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# Glen Canyon Monthly Operations Call

## Basin Hydrology and Operations

May 22, 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.”

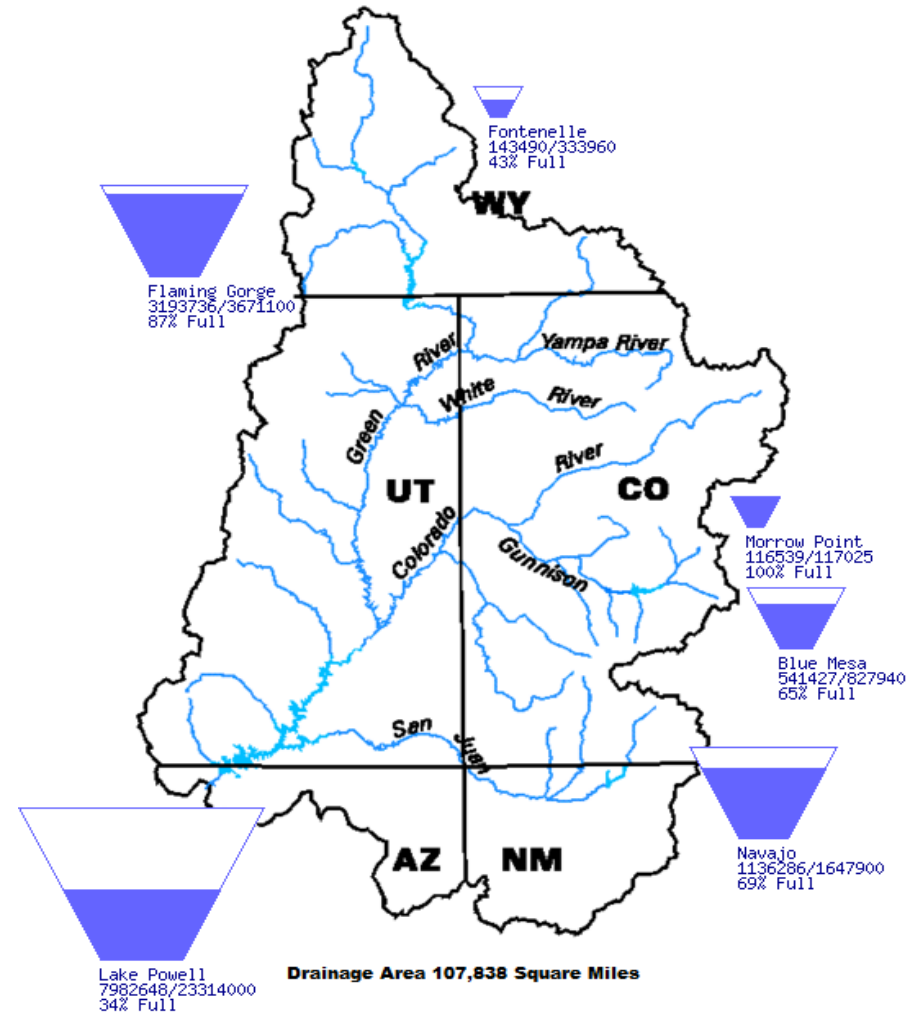


# Upper Basin Storage (as of May 19, 2023)

Data Current as of:  
05/19/2024

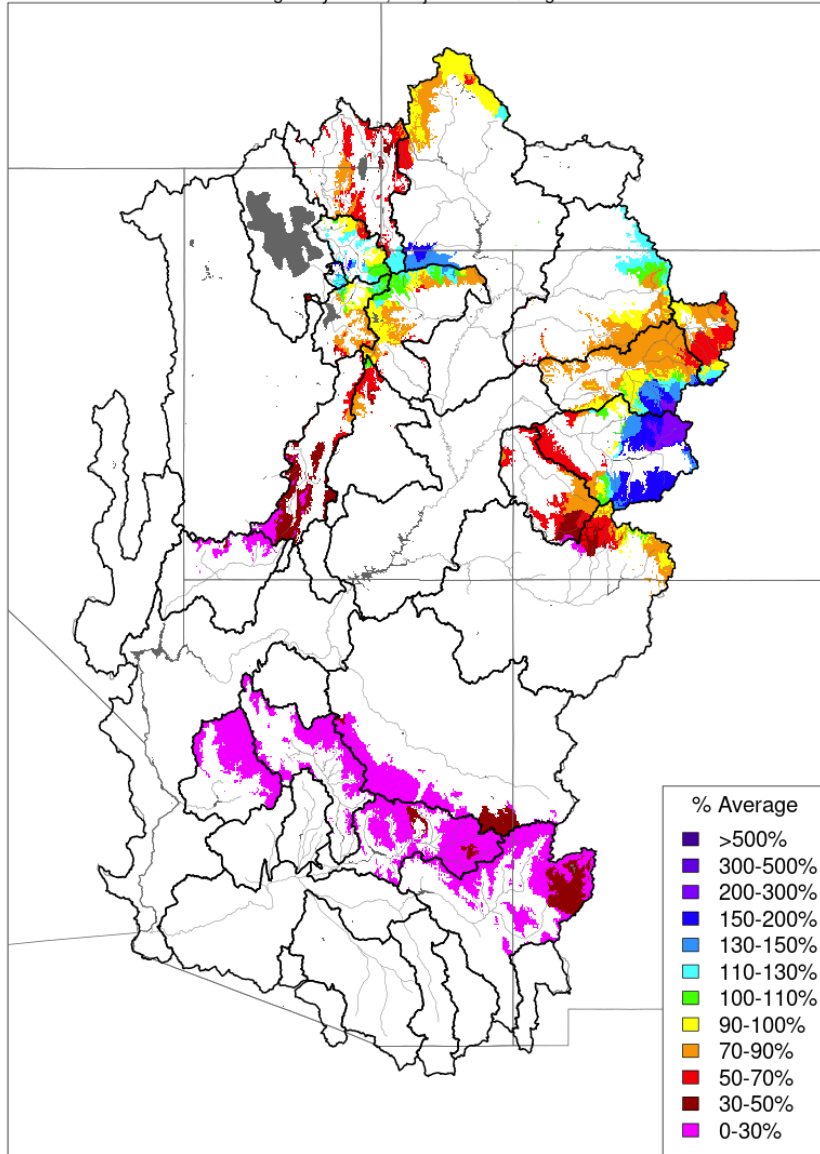
| Reservoir            | Percent Current Live Storage | Current Live Storage (maf) | Live Storage Capacity (maf) | Elevation (feet) |
|----------------------|------------------------------|----------------------------|-----------------------------|------------------|
| Fontenelle           | 43                           | 0.14                       | 0.33                        | 6,477.03         |
| Flaming Gorge        | 87                           | 3.19                       | 3.67                        | 6,028.11         |
| Blue Mesa            | 65                           | 0.54                       | 0.83                        | 7,485.29         |
| Navajo               | 69                           | 1.14                       | 1.65                        | 6,046.95         |
| Lake Powell          | 34                           | 7.98                       | 23.31                       | 3,562.74         |
| UC System Storage    | 44                           | 13.13                      | 29.79                       |                  |
| Total System Storage | 42                           | 24.53                      | 58.48                       |                  |

Upper Colorado River Drainage Basin



### Month to Date Precipitation - May 20 2024

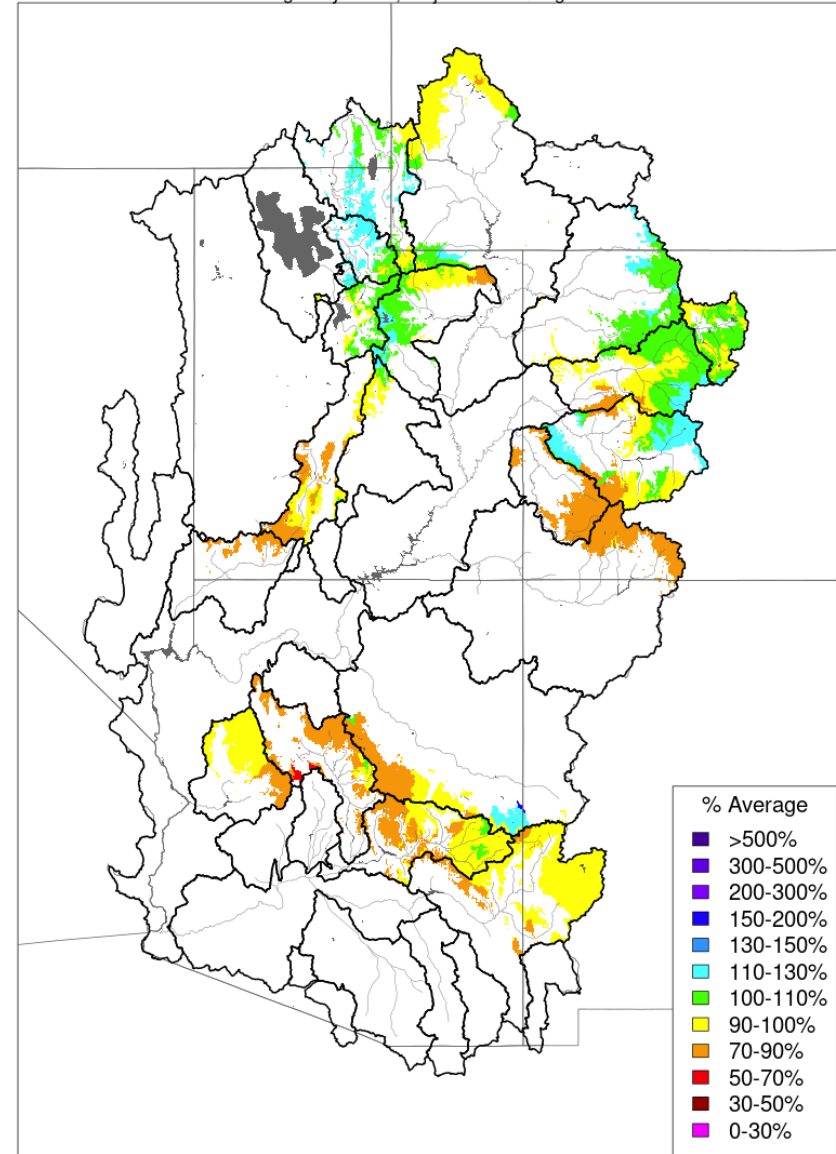
Averaged by Basin, Major Contributing Areas



Prepared by NOAA, Colorado Basin River Forecast Center  
Salt Lake City, Utah, [www.cbrfc.noaa.gov](http://www.cbrfc.noaa.gov)

