



— BUREAU OF —
RECLAMATION

Glen Canyon Monthly Operations Call

Basin Hydrology and Operations

November 22, 2022

Background

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

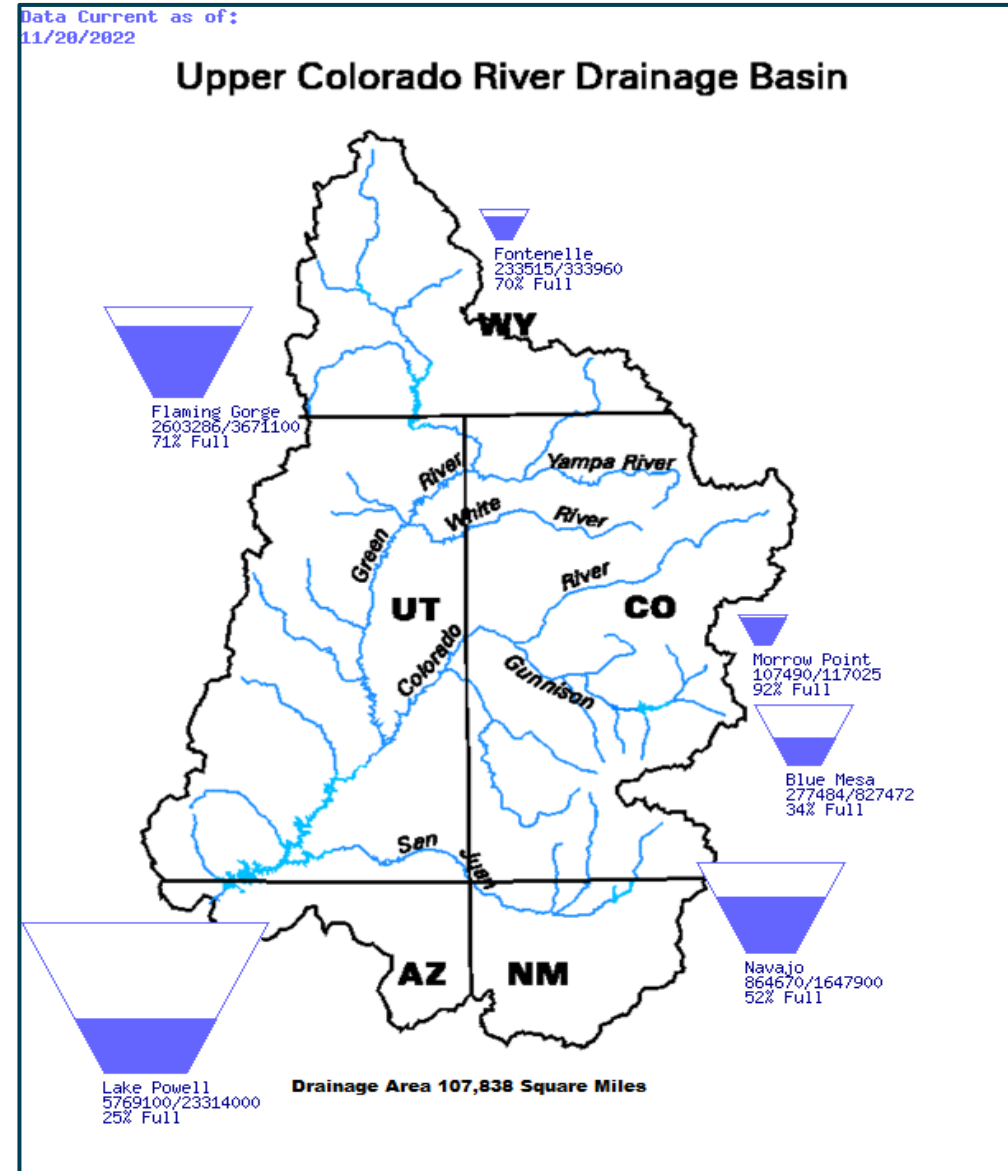
“Annually, Reclamation will develop a hydrograph based on the characteristics above. Reclamation will seek consensus on the annual hydrograph through monthly operational coordination calls with governmental entities, and regular meetings of the GCDAMP Technical Working Group (TWG) and AMWG.

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.”



