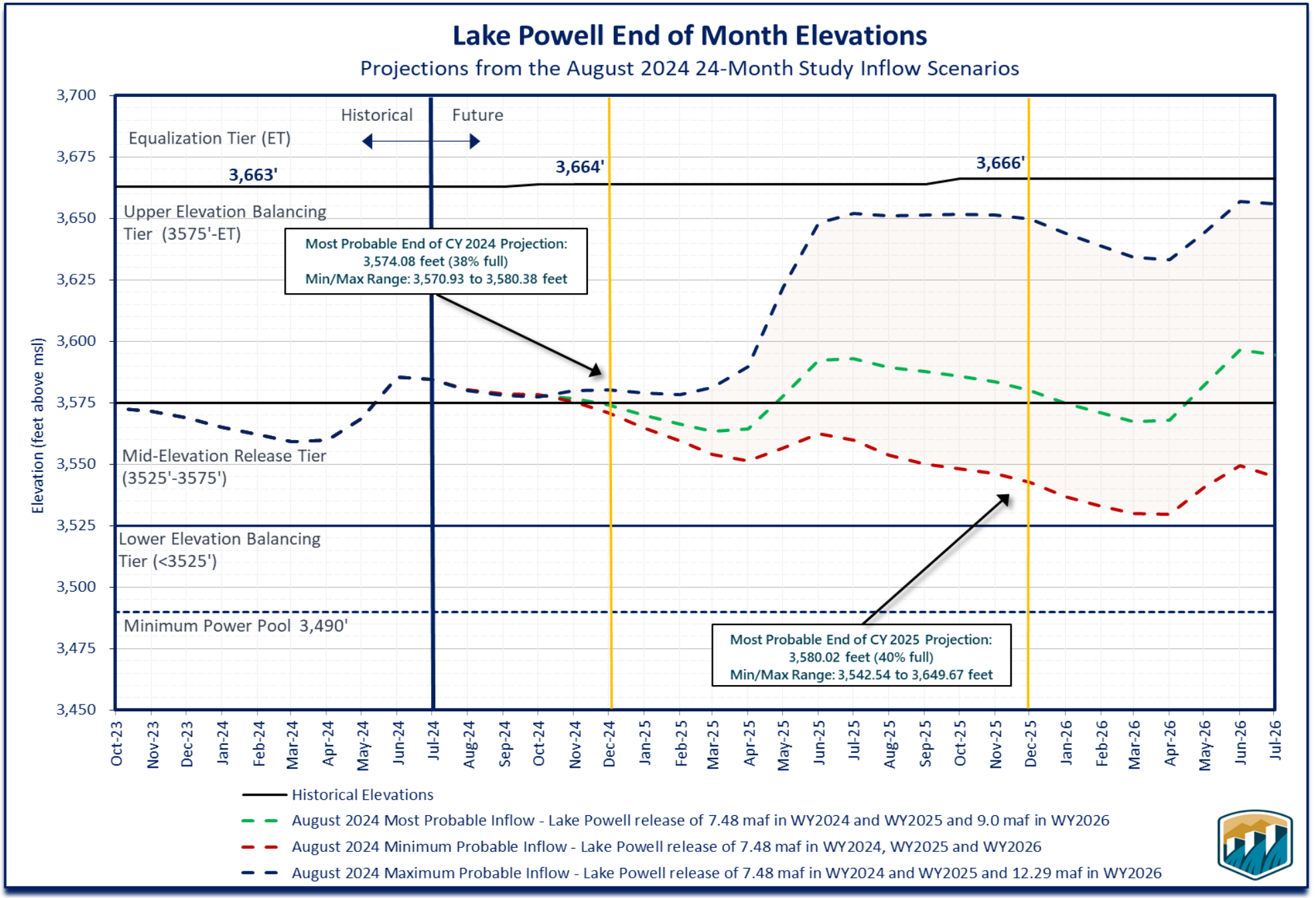
Release Scenarios for Water Year 2026

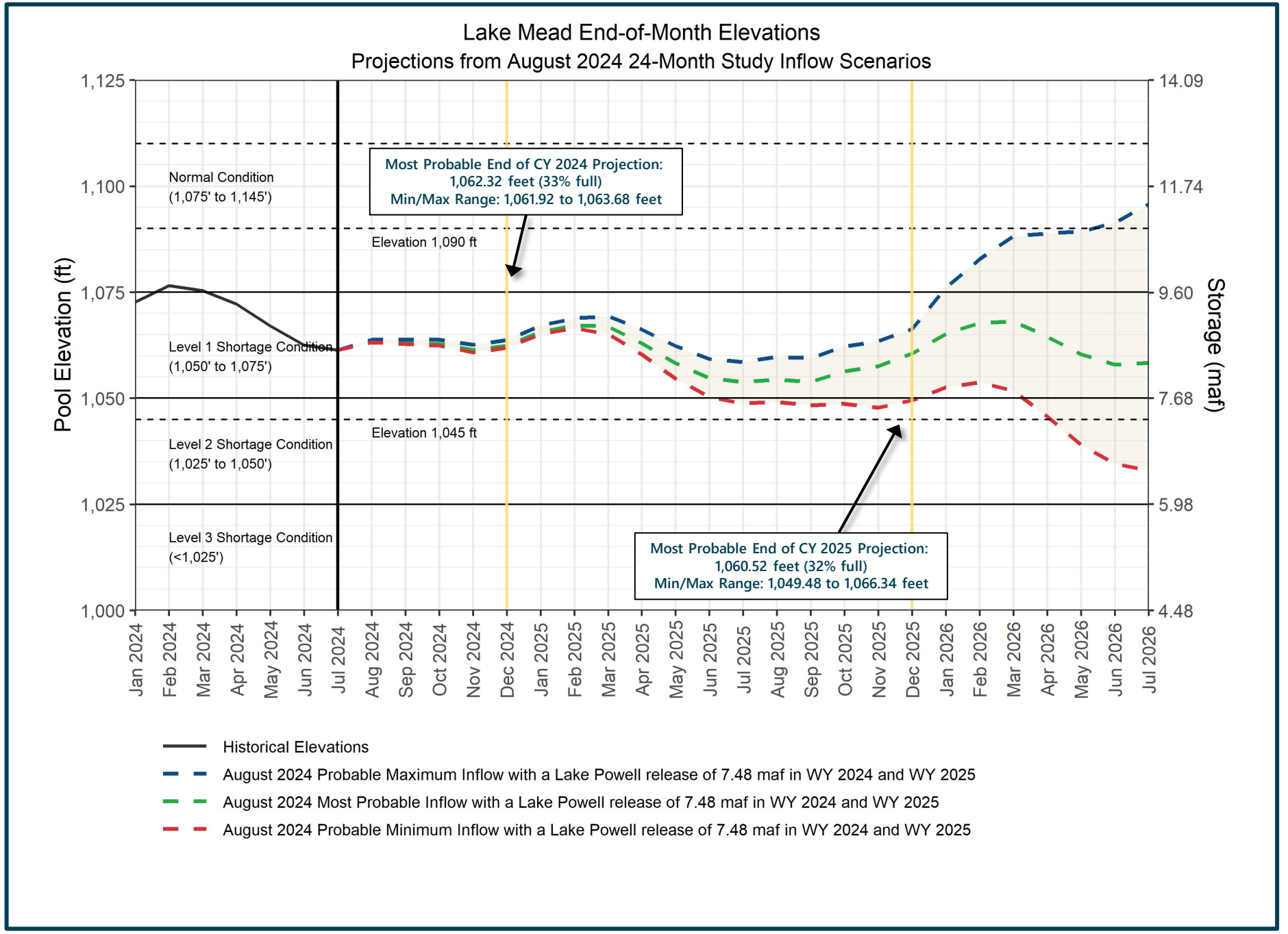
Based on August 2024 Modeling



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

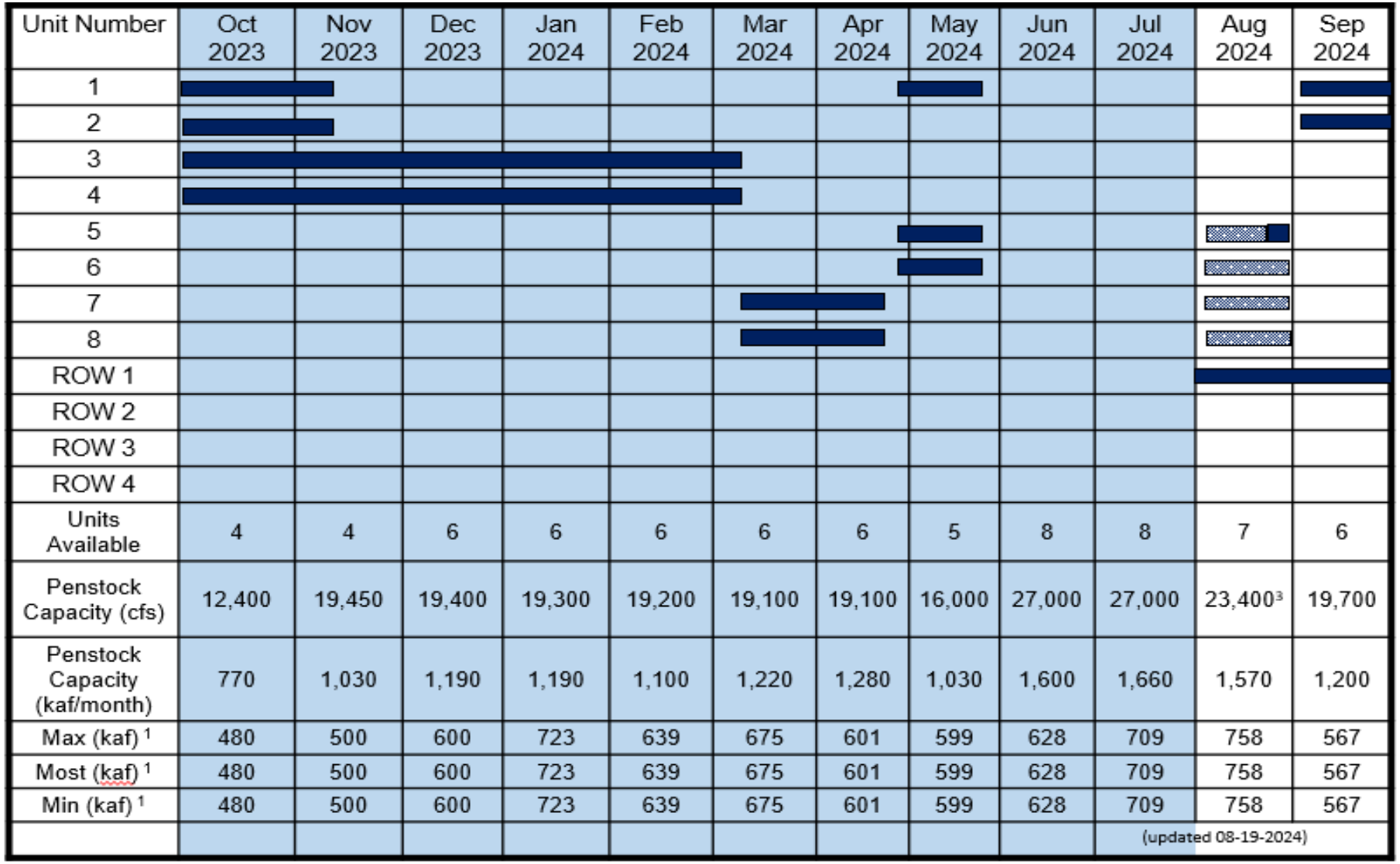

Lake Powell End of Month Elevations
Projections from the August 2024 24-Month Study Inflow Scenarios
Historical
Future
Equalization Tier (ET)
3,663'
3,664'
3,666'
Upper Elevation Balancing Tier (3575'-ET)
Most Probable End of CY 2024 Projection:
3,574.08 feet (38% full)
Min/Max Range: 3,570.93 to 3,580.38 feet
Mid-Elevation Release Tier (3525'-3575')
Lower Elevation Balancing Tier (<3525')
Minimum Power Pool 3,490'
Most Probable End of CY 2025 Projection:
3,580.02 feet (40% full)
Min/Max Range: 3,542.54 to 3,649.67 feet
Elevation (feet above msl)
3,700
3,675
3,650
3,625
3,600
3,575
3,550
3,525
3,500
3,475
3,450
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24
Jan-25
Feb-25
Mar-25
Apr-25
May-25
Jun-25
Jul-25
Aug-25
Sep-25
Oct-25
Nov-25
Dec-25
Jan-26
Feb-26
Mar-26
Apr-26
May-26
Jun-26
Jul-26
Historical Elevations
August 2024 Most Probable Inflow - Lake Powell release of 7.48 maf in WY2024 and WY2025 and 9.0 maf in WY2026
August 2024 Minimum Probable Inflow - Lake Powell release of 7.48 maf in WY2024, WY2025 and WY2026
August 2024 Maximum Probable Inflow - Lake Powell release of 7.48 maf in WY2024 and WY2025 and 12.29 maf in WY2026


Lake Mead End-of-Month Elevations
Projections from August 2024 24-Month Study Inflow Scenarios
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')
Elevation 1,090 ft
Elevation 1,045 ft