### Water Year to Date Precipitation, October 01 - May 20 2024

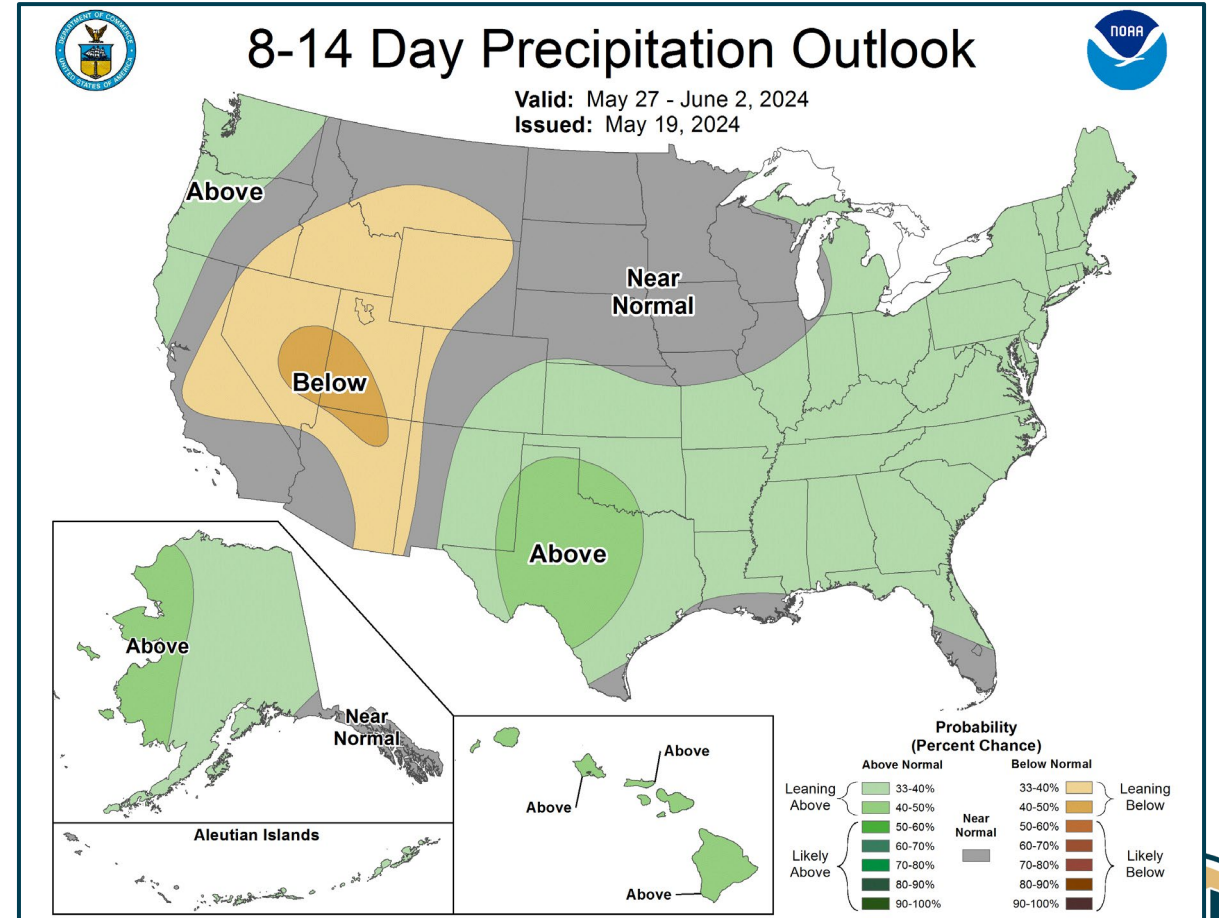
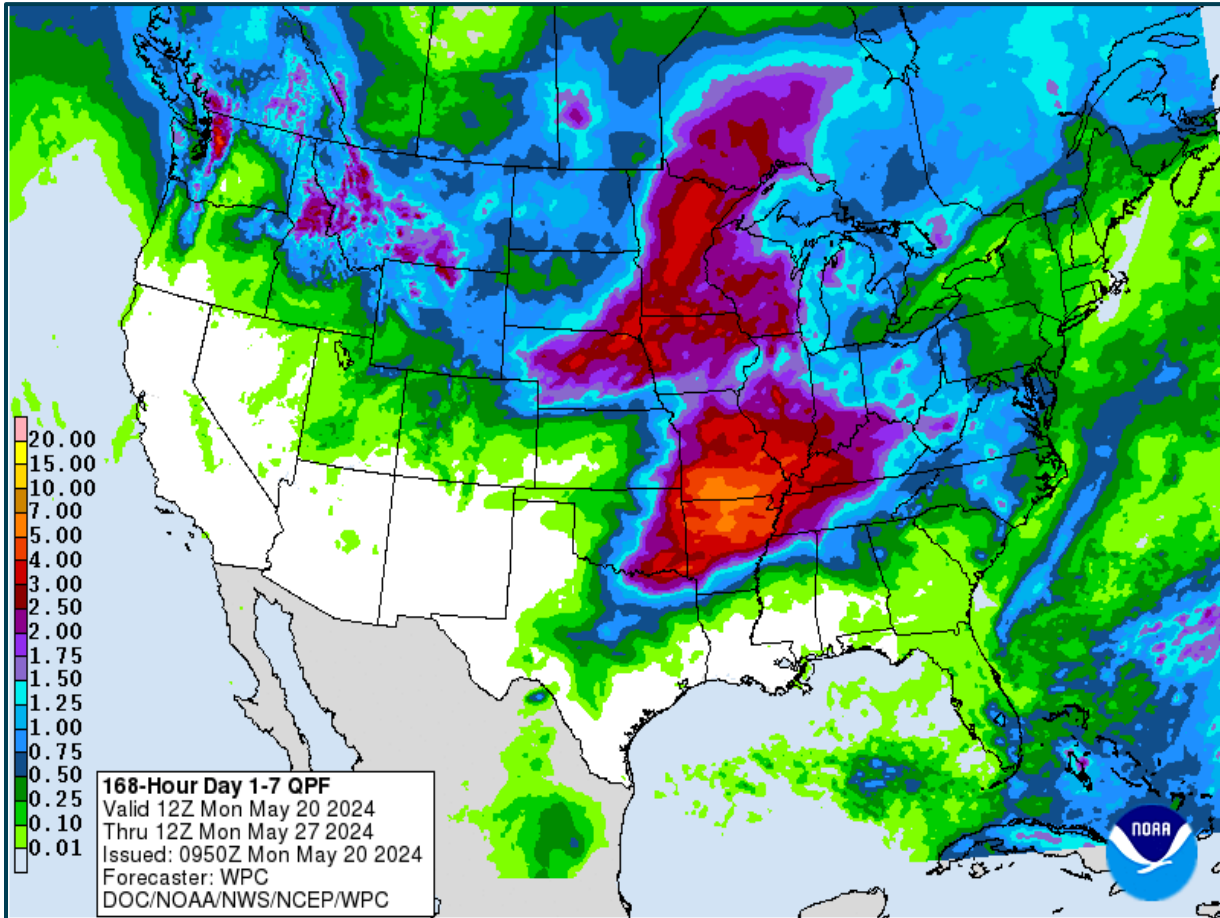
Averaged by Basin, Major Contributing Areas



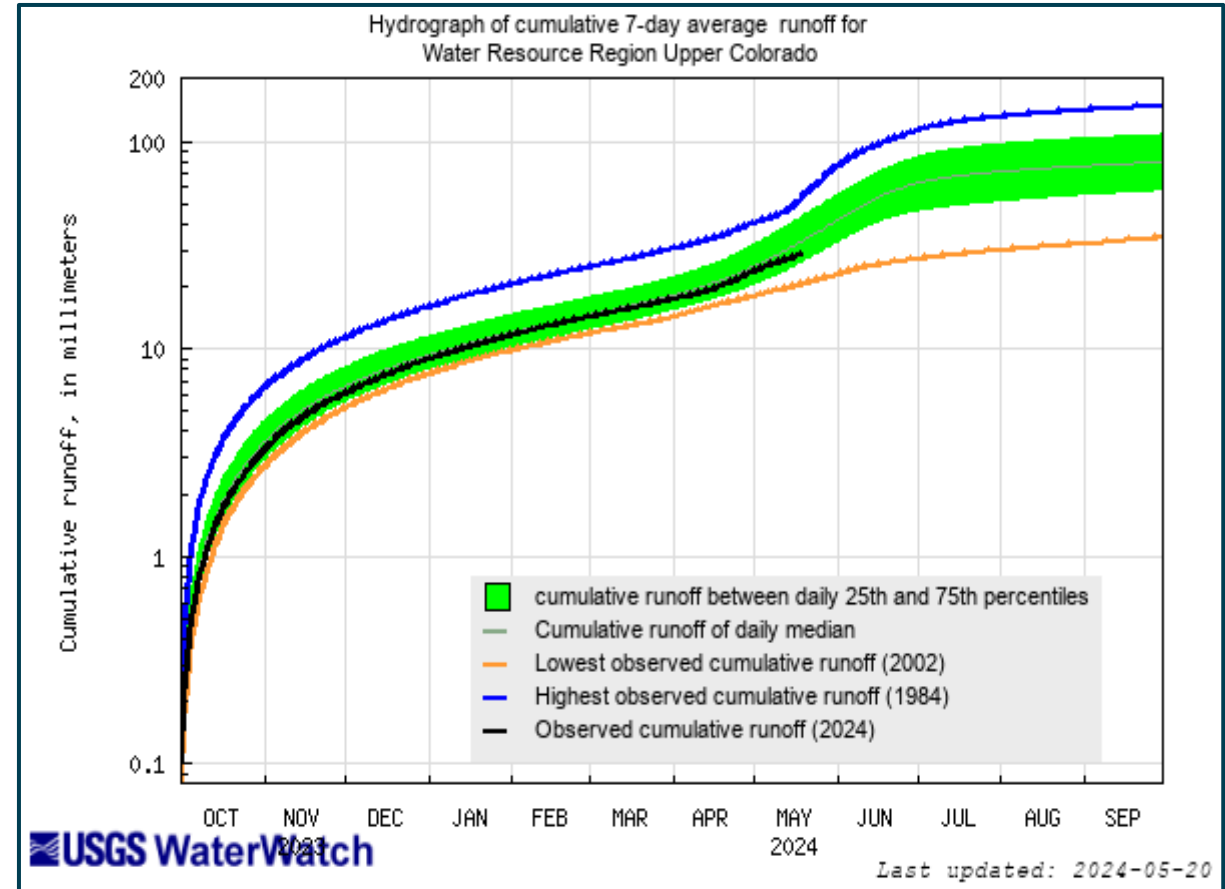
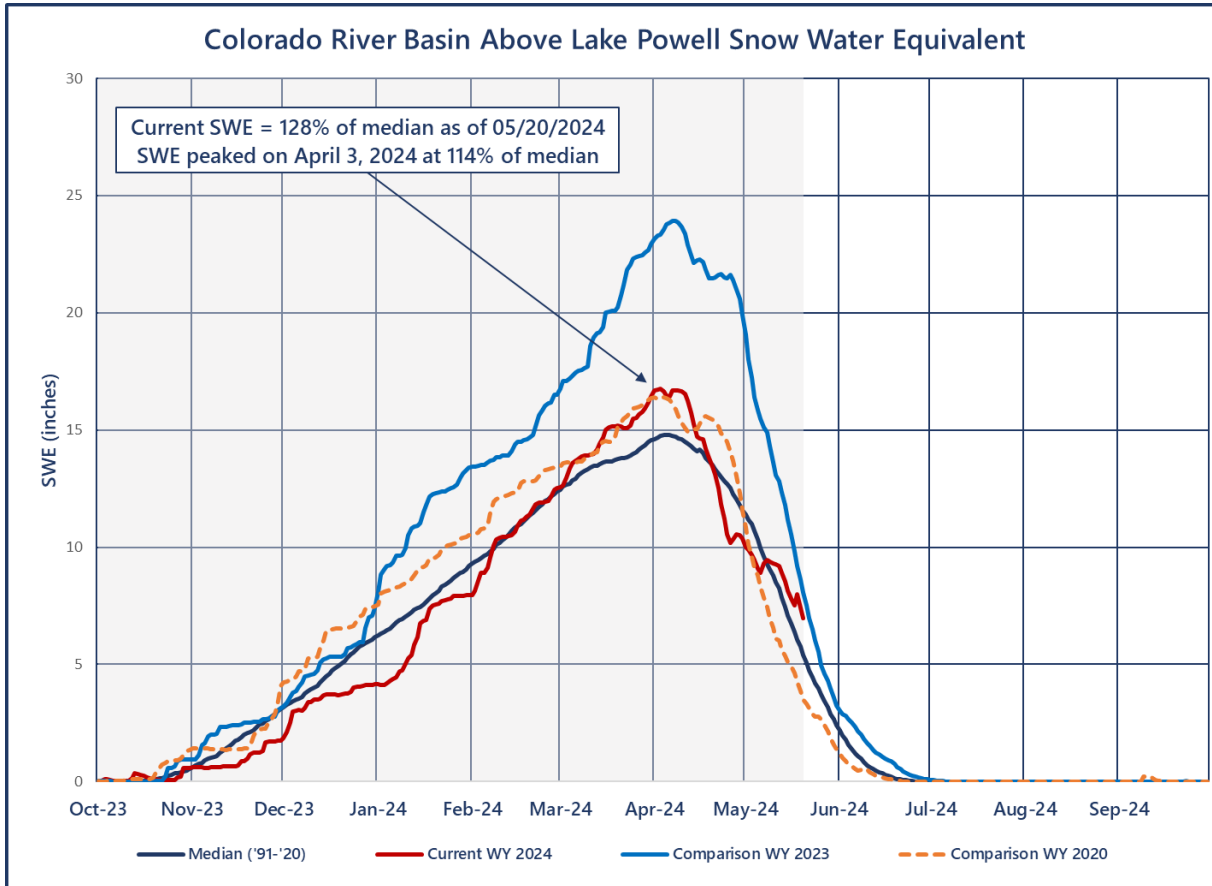
Prepared by NOAA, Colorado Basin River Forecast Center  
Salt Lake City, Utah, [www.cbrfc.noaa.gov](http://www.cbrfc.noaa.gov)