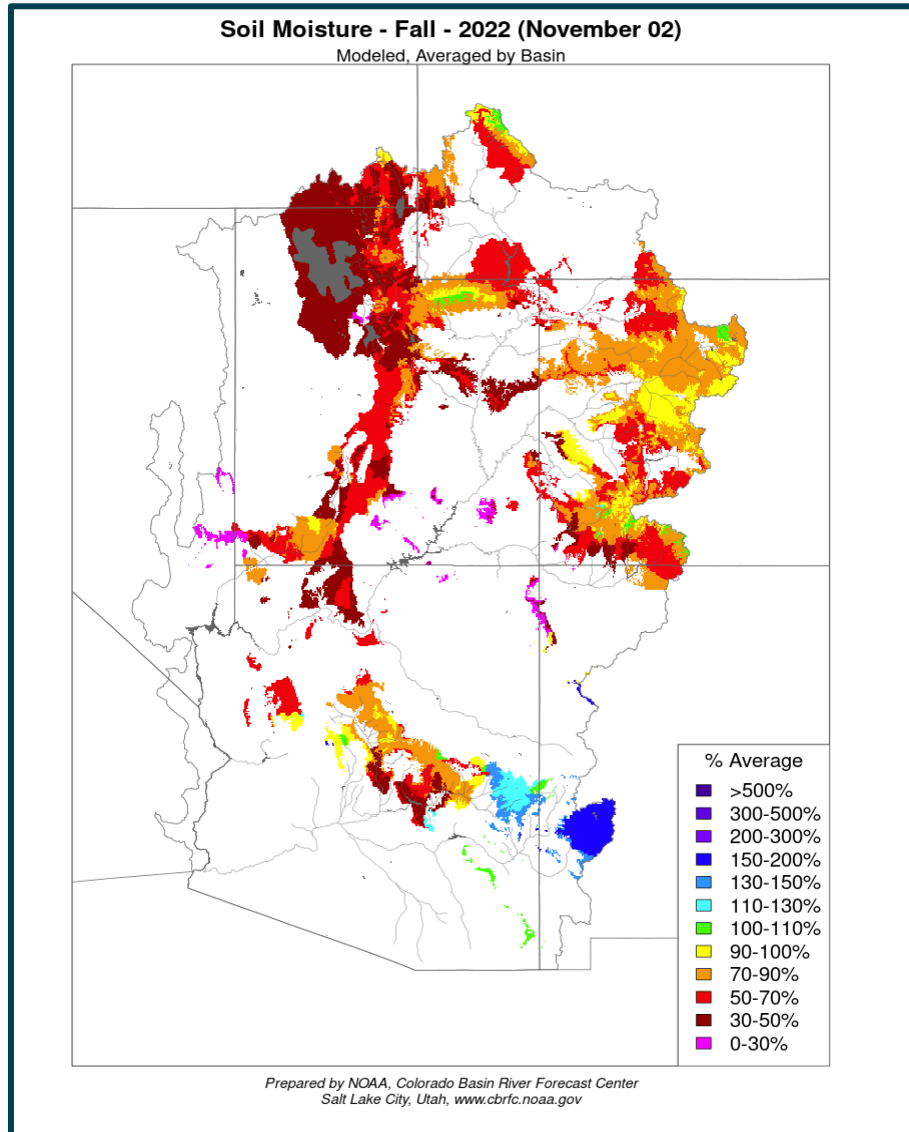
Upper Basin Storage (as of November 20, 2022)

Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	70	0.23	0.33	6,492.28
Flaming Gorge	71	2.60	3.67	6,010.61
Blue Mesa	34	0.28	0.83	7,444.00
Navajo	52	0.86	1.65	6,019.83
Lake Powell	25	5.77	23.31	3,528.85
UC System Storage	33	9.87	29.79	
Total System Storage	33	19.25	58.48	