Most Probable End of CY 2024 Projection:
1,062.32 feet (33% full)
Min/Max Range: 1,061.92 to 1,063.68 feet
Most Probable End of CY 2025 Projection:
1,060.52 feet (32% full)
Min/Max Range: 1,049.48 to 1,066.34 feet
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
Aug 2025
Sep 2025
Oct 2025
Nov 2025
Dec 2025
Jan 2026
Feb 2026
Mar 2026
Apr 2026
May 2026
Jun 2026
Jul 2026
Historical Elevations
August 2024 Probable Maximum Inflow with a Lake Powell release of 7.48 maf in WY 2024 and WY 2025
August 2024 Most Probable Inflow with a Lake Powell release of 7.48 maf in WY 2024 and WY 2025
August 2024 Probable Minimum Inflow with a Lake Powell release of 7.48 maf in WY 2024 and WY 2025

Upper Colorado Basin

Hydropower Maintenance

Glen Canyon Dam Power Plant Unit Outage Schedule for 2024



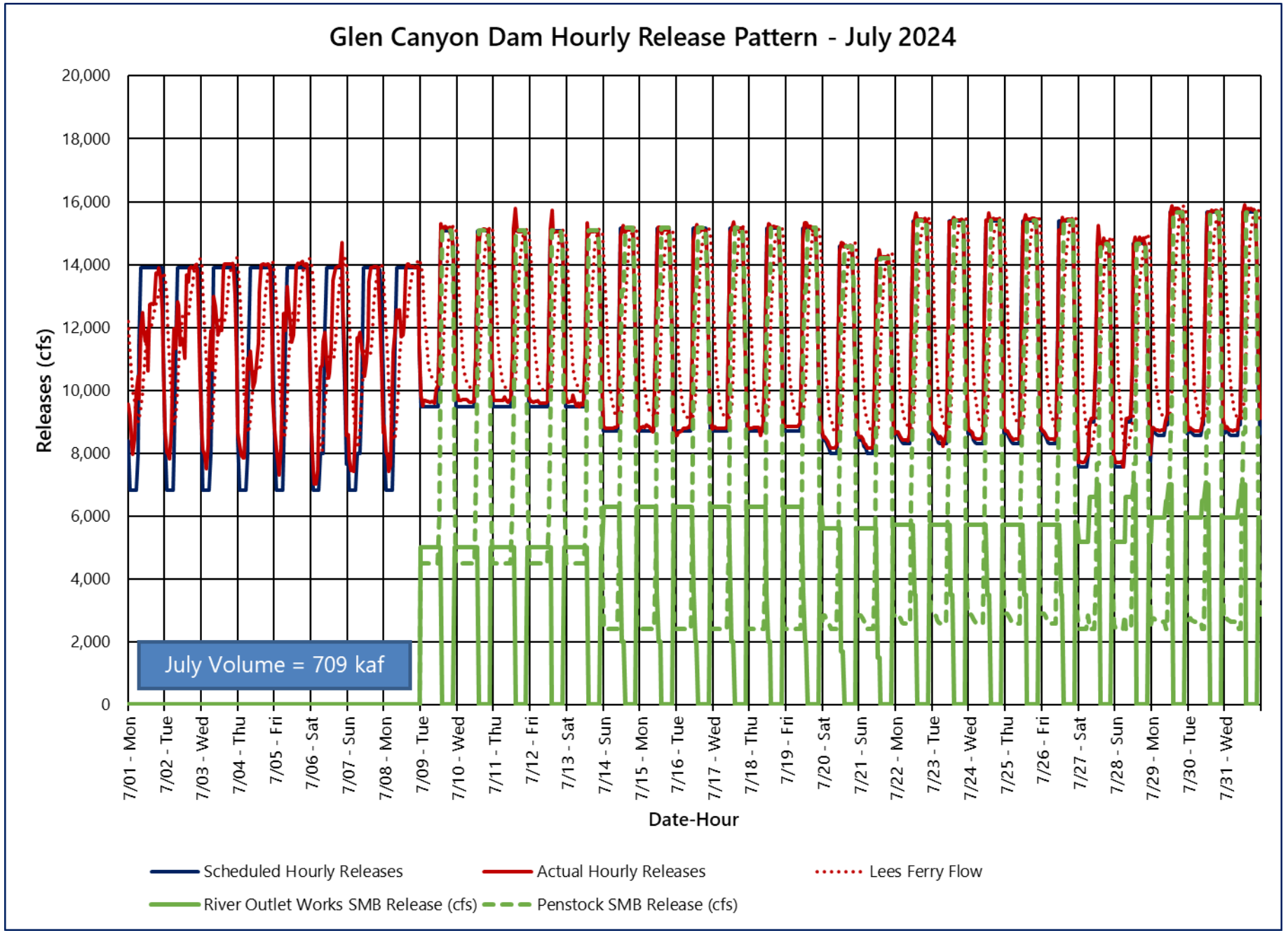
Unit Number	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024	
1													
2													
3													
4													
5													
6													
7													
8													
ROW 1													
ROW 2													
ROW 3													
ROW 4													
Units Available	4	4	6	6	6	6	6	5	8	8	7	6	
Penstock Capacity (cfs)	12,400	19,450	19,400	19,300	19,200	19,100	19,100	16,000	27,000	27,000	23,400[3]	19,700	AUG MOST[2]
Penstock Capacity (kaf/month)	770	1,030	1,190	1,190	1,100	1,220	1,280	1,030	1,600	1,660	1,570	1,200	AUG MOST
Max (kaf) [1]	480	500	600	723	639	675	601	599	628	709	758	567	7.48 maf
Most (kaf) [1]	480	500	600	723	639	675	601	599	628	709	758	567	7.48 maf
Min (kaf) [1]	480	500	600	723	639	675	601	599	628	709	758	567	7.48 maf
										(updated 08-19-2024)			