# Weather Prediction Center and Climate Prediction Center Precipitation Forecasts



# Upper Colorado SWE and Observed Inflows



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



# Most Probable May Forecast Water Year 2024

April – July 2024  
Forecasted Unregulated Inflow  
as of May 3, 2024

| Reservoir     | Inflow (kaf) | Change from Apr | Percent of Avg <sup>1</sup> |
|---------------|--------------|-----------------|-----------------------------|
| Fontenelle    | 600          | -110            | 82                          |
| Flaming Gorge | 800          | -160            | 83                          |
| Blue Mesa     | 570          | -30             | 90                          |
| Navajo        | 420          | 0               | 67                          |
| Powell        | 5,100        | -600            | 80                          |

May Midmonth = 5,100 kaf (80%)

Water Year 2024  
Unregulated Inflow Forecast  
as of May 3, 2024

| Reservoir     | Inflow (kaf) | Change from Apr | Percent of Avg <sup>1</sup> |
|---------------|--------------|-----------------|-----------------------------|
| Fontenelle    | 936          | -120            | 87                          |
| Flaming Gorge | 1,274        | -170            | 90                          |
| Blue Mesa     | 812          | -30             | 90                          |
| Navajo        | 564          | 0               | 62                          |
| Powell        | 7,792        | -599            | 81                          |

May Midmonth = 7,792 kaf (81%)

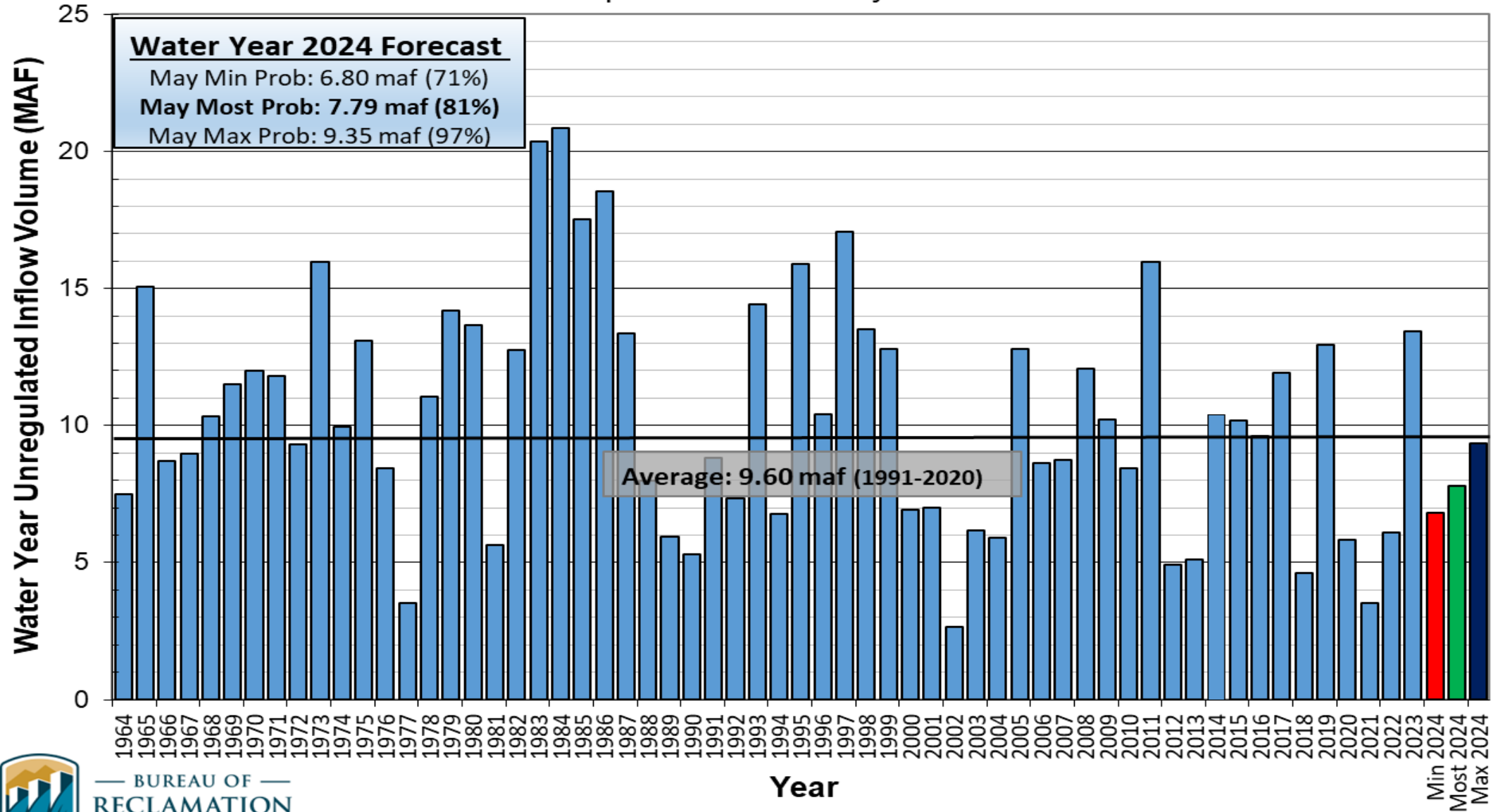
<sup>1</sup>Averages are based on the 1991 through 2020 period of record.



# Lake Powell Unregulated Inflow

## Water Year 2024 Forecast (issued May 3)

### Comparison with History



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# Upper Colorado Basin

Hydrology and Operations  
Projections Based on May  
2024 24-Month Study



# Upper Basin Reservoir Operations

## Water Years 2024 and 2025

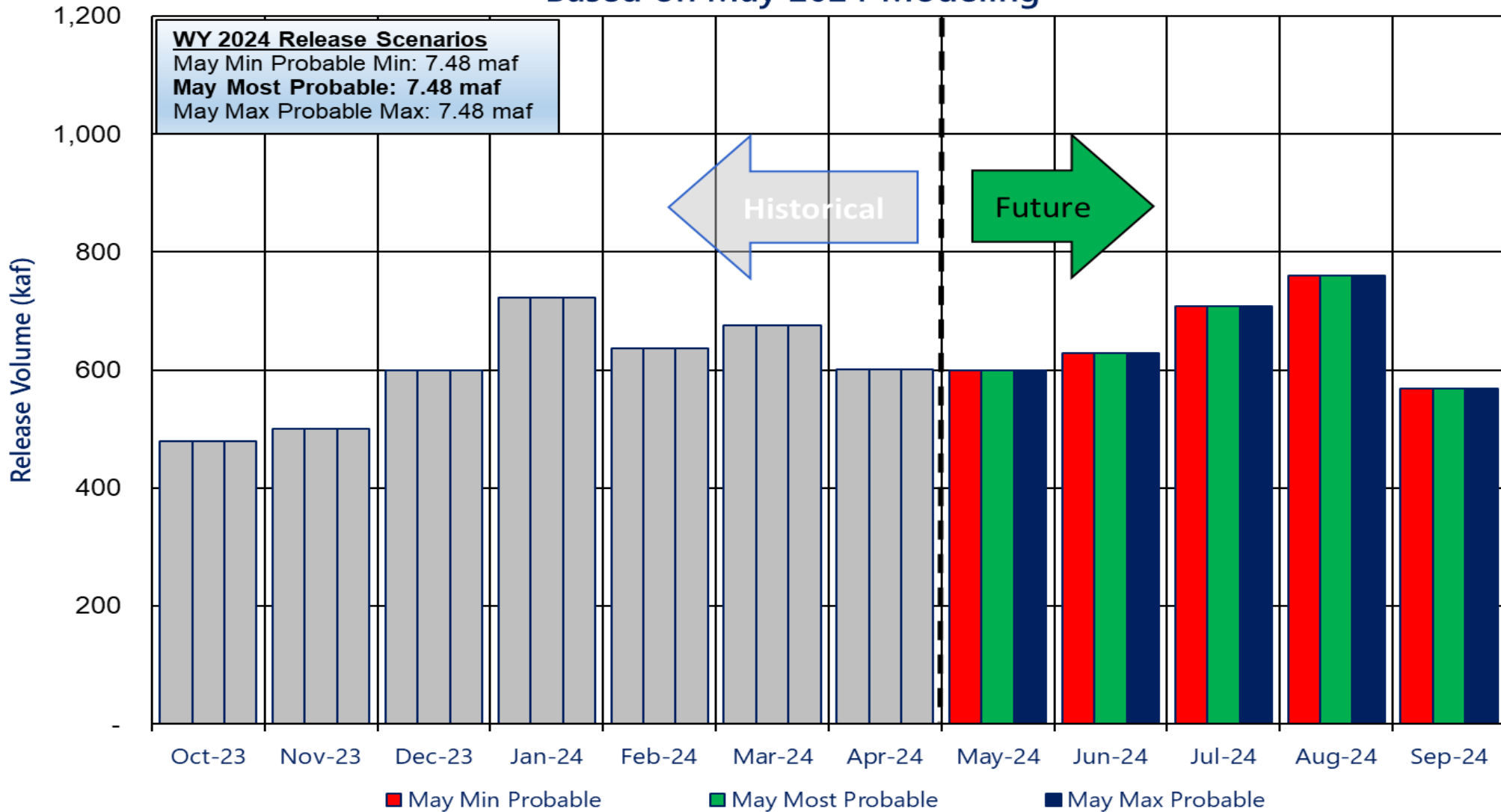
- Lake Powell will be operated consistent with the 2007 Interim Guidelines, the Upper Basin Drought Response Operations Agreement and Upper Basin Records of Decision
- Lake Powell WY 2024 will operate in the Mid-Elevation Release Tier where Lake Powell will release 7.48 maf
- Includes the Supplemental Environmental Impact Statement for Near-term Colorado River Operations Record of Decision (2024 Near-term SEIS)
- 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