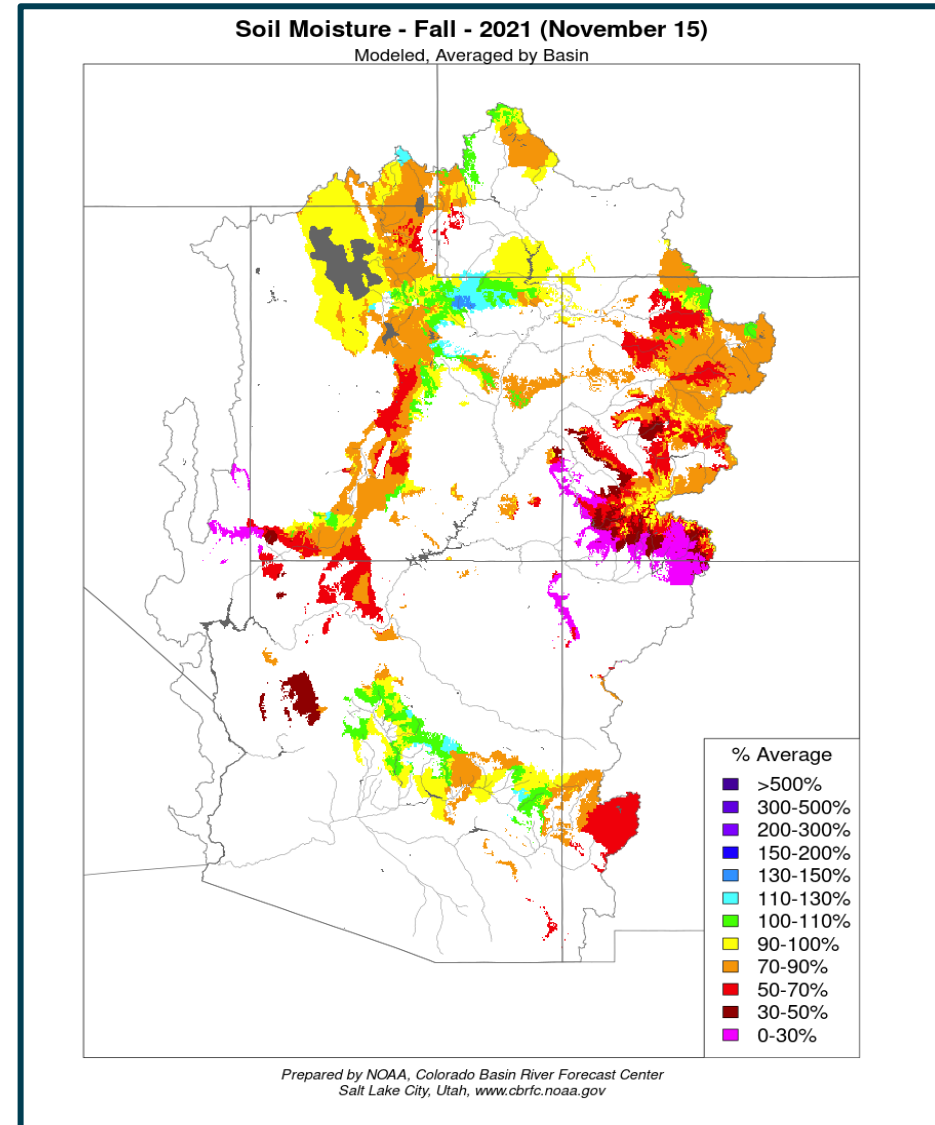


November Soil Moisture Comparison WY2022 and WY2023

Soil Moisture – November 2, 2022

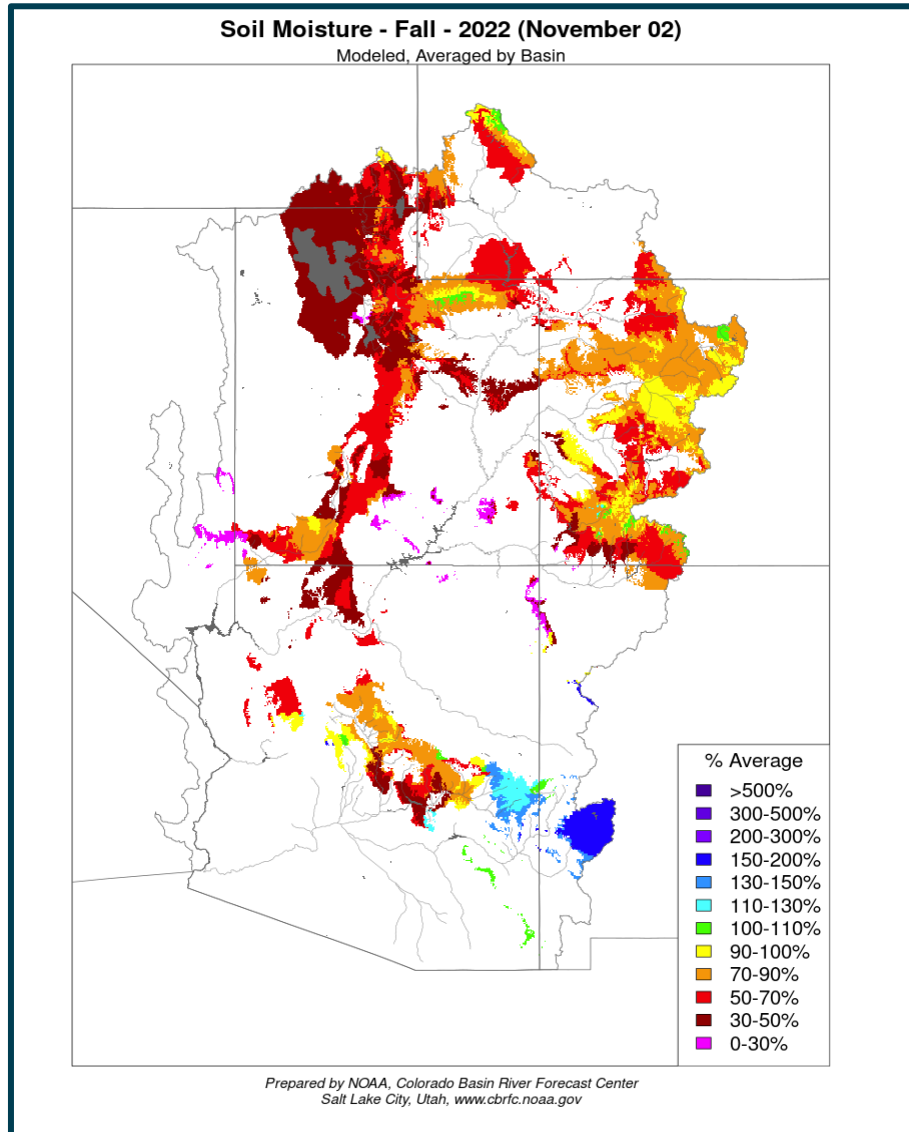