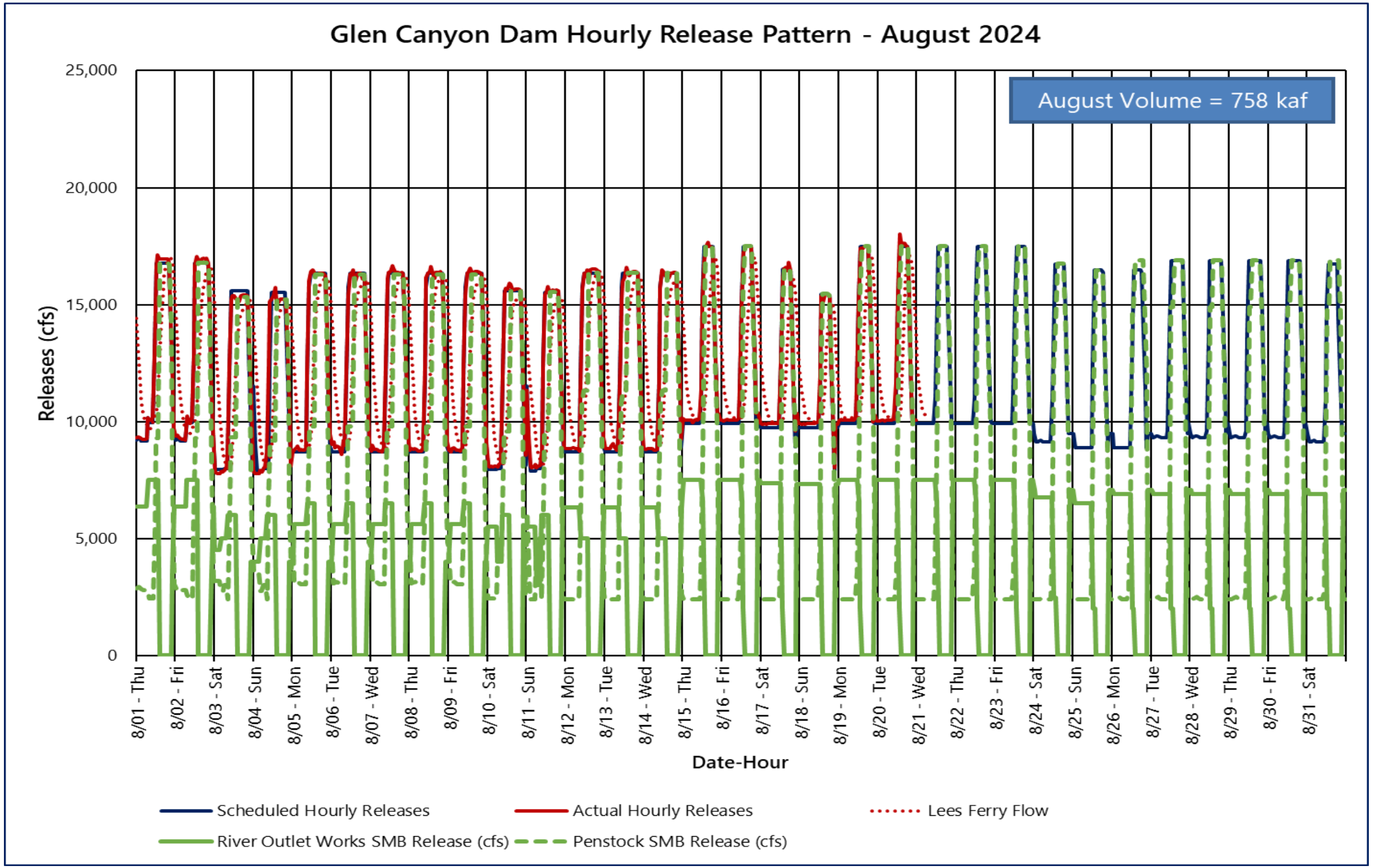
1 Projected release, based on August 2024 24MS for the minimum, most probable and the maximum probable 24-Month Study model runs.
2 Dependent upon availability to shift contingency regulation, which will increase capacity by 30-40MW (3%) at current efficiency.
3 NERC testing with occasional removal of penstock generating capacity.

Glen Canyon Dam Power Plant Unit Outage Schedule for 2025

Unit Number	Oct 2024	Nov 2024	Dec 2024	Jan 2025	Feb 2025	Mar 2025	Apr 2025	May 2025	Jun 2025	Jul 2025	Aug 2025	Sep 2025	
1													
2													
3													
4													
5													
6													
7													
8													
ROW 1													
ROW 2													
ROW 3													
ROW 4													
Units Available	5	6	8	6	6	6	7	7	8	8	8	6	
Penstock Capacity (cfs)	16,100/ 4,000[3]	19,700	26,900	19,700	19,700	19,700	23,300	23,300	26,900	26,900	26,900	19,700	AUG MOST[2]
Penstock Capacity (kaf/month)	1,200	1,500	1,650	1,580	1,110	1,240	1,380	1,590	1,600	1,650	1,650	1,180	AUG MOST
Max (kaf) [1]	480	500	600	723	639	675	601	599	628	709	758	568	7.48 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 08-19-2024)			

1 Projected release, based on August 2024 24MS for the minimum, most probable and 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.
3 Tailwater/Forebay inspection from October 21-24 will require one day at 4,000 cfs, and possibly two if necessary.


Glen Canyon Dam Hourly Release Pattern - July 2024
Releases (cfs)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
July Volume = 709 kaf
7/01 - Mon
7/02 - Tue
7/03 - Wed
7/04 - Thu
7/05 - Fri
7/06 - Sat
7/07 - Sun
7/08 - Mon
7/09 - Tue
7/10 - Wed
7/11 - Thu
7/12 - Fri
7/13 - Sat
7/14 - Sun
7/15 - Mon
7/16 - Tue
7/17 - Wed
7/18 - Thu
7/19 - Fri
7/20 - Sat
7/21 - Sun
7/22 - Mon
7/23 - Tue
7/24 - Wed
7/25 - Thu
7/26 - Fri
7/27 - Sat
7/28 - Sun
7/29 - Mon
7/30 - Tue
7/31 - Wed
Date-Hour
Scheduled Hourly Releases
Actual Hourly Releases
Lees Ferry Flow
River Outlet Works SMB Release (cfs)
Penstock SMB Release (cfs)

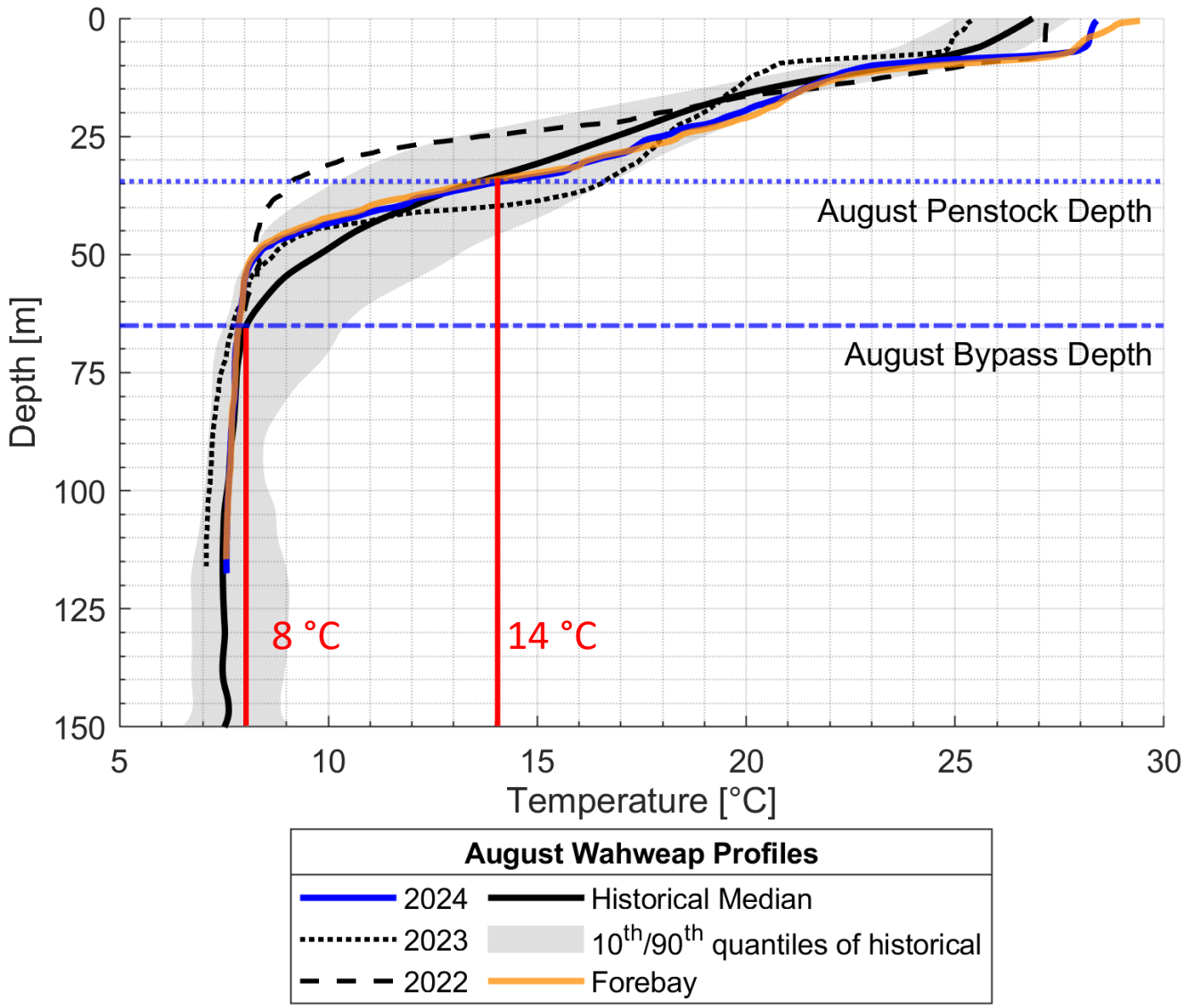

Glen Canyon Dam Hourly Release Pattern - August 2024
August Volume = 758 kaf
Releases (cfs)
25,000
20,000
15,000
10,000
5,000
0
8/01 - Thu
8/02 - Fri
8/03 - Sat
8/04 - Sun
8/05 - Mon
8/06 - Tue
8/07 - Wed
8/08 - Thu
8/09 - Fri
8/10 - Sat
8/11 - Sun
8/12 - Mon
8/13 - Tue
8/14 - Wed
8/15 - Thu
8/16 - Fri
8/17 - Sat
8/18 - Sun
8/19 - Mon
8/20 - Tue
8/21 - Wed
8/22 - Thu
8/23 - Fri
8/24 - Sat
8/25 - Sun
8/26 - Mon
8/27 - Tue
8/28 - Wed
8/29 - Thu
8/30 - Fri
8/31 - Sat
Date-Hour
Scheduled Hourly Releases
Actual Hourly Releases
Lees Ferry Flow
River Outlet Works SMB Release (cfs)
Penstock SMB Release (cfs)