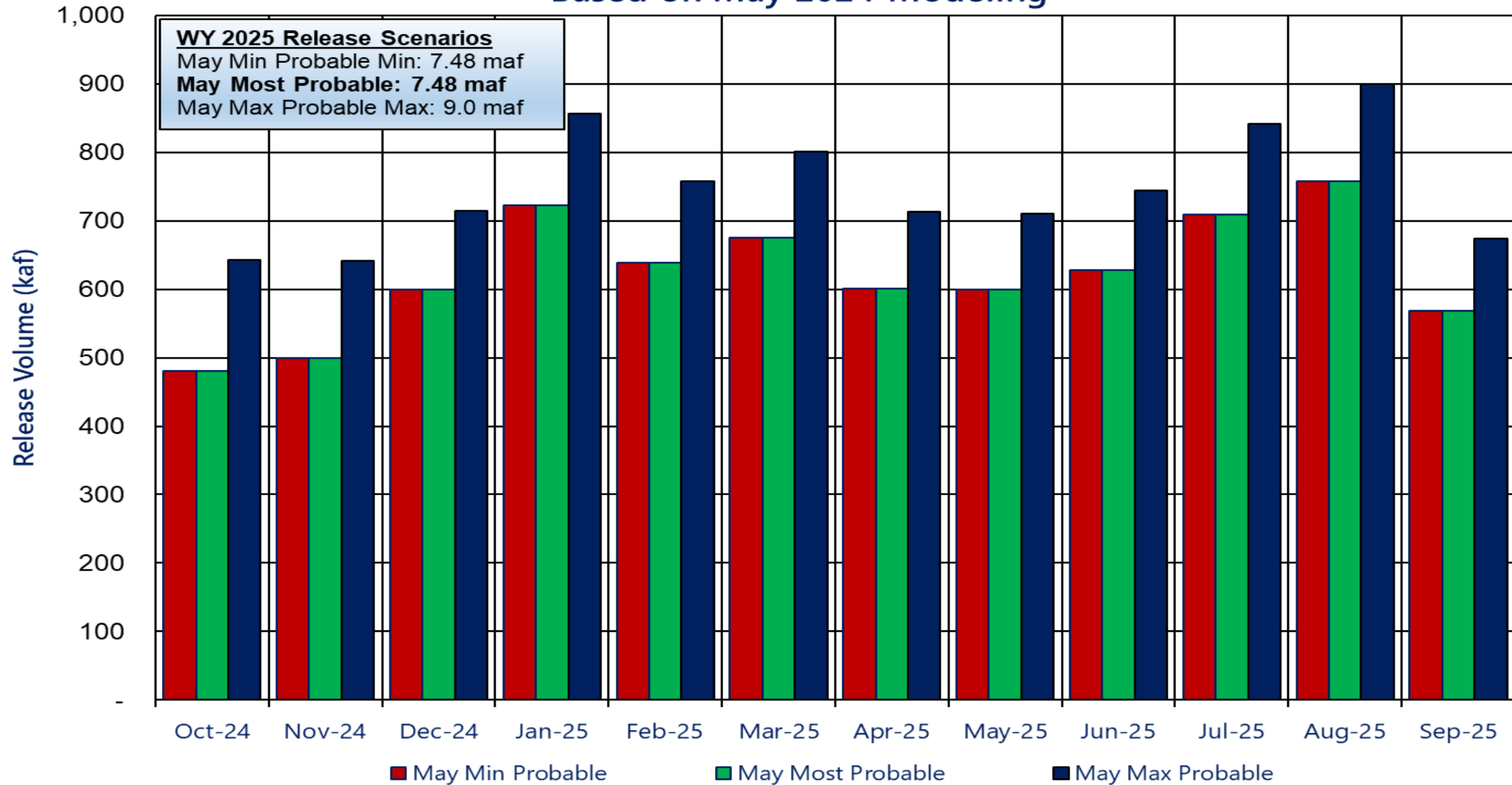
### Based on May 2024 Modeling



# Potential Lake Powell Monthly Release Volume Distribution

## Release Scenarios for Water Year 2025

### Based on May 2024 Modeling



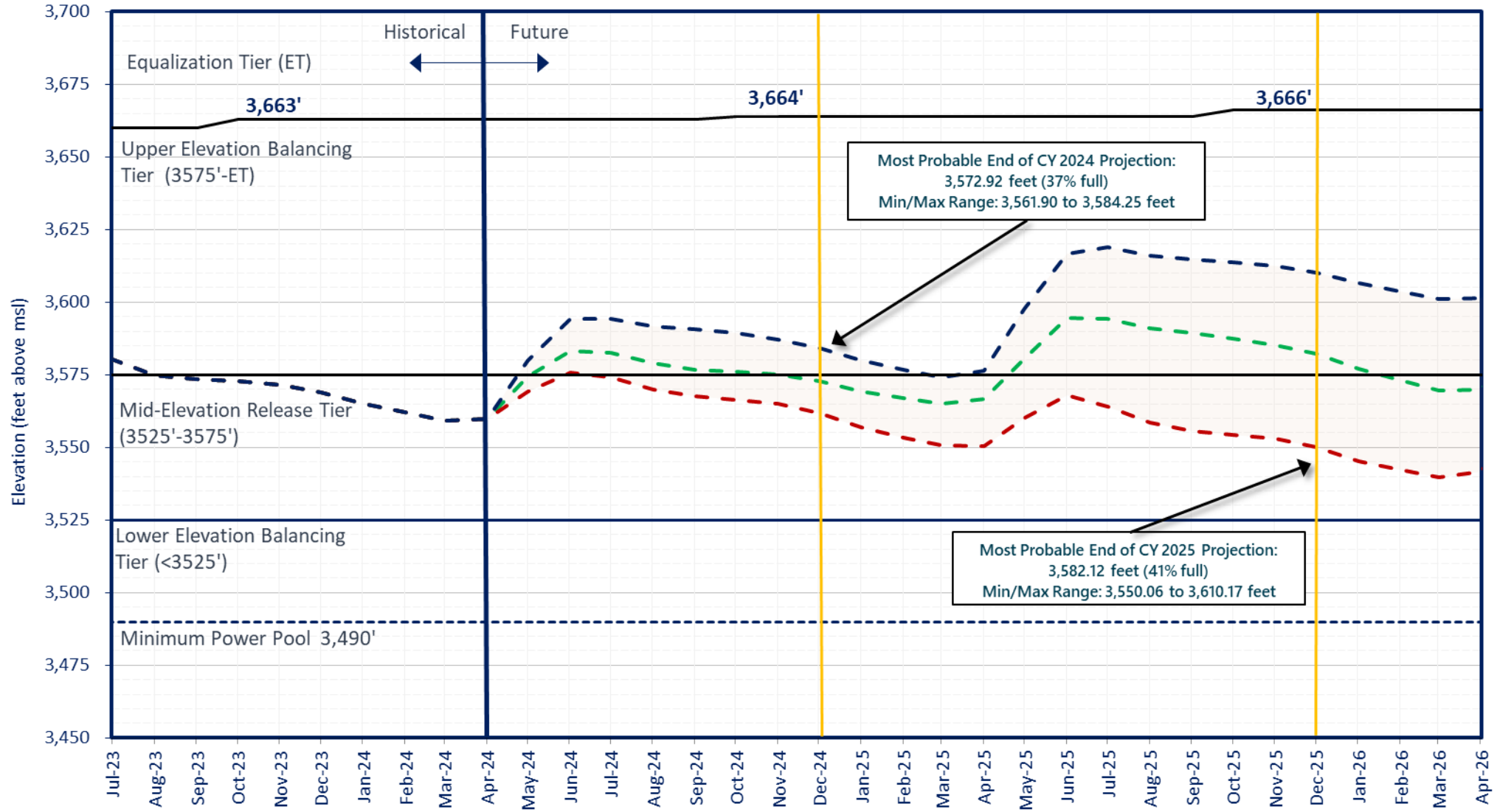
# Reclamation Operational Modeling Model Comparison

|                                | 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

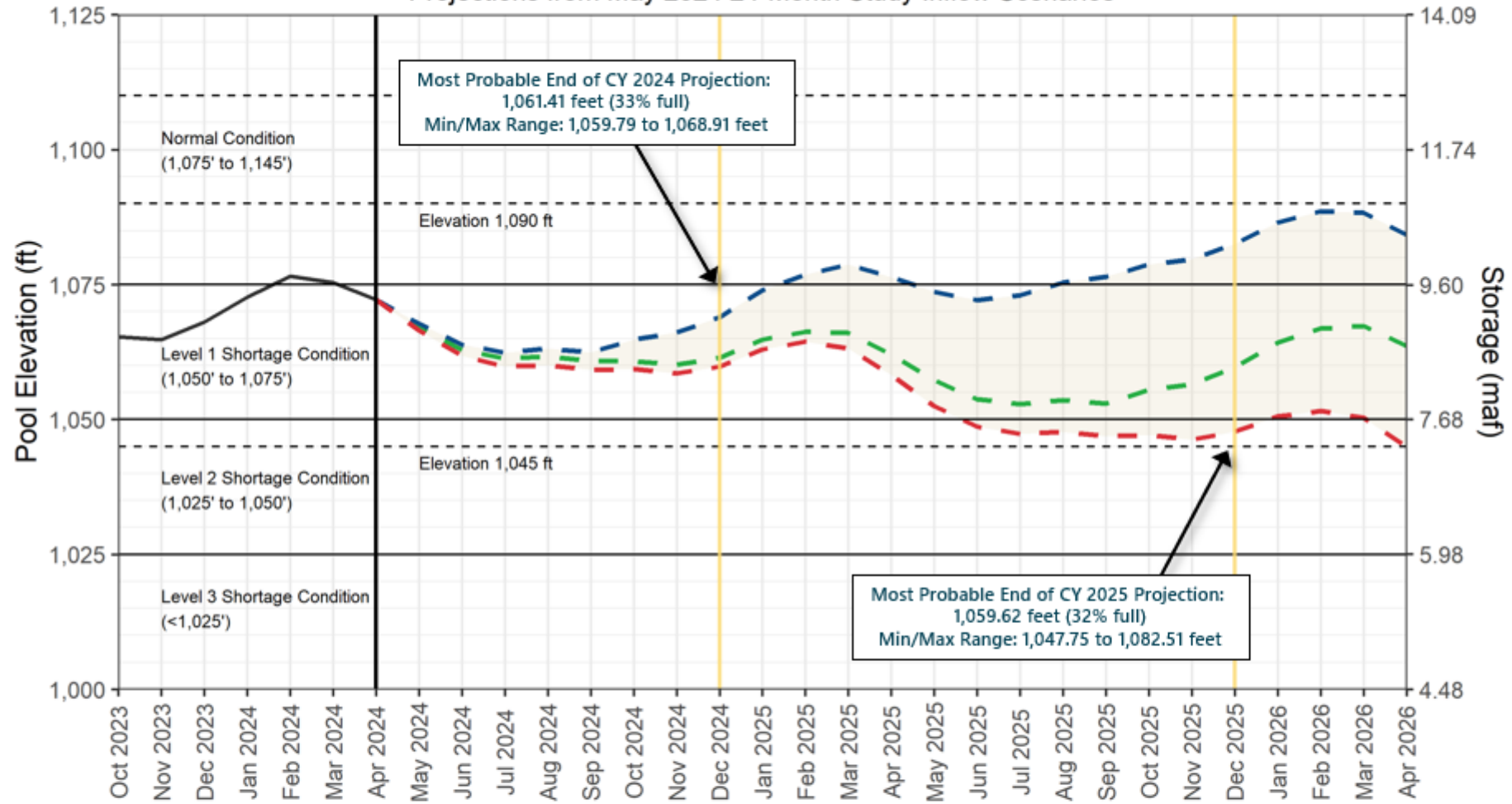
Projections from the May 2024 24-Month Study Inflow Scenarios



- Historical Elevations
- May 2024 Most Probable Inflow - Lake Powell release of 7.48 maf in WY2024 and WY2025
- May 2024 Minimum Probable Inflow - Lake Powell release of 7.48 maf in WY2024 and WY2025
- May 2024 Maximum Probable Inflow - Lake Powell release of 7.48 maf in WY2024 and 9.0 maf in WY2025