BUREAU OF RECLAMATION

August 24 Month Study Water Quality Update

8/21/2024

Wahweap and Forebay August Profile



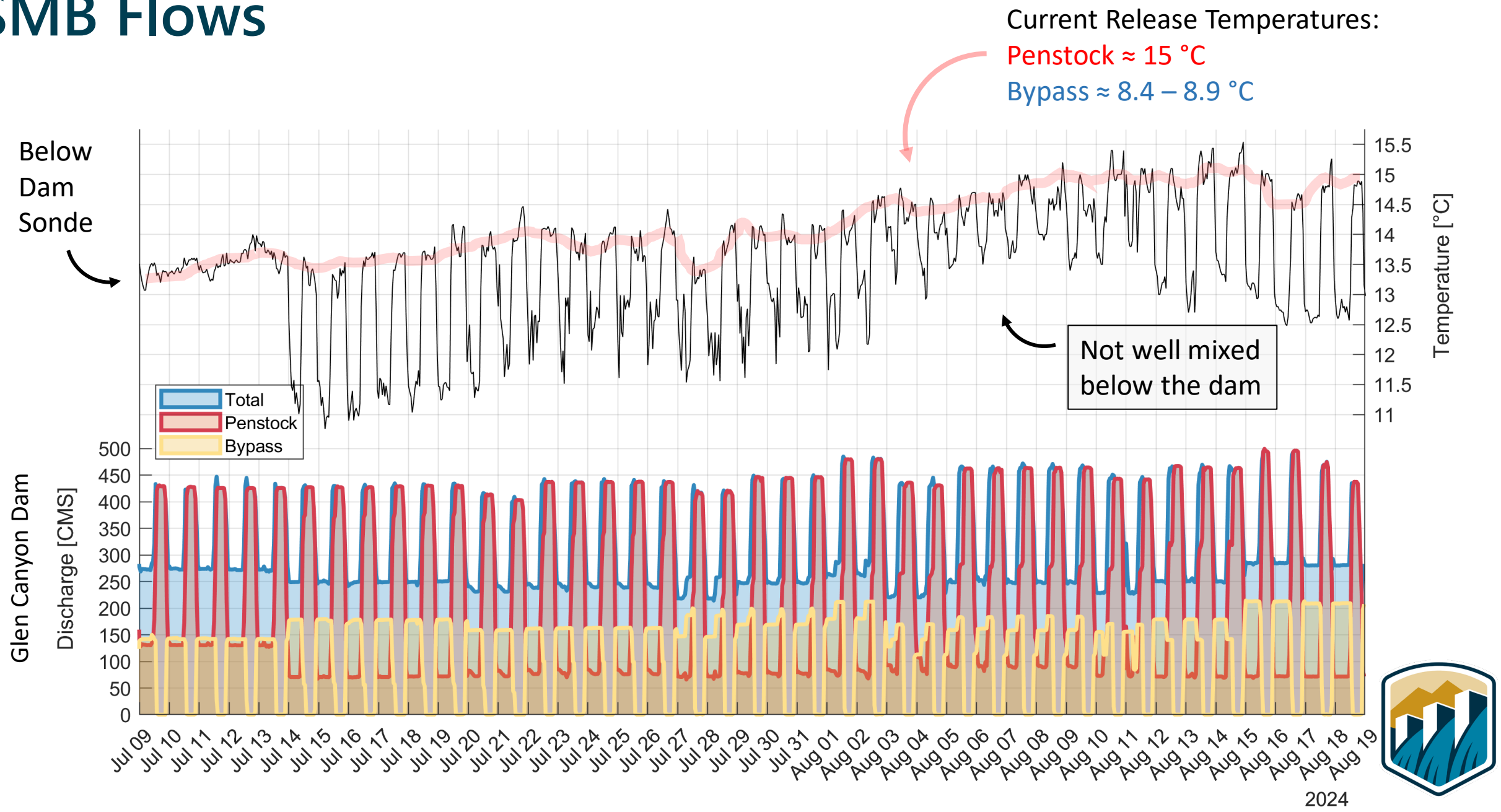
1.0 °C diff at surface
(likely due to time of day)