## Lake Mead End-of-Month Elevations Projections from May 2024 24-Month Study Inflow Scenarios



- Historical Elevations
- May 2024 Probable Maximum Inflow with a Lake Powell release of 7.48 maf in WY 2024 and 9.00 maf in WY 2025
- May 2024 Most Probable Inflow with a Lake Powell release of 7.48 maf in WY 2024 and WY 2025
- May 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                       |          |          |          |          |          | █        |          |          |          |          | █                    |          |
| Units Available         | 4        | 4        | 6        | 6        | 6        | 6        | 6        | 5        | 6        | 8        | 7                    | 6        |
| Capacity (cfs)          | 12,400   | 19,450   | 19,400   | 19,300   | 19,200   | 19,100   | 19,100   | 16,000   | 27,000   | 27,000   | 23,400 <sup>3</sup>  | 19,600   |
| Capacity (kaf/month)    | 770      | 1,030    | 1,190    | 1,190    | 1,100    | 1,220    | 1,280    | 1,030    | 1,510    | 1,660    | 1,570                | 1,200    |
| Max (kaf) <sup>1</sup>  | 480      | 500      | 600      | 723      | 639      | 675      | 601      | 599      | 628      | 709      | 758                  | 567      |
| Most (kaf) <sup>1</sup> | 480      | 500      | 600      | 723      | 639      | 675      | 601      | 599      | 628      | 709      | 758                  | 567      |
| Min (kaf) <sup>1</sup>  | 480      | 500      | 600      | 723      | 639      | 675      | 601      | 599      | 628      | 709      | 758                  | 567      |
|                         |          |          |          |          |          |          |          |          |          |          | (updated 05-20-2024) |          |

MAY MOST<sup>2</sup>

MAY MOST

7.48 maf

7.48 maf

7.48 maf

1 Projected release, based on May 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.



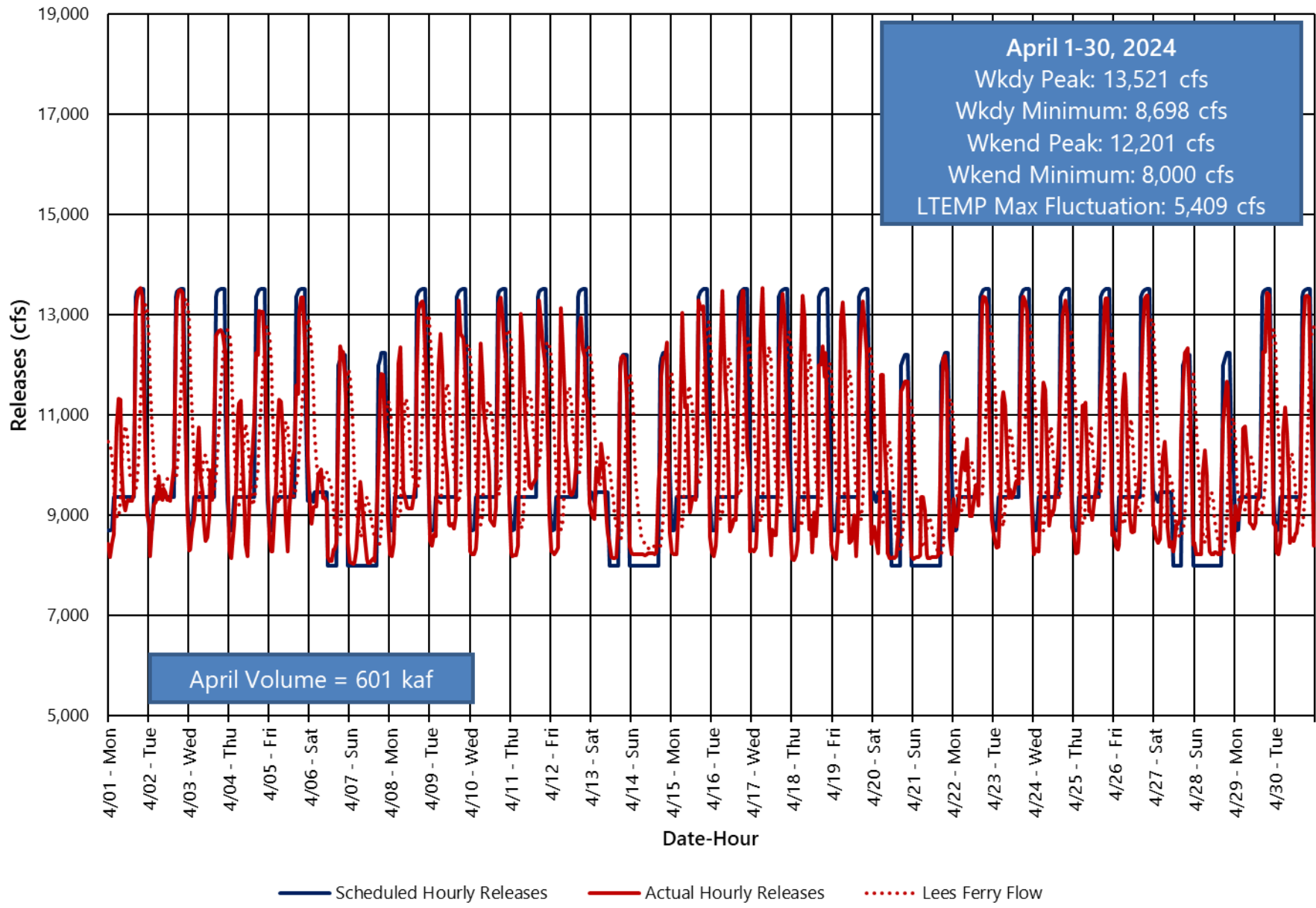
# Glen Canyon Dam Power Plant Unit Outage Schedule for 2025

| 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                       |                               |          |          | ■        |          |          |          |          |          |          |          |          |                       |
| Units Available         | 5                             | 6        | 8        | 6        | 6        | 6        | 7        | 8        | 8        | 8        | 8        | 6        |                       |
| Capacity (cfs)          | 16,000/<br>4,000 <sup>3</sup> | 19,600   | 26,800   | 19,600   | 19,760   | 19,600   | 23,300   | 26,800   | 26,800   | 26,800   | 26,800   | 19,600   | MAY MOST <sup>2</sup> |
| Capacity (kaf/month)    | 1,200                         | 1,500    | 1,650    | 1,580    | 1,100    | 1,230    | 1,380    | 1,590    | 1,600    | 1,650    | 1,650    | 1,180    | MAY MOST              |
| Max (kaf) <sup>1</sup>  | 643                           | 642      | 715      | 857      | 758      | 801      | 713      | 710      | 745      | 842      | 900      | 674      | 9.00 maf              |
| Most (kaf) <sup>1</sup> | 480                           | 500      | 600      | 723      | 639      | 675      | 601      | 599      | 628      | 709      | 758      | 568      | 7.48 maf              |
| Min (kaf) <sup>1</sup>  | 480                           | 500      | 600      | 723      | 639      | 675      | 601      | 599      | 628      | 709      | 758      | 568      | 7.48 maf              |
|                         |                               |          |          |          |          |          |          |          |          |          |          |          | (updated 05-20-2024)  |

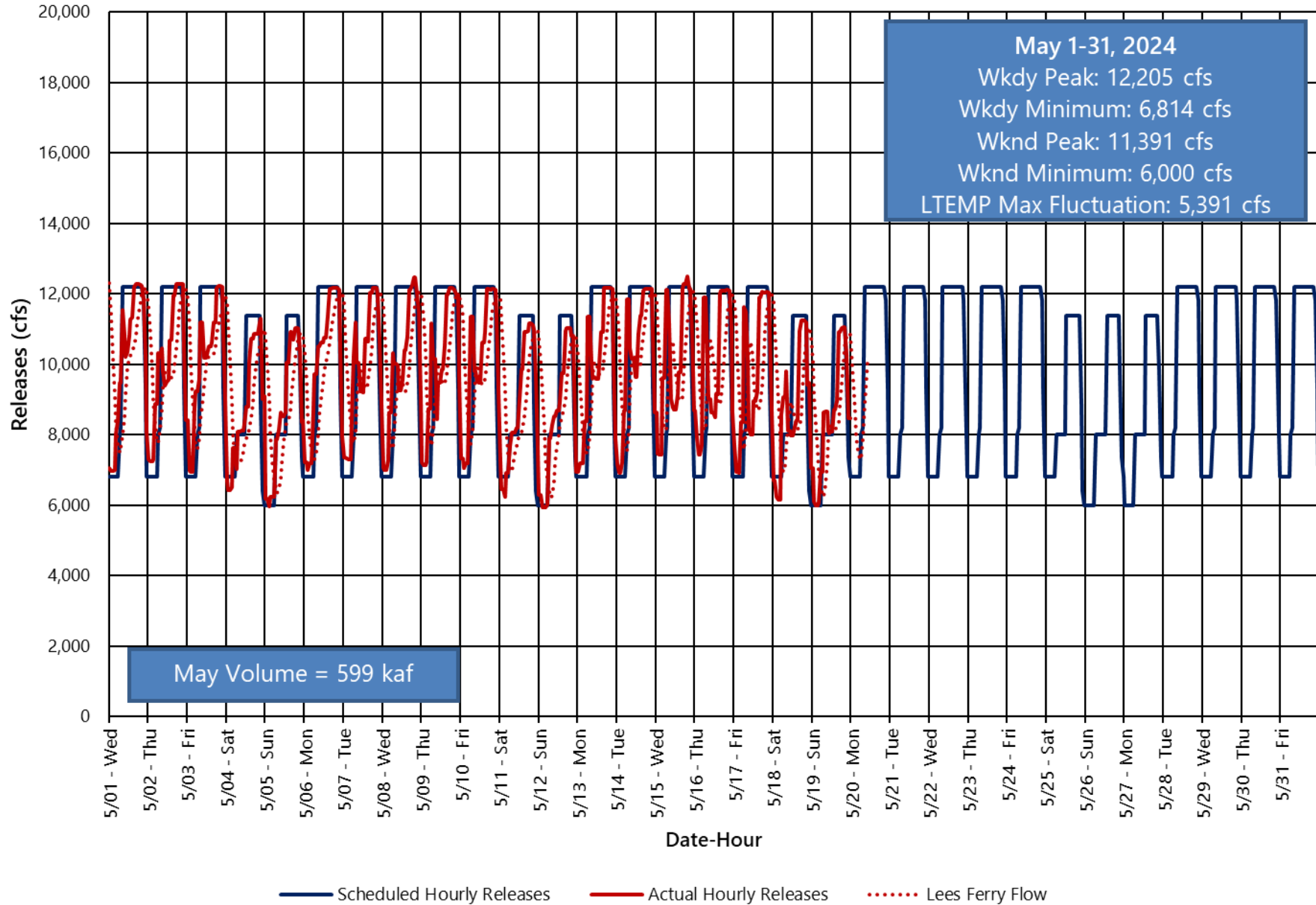
1 Projected release, based on May 2024 24MS for the minimum, most probable and the maximum probable 24-Month Study model runs.  
 2 Dependent upon availability to shift contingency regulation, which will increase capacity by 30-40MW (3%) at current efficiency.  
 3 Tailwater/Forebay inspection will require one day at 4,000 cfs and possibly two if necessary.