0.44 °C diff at penstock

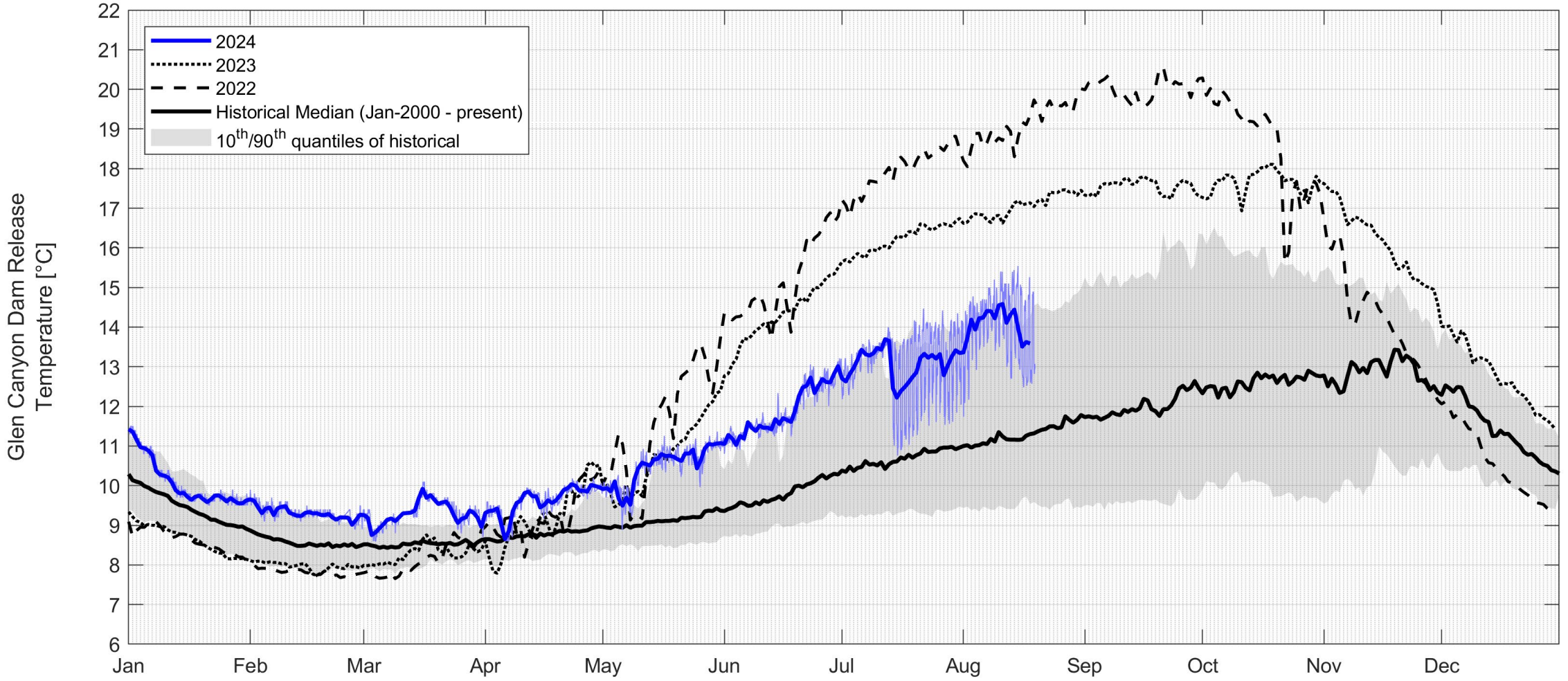
0 °C diff at bypass

Measured on 8/6/2024
Wahweap = 12:04 PM
Forebay = 14:52 PM

SMB Flows

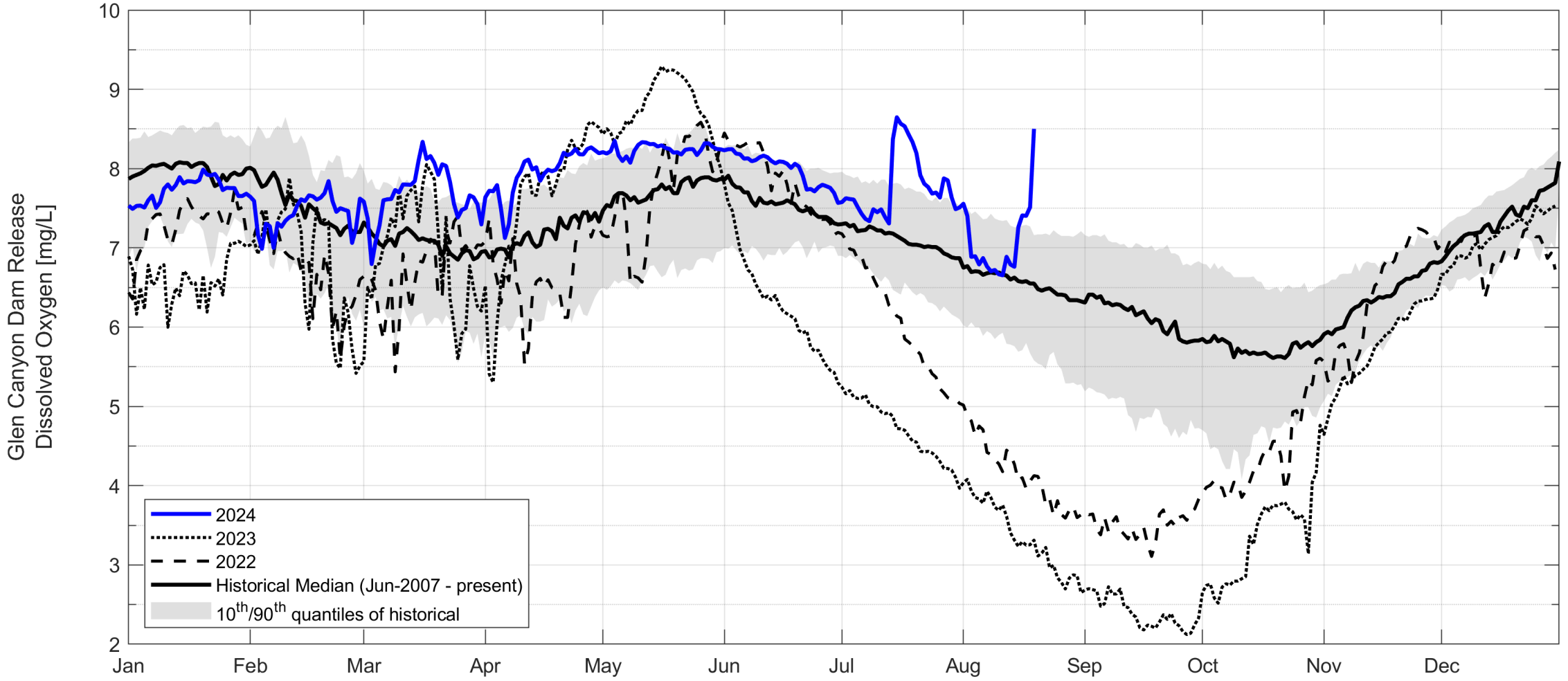

Current Release Temperatures:
Penstock ≈ 15 °C
Bypass ≈ 8.4 – 8.9 °C
Below Dam Sonde
Not well mixed below the dam
Total
Penstock
Bypass
Glen Canyon Dam
Discharge [CMS]
Temperature [°C]
2024