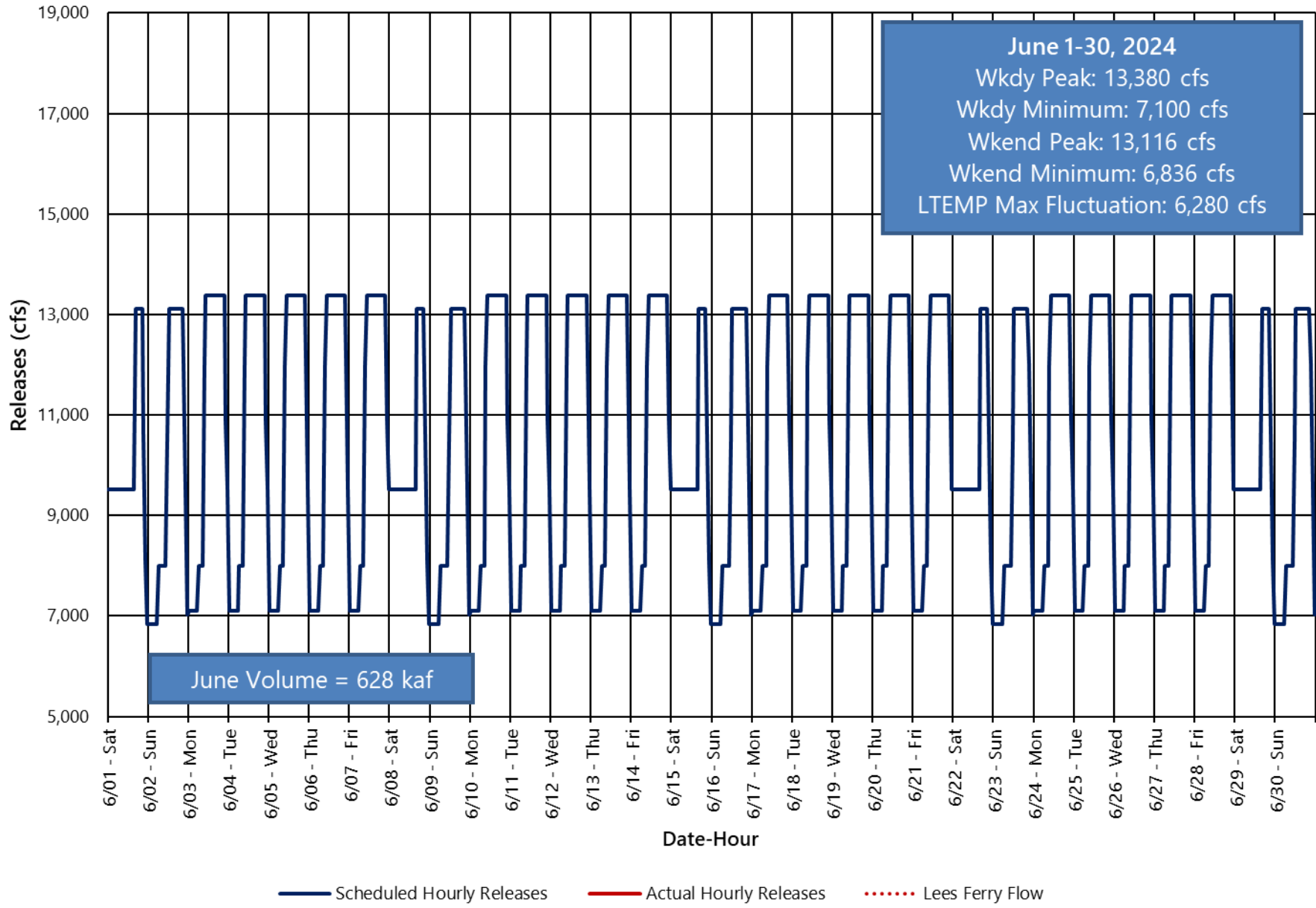
### Glen Canyon Dam Hourly Release Pattern - April 2024



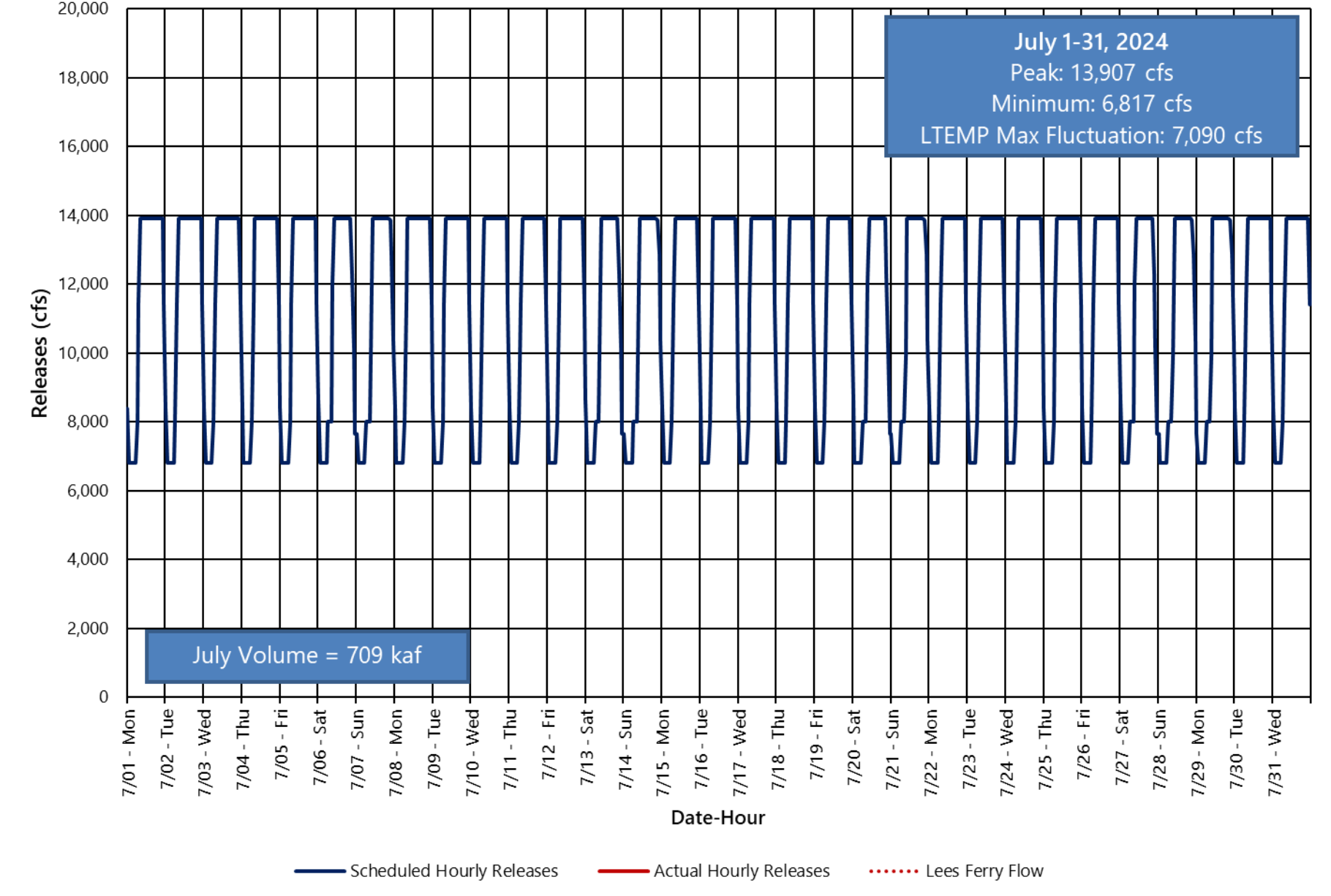
### Glen Canyon Dam Hourly Release Pattern - May 2024



### Glen Canyon Dam Hourly Release Pattern - June 2024



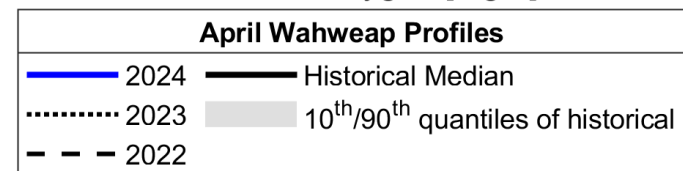
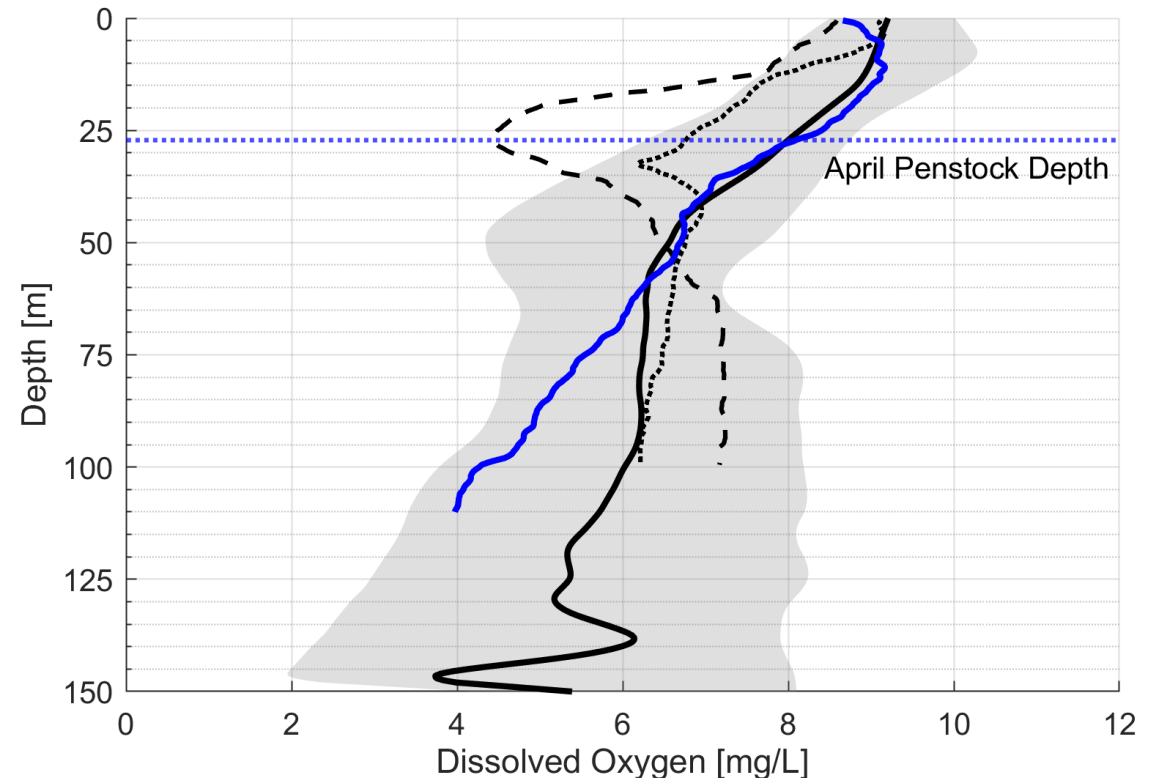
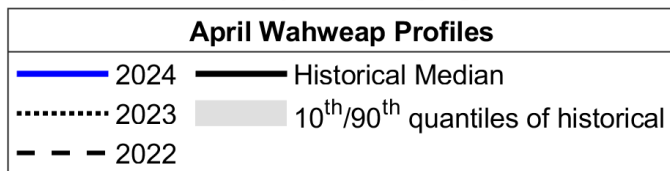
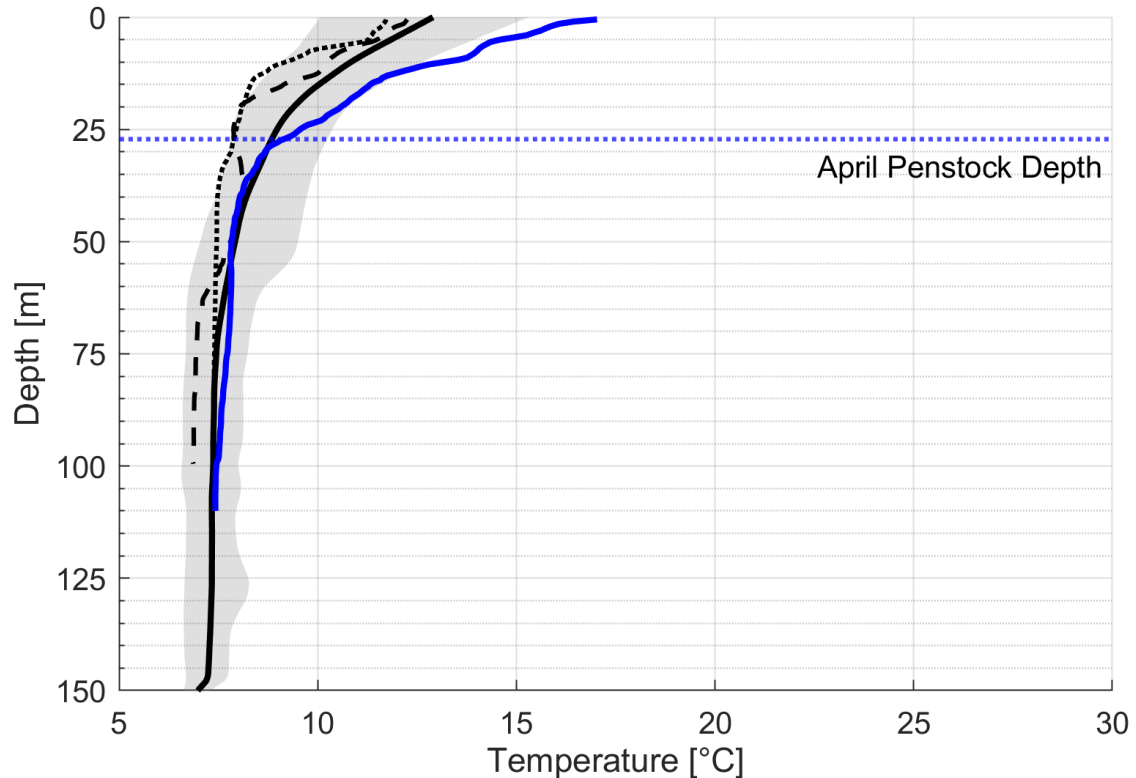
### Glen Canyon Dam Hourly Release Pattern - July 2024