Glen Canyon Dam Observations – Temperature



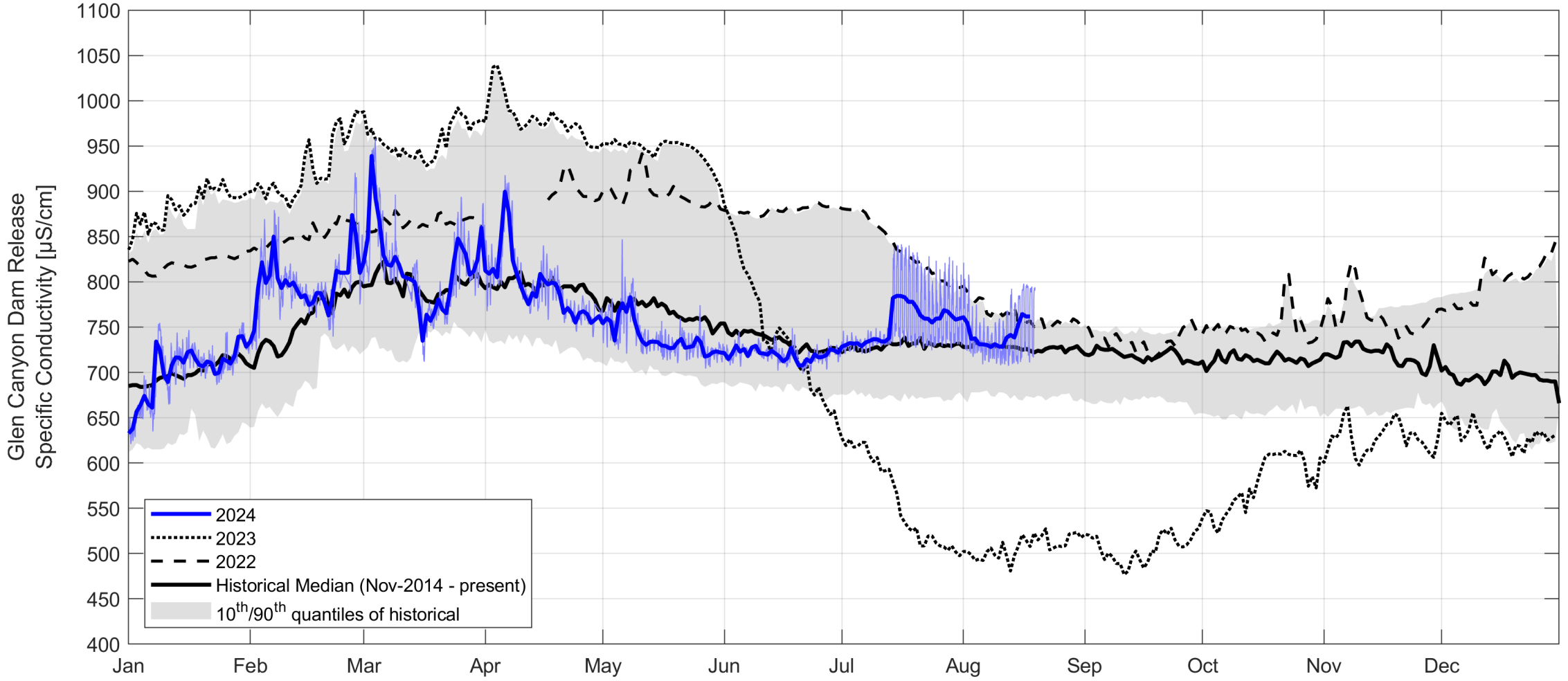
Note: not well mixed below the dam

Glen Canyon Dam Observations – Dissolved Oxygen



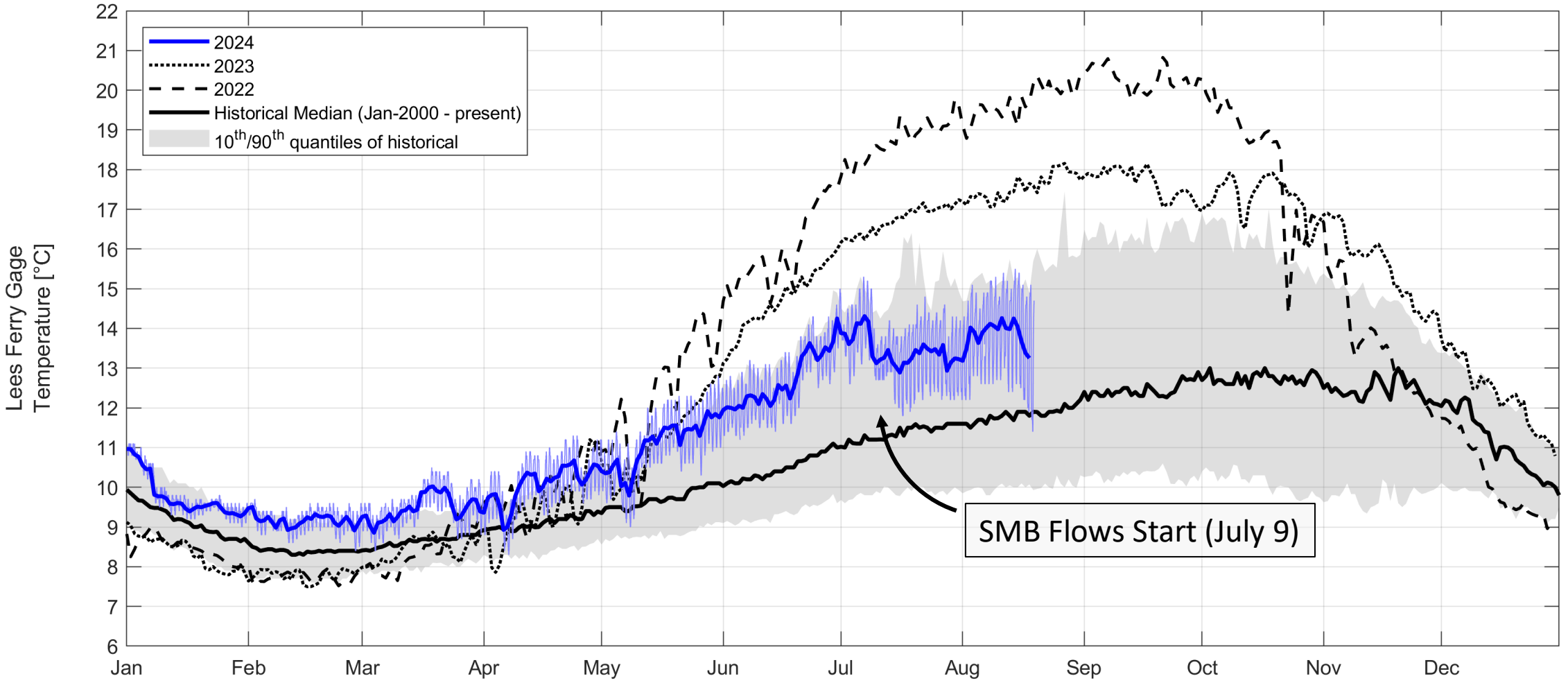
Note: not well mixed below the dam

Glen Canyon Dam Observations – Specific Conductance

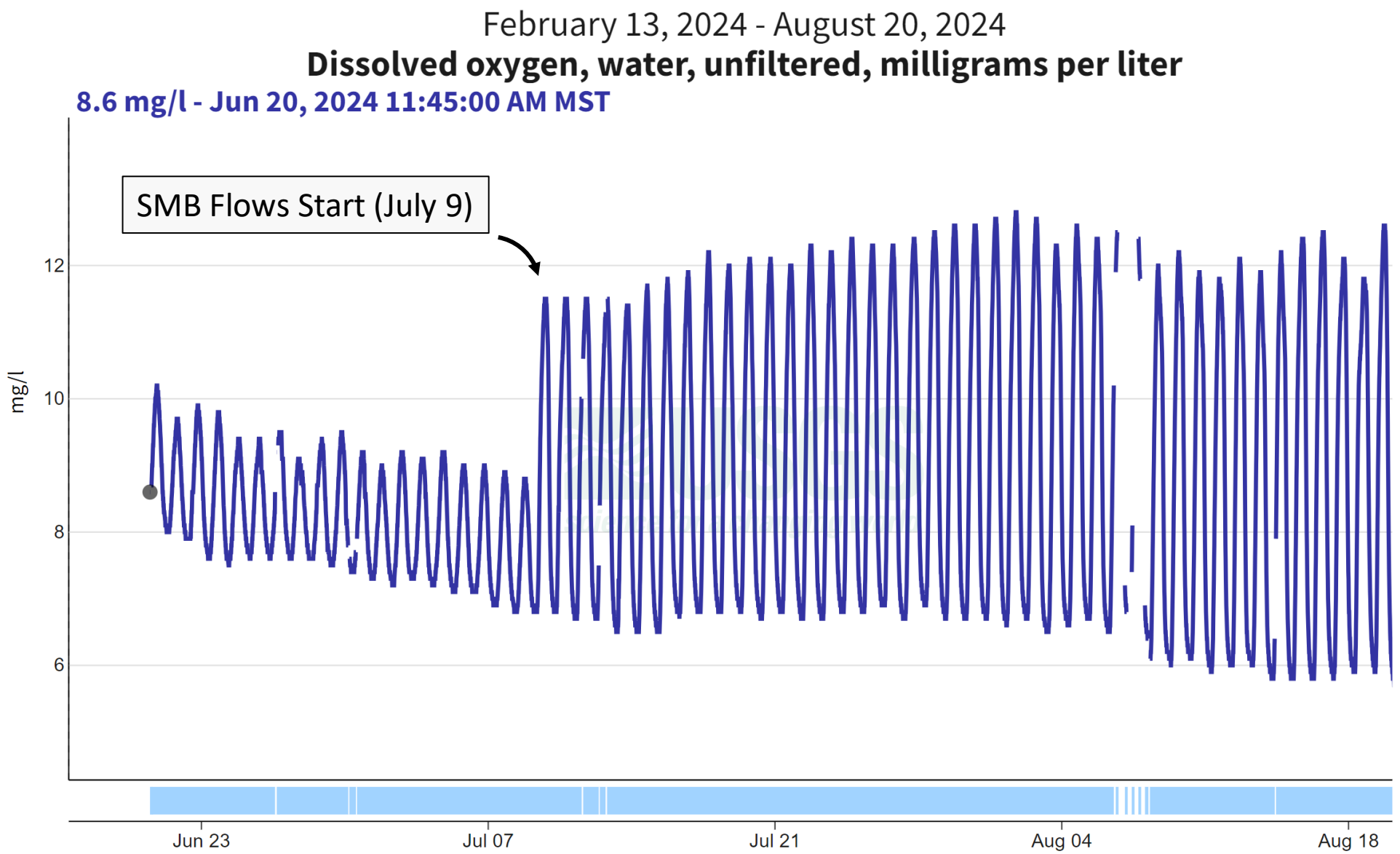


Note: not well mixed below the dam

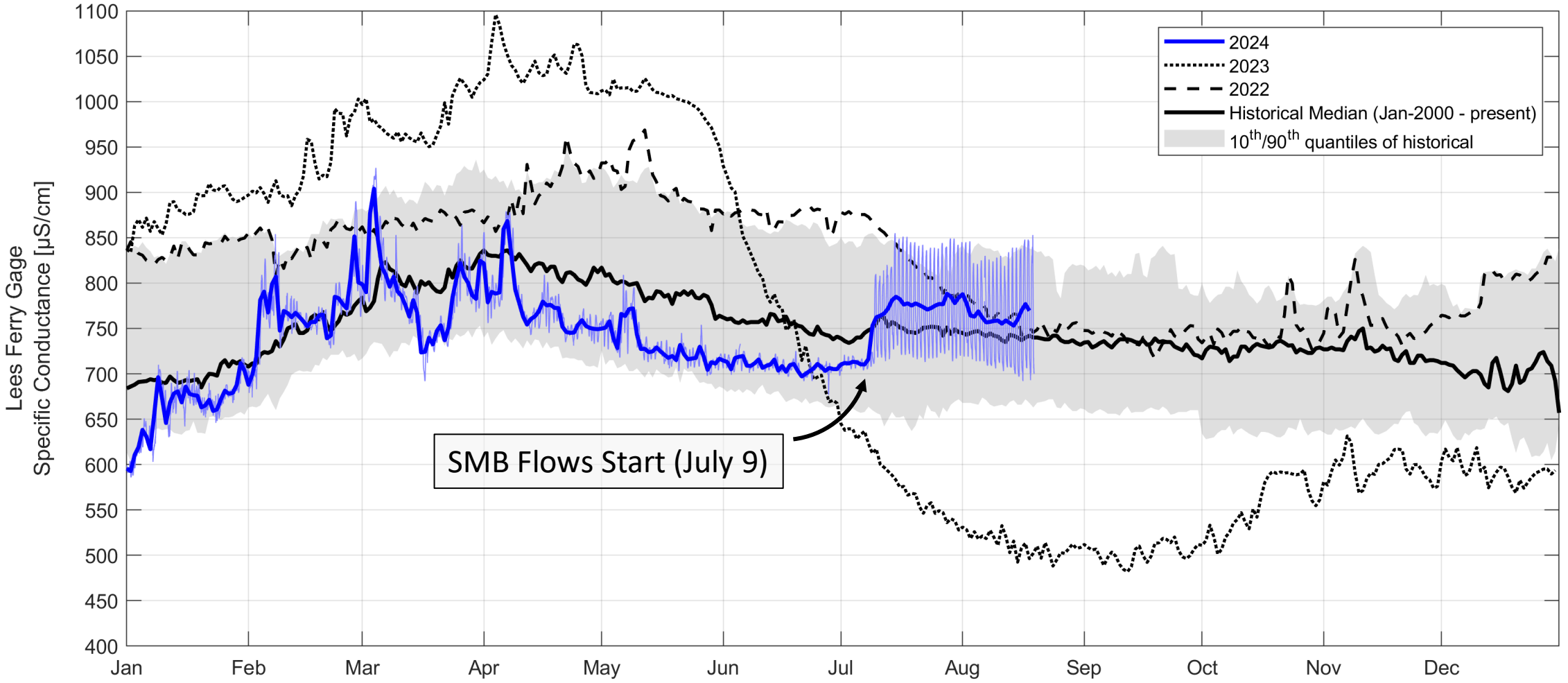
Lees Ferry Observations – Temperature



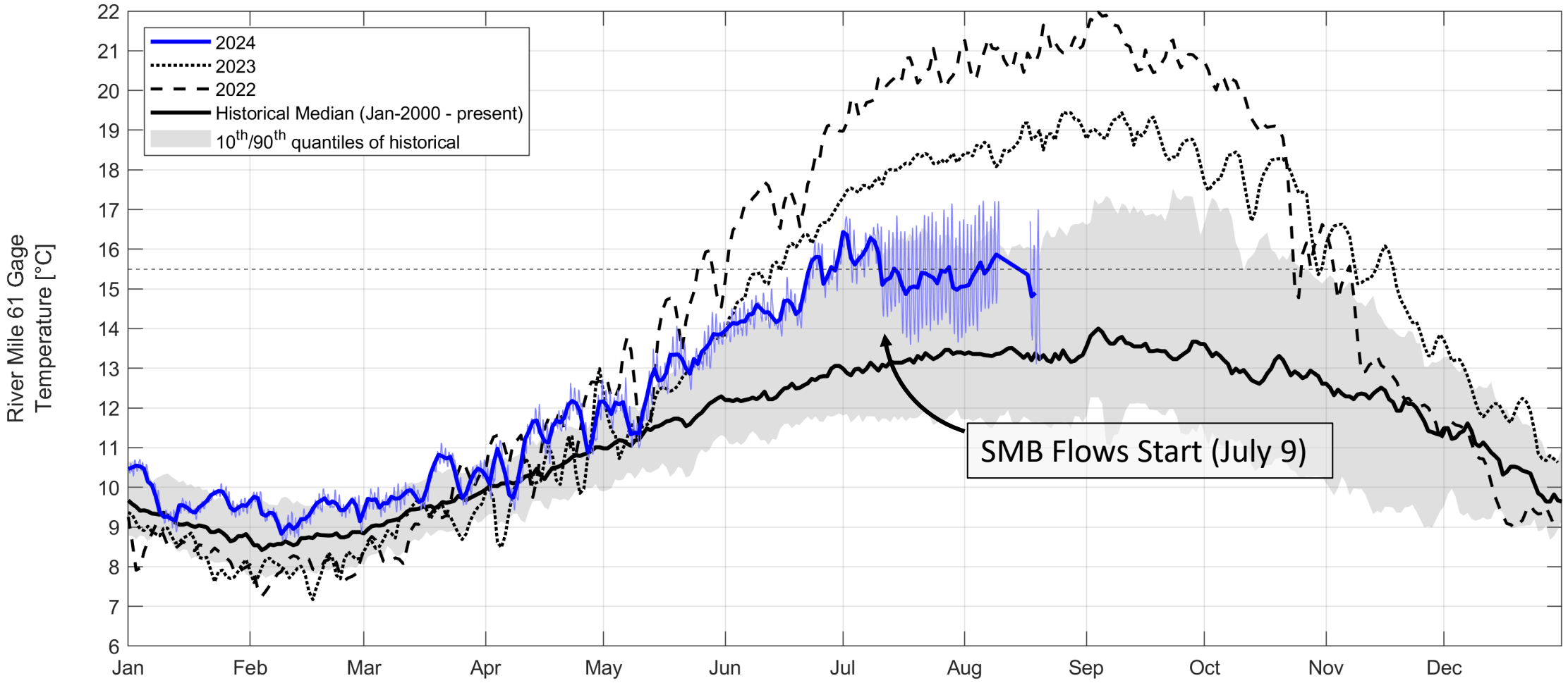
Lees Ferry Observations – Dissolved Oxygen