# Water Quality



# Water Quality Observations in Forebay near GCD

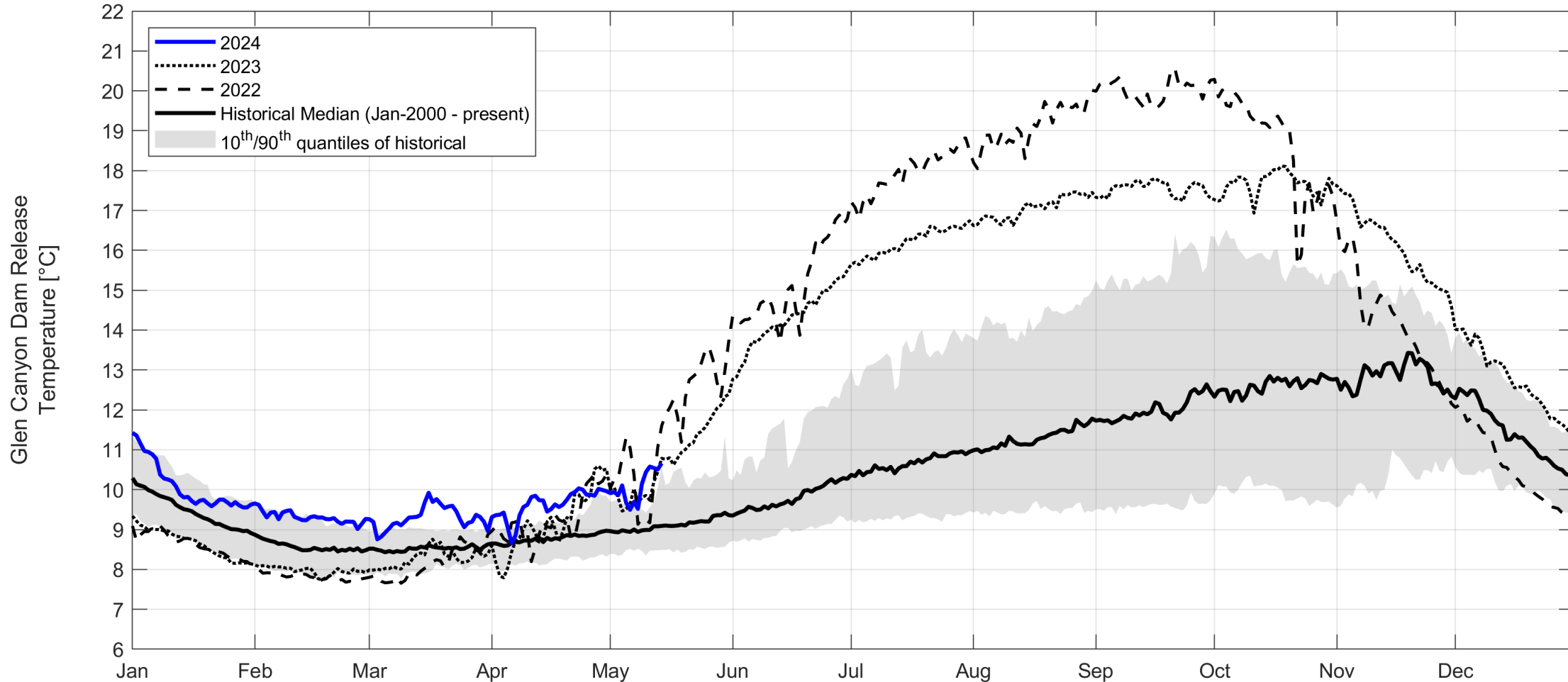


- Reservoir is starting to stratify
- Surface temperatures are warm





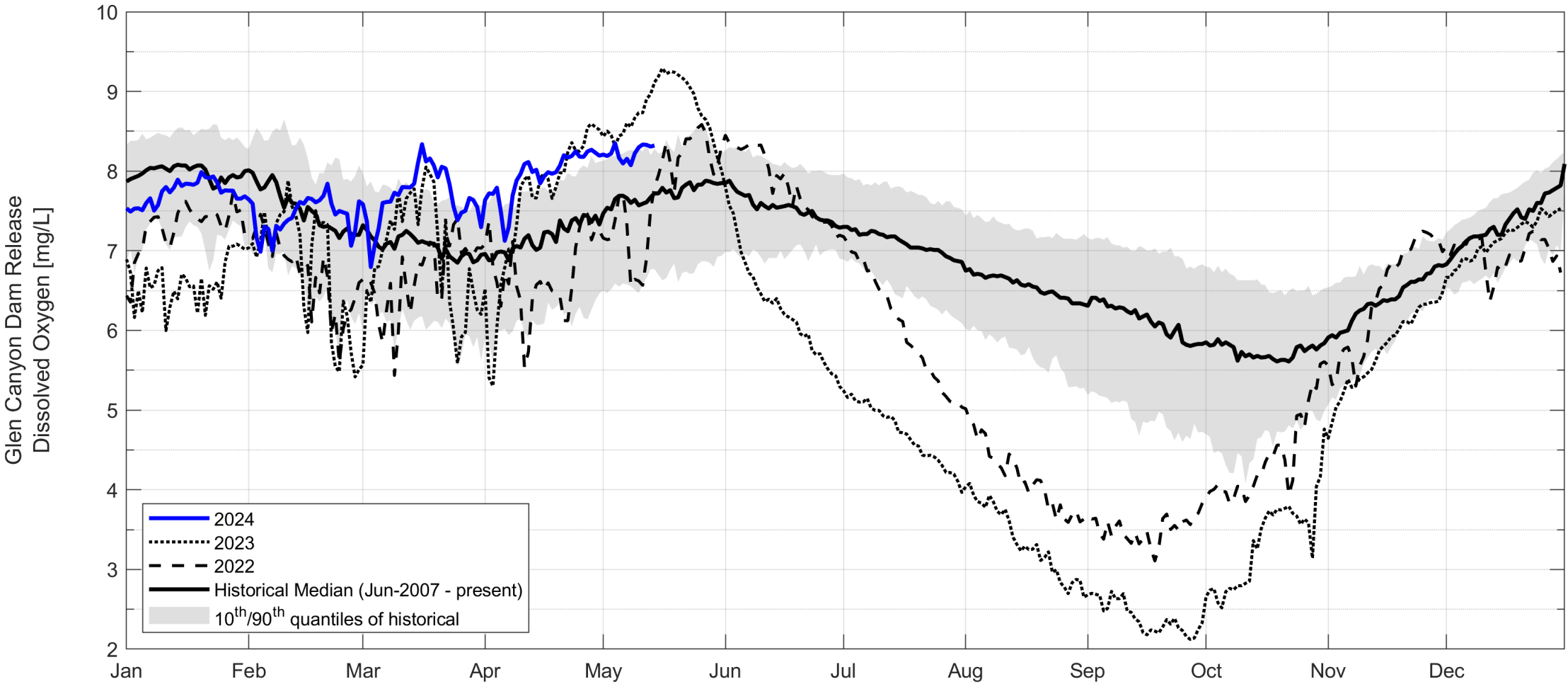
# Glen Canyon Dam Observations - Temperature



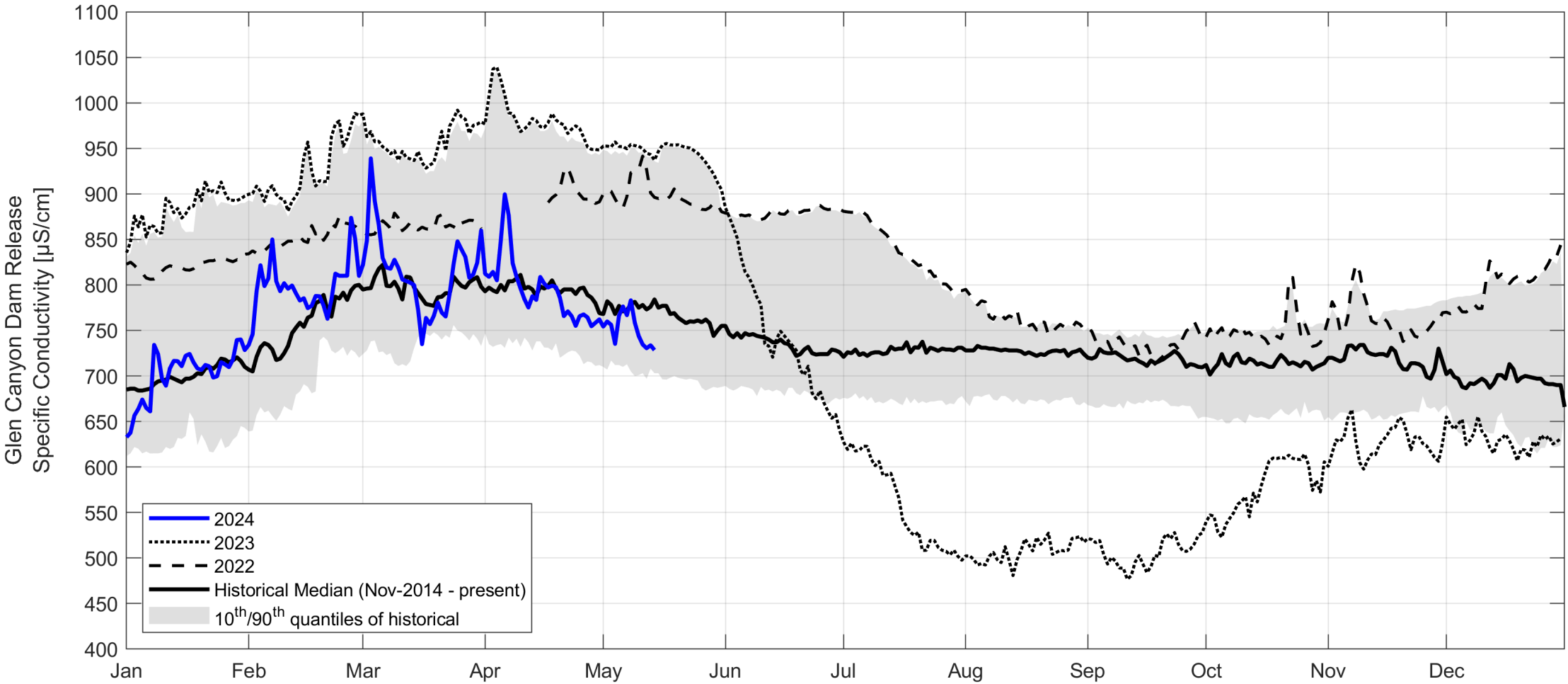
- Already starting to observe warmer than normal releases out of the dam