Lees Ferry Observations – Specific Conductance

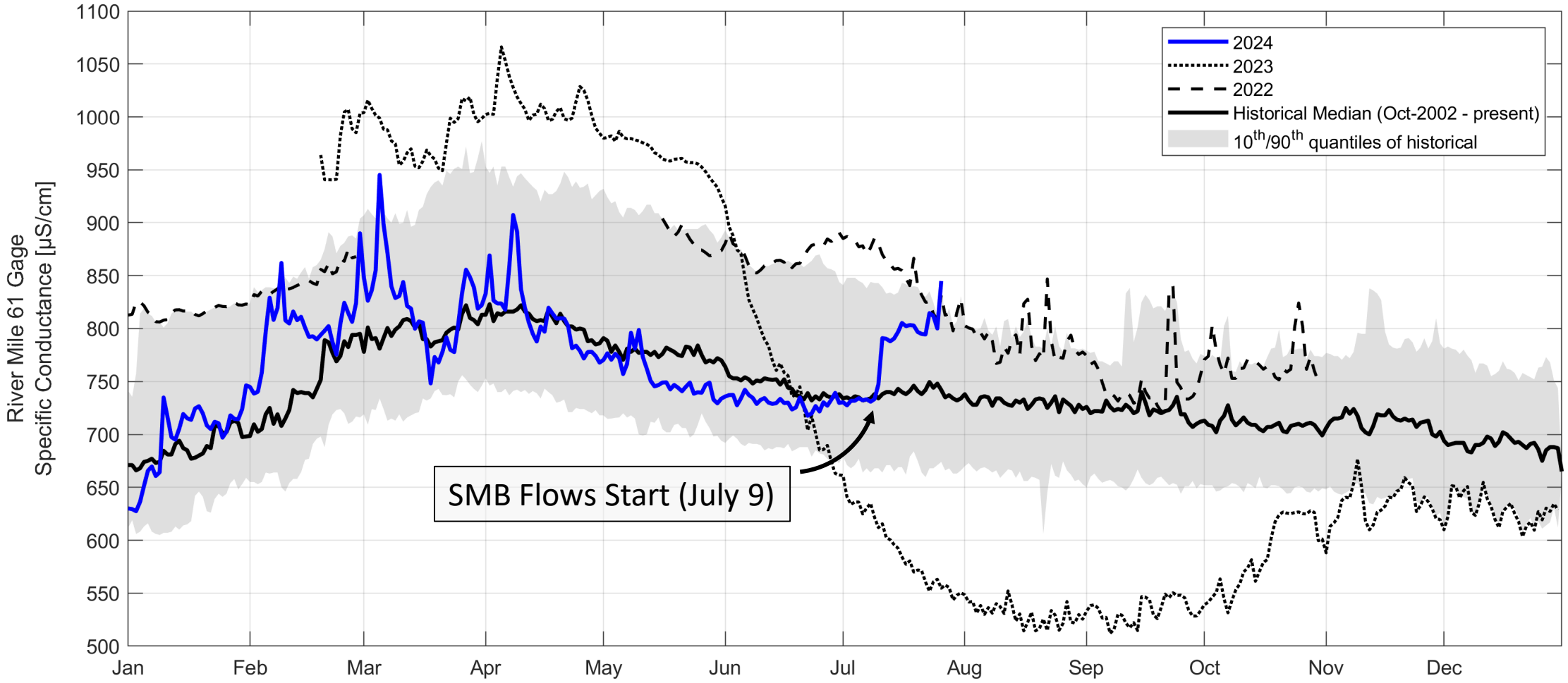


River Mile 61 Observations – Temperature

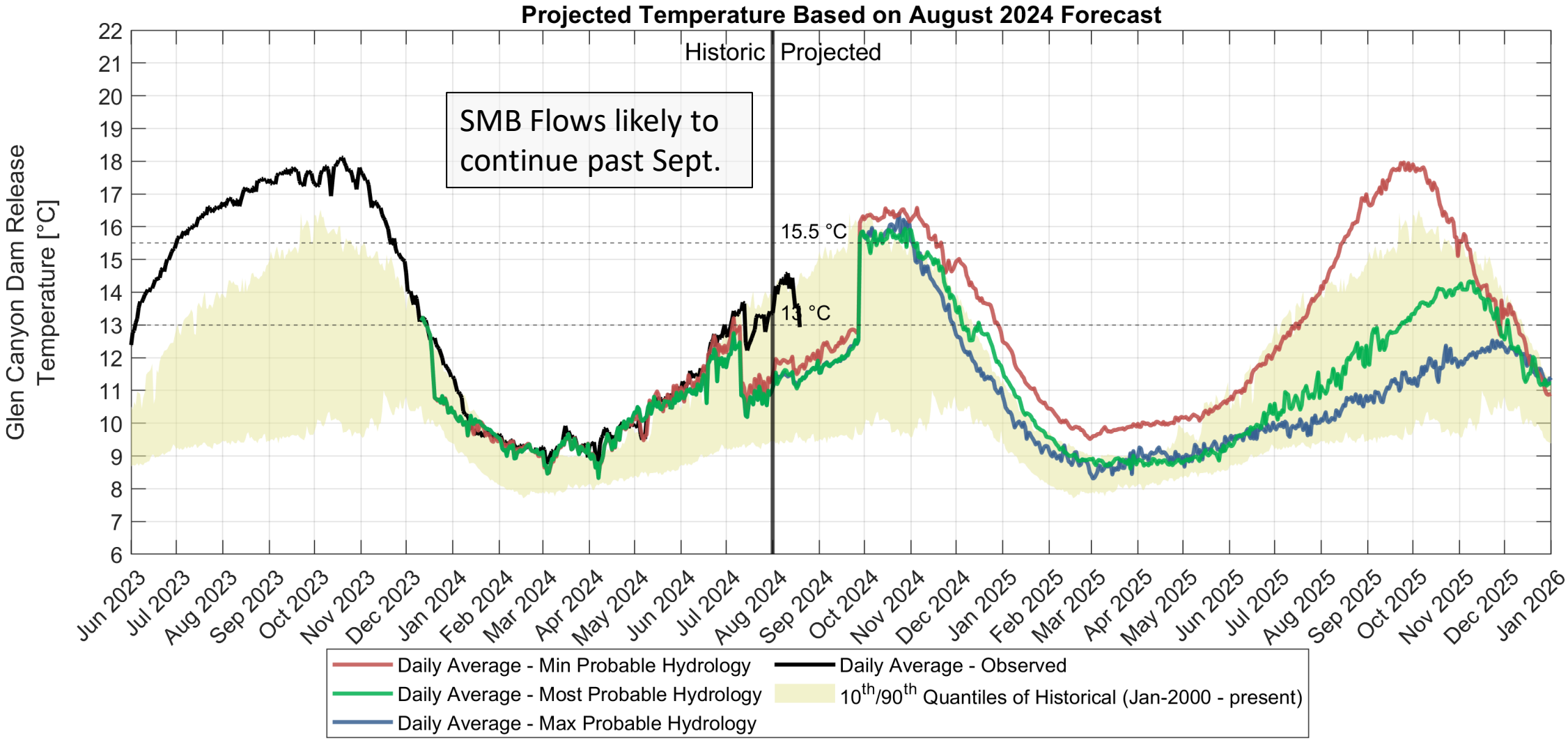


Now in real time: https://waterdata.usgs.gov/monitoring-location/09383100/#parameterCode=00010&period=P7D&showMedian=false

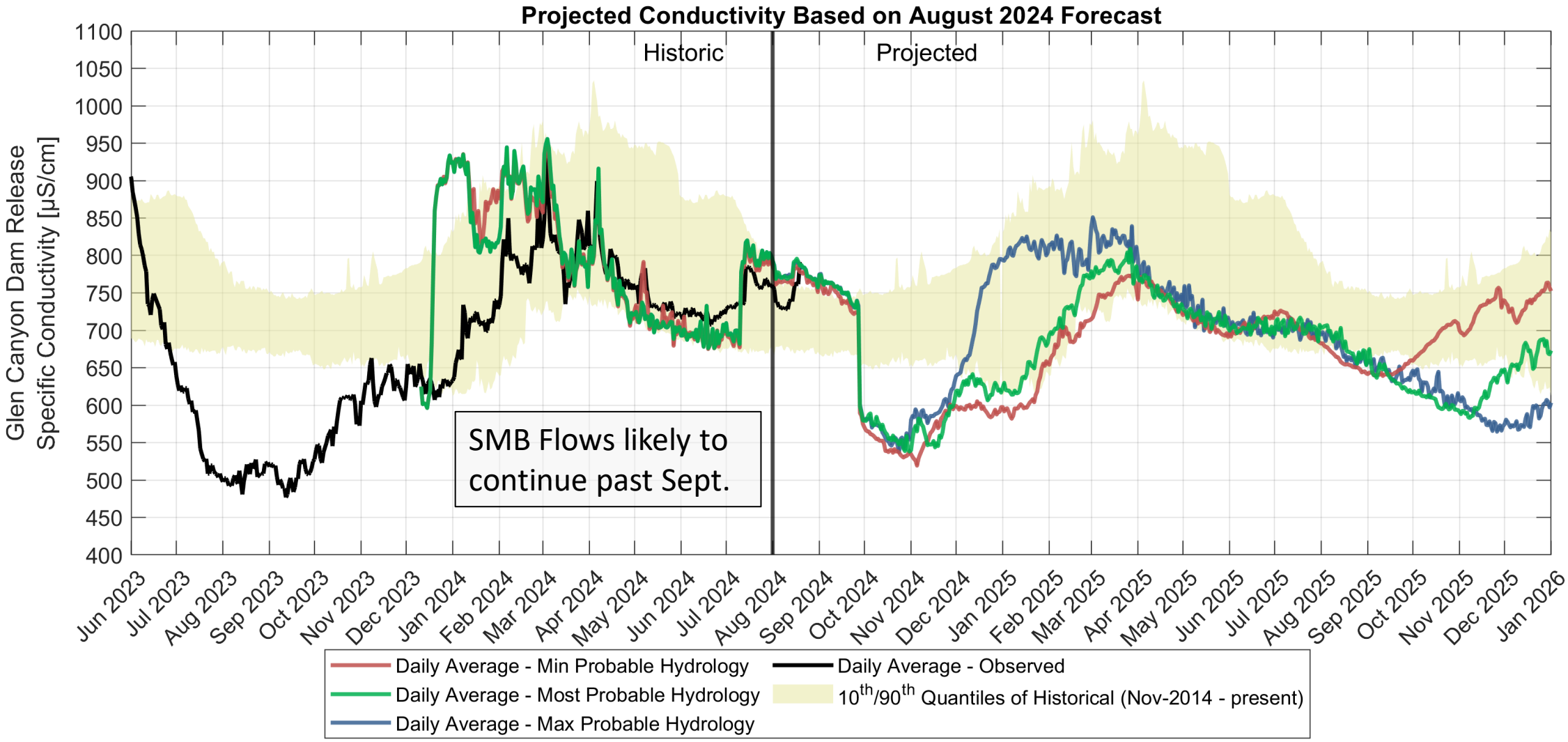
River Mile 61 Observations – Specific Conductance



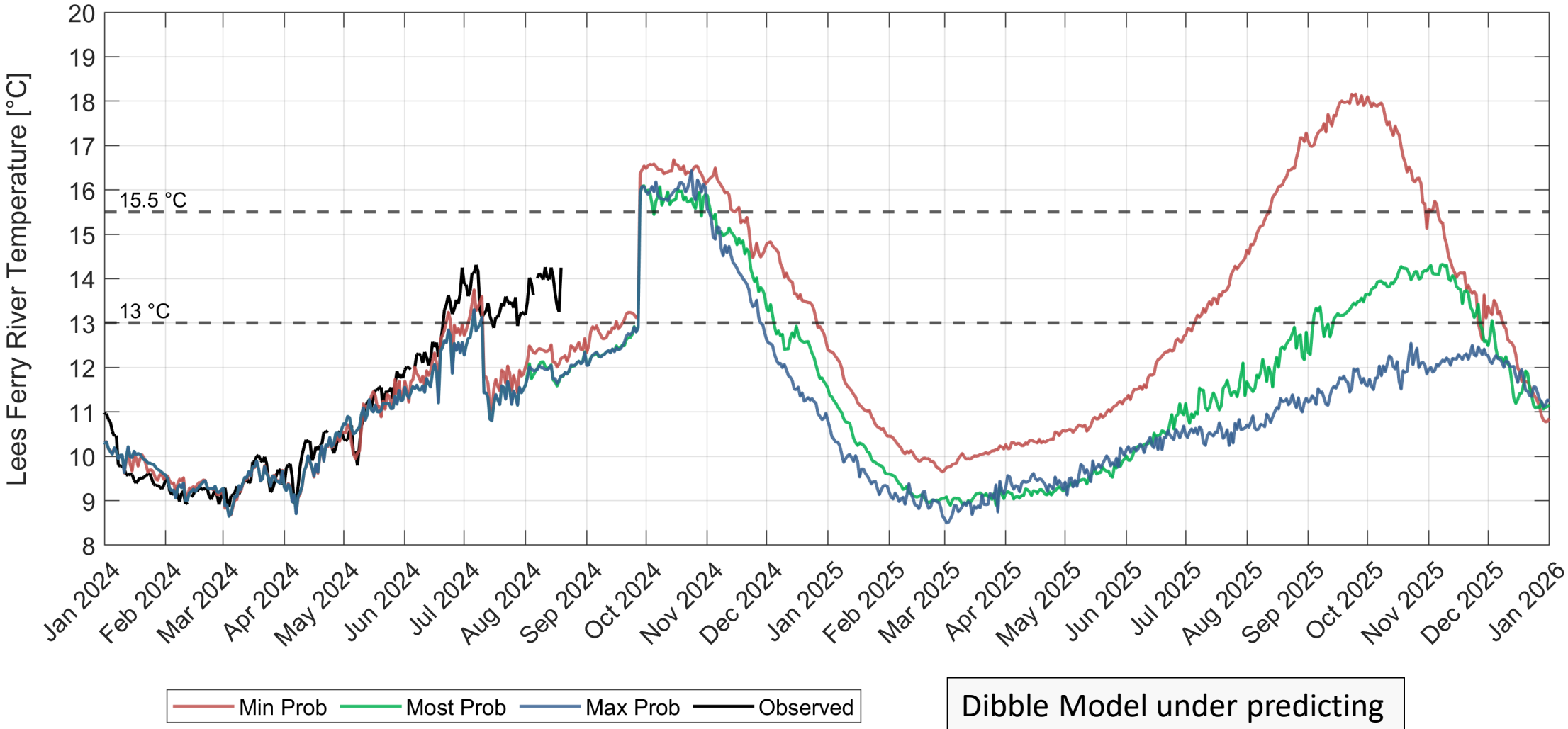
CE-QUAL-W2 Modeled Temperature



CE-QUAL-W2 Modeled Conductivity

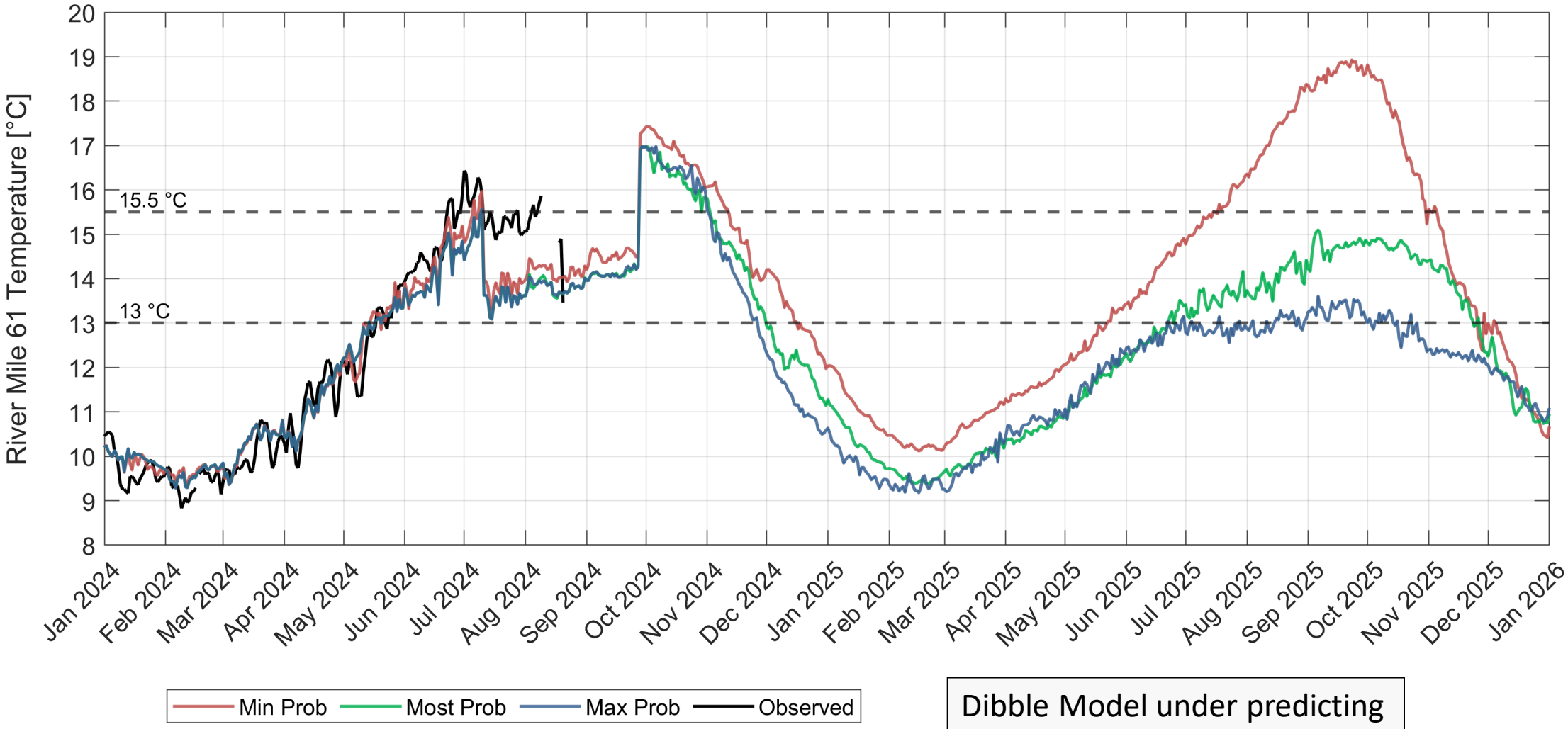


Dibble et al. Grand Canyon Modeled Lees Ferry



Dibble Model under predicting temperatures with SMB Flows

Dibble et al. Grand Canyon Modeled River Mile 61



Dibble Model under predicting temperatures with SMB Flows


Questions?
BUREAU OF
RECLAMATION