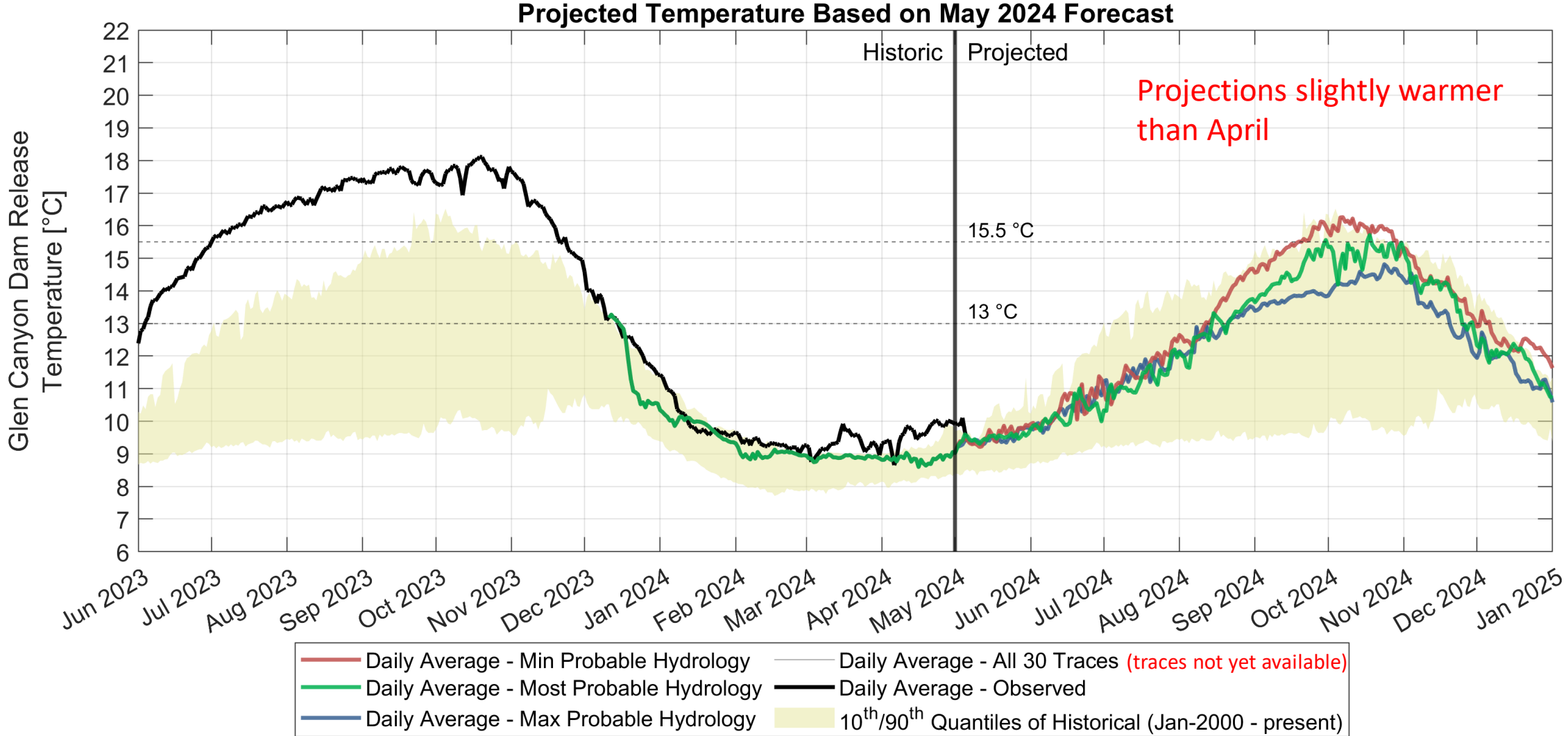
# Glen Canyon Dam Observations – Dissolved Oxygen



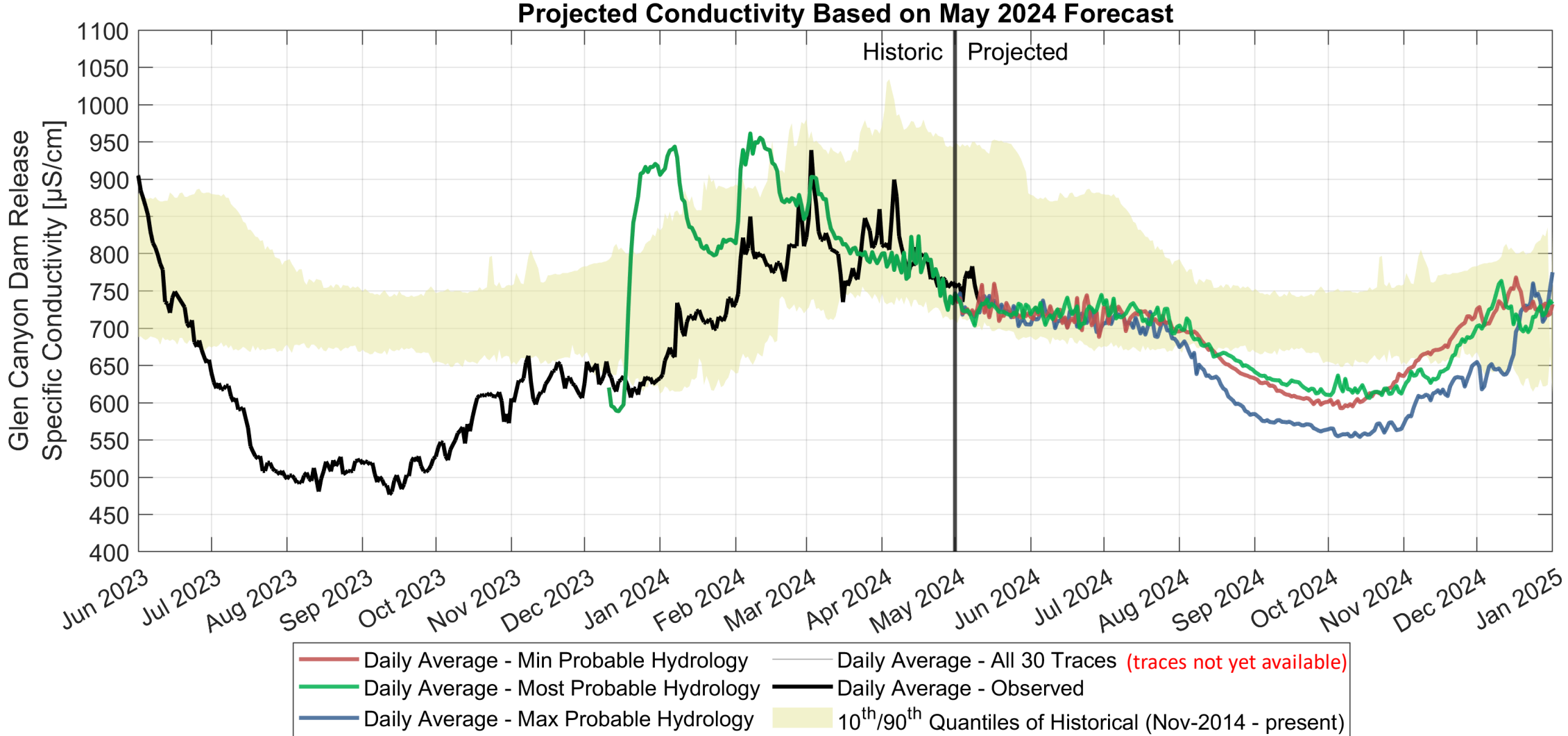
# Glen Canyon Dam Observations – Specific Conductance



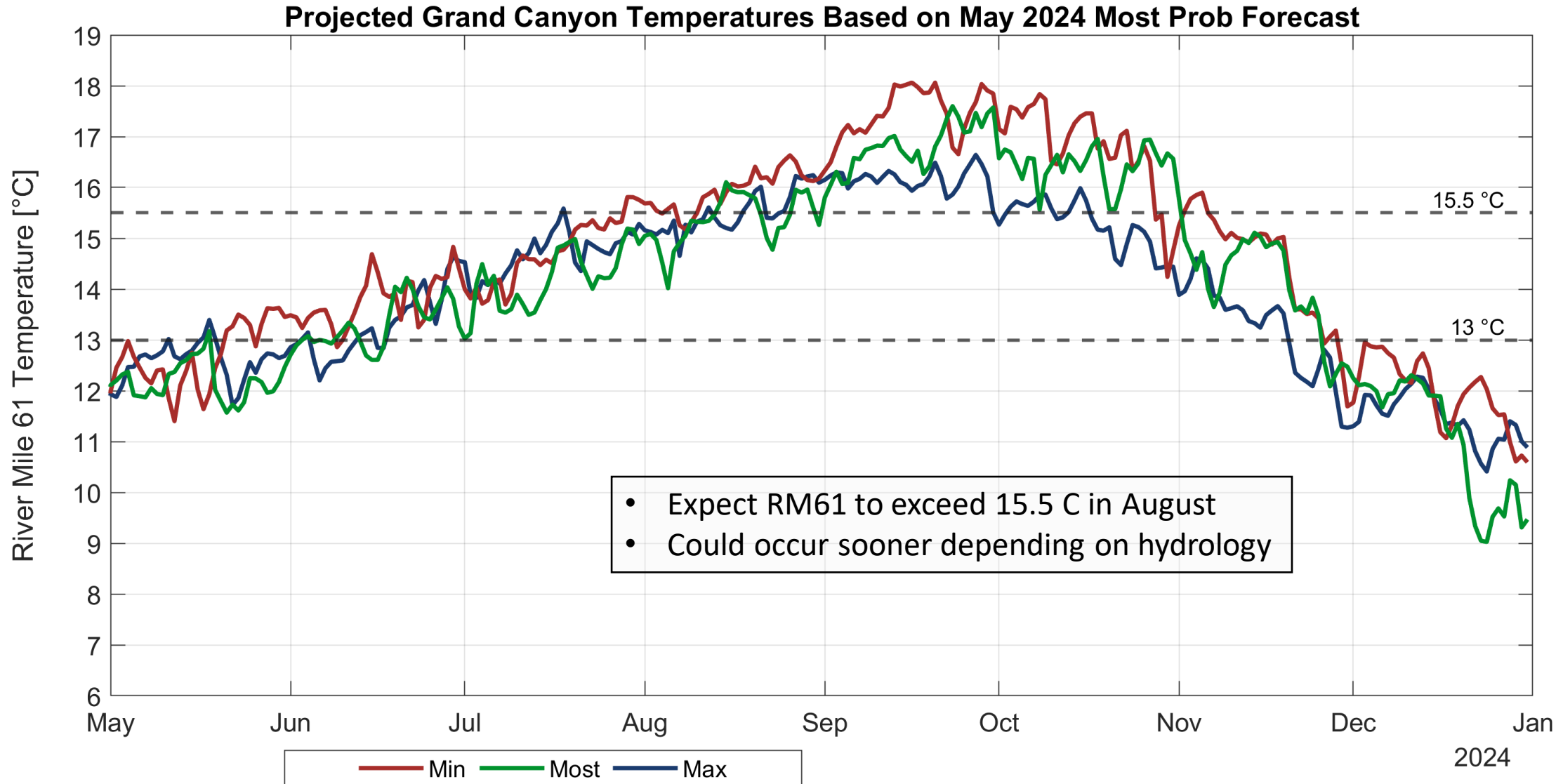
# CE-QUAL-W2 Modeled Temperature



# CE-QUAL-W2 Modeled Conductivity



# Dibble et al. Grand Canyon Modeled Temperature



# Questions?



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