Soil Moisture – November 15, 2021

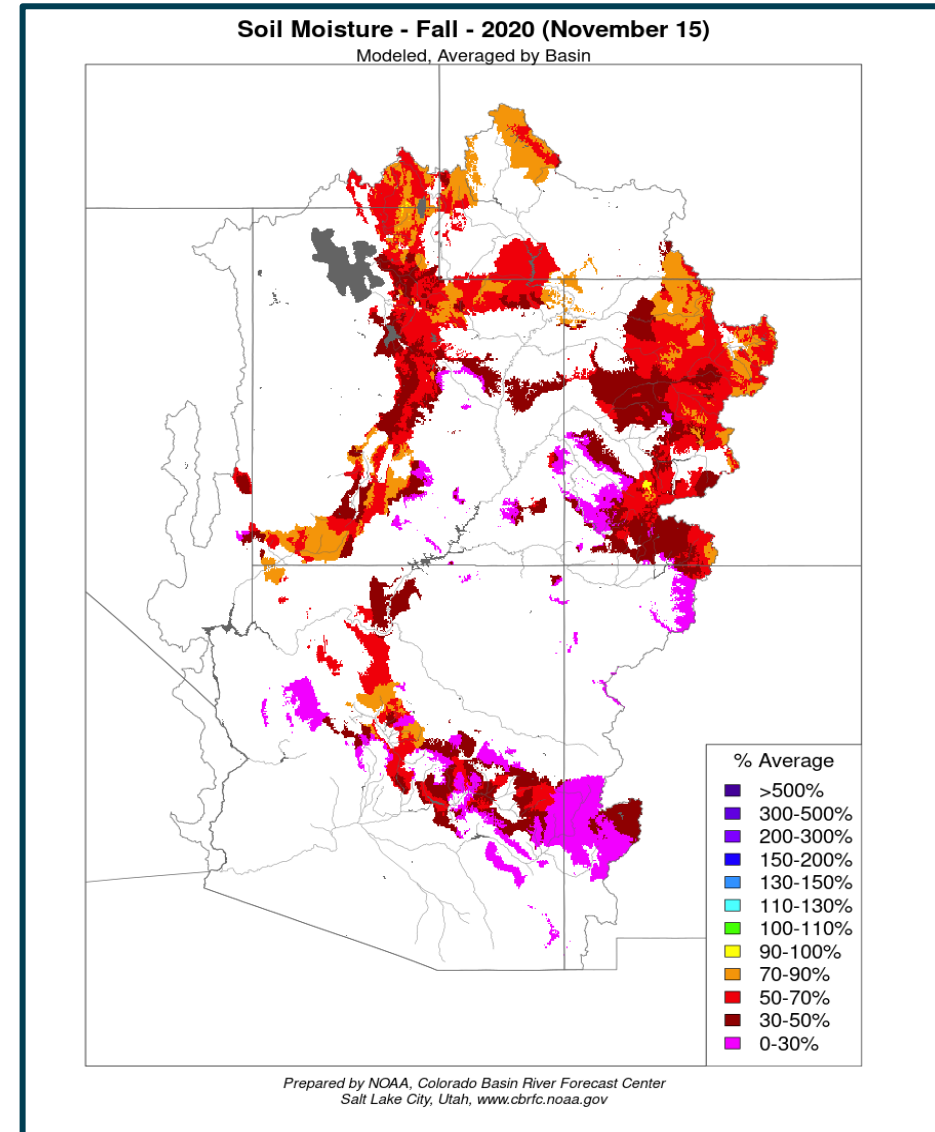


November Soil Moisture Comparison WY2021 and WY2023

Soil Moisture – November 2, 2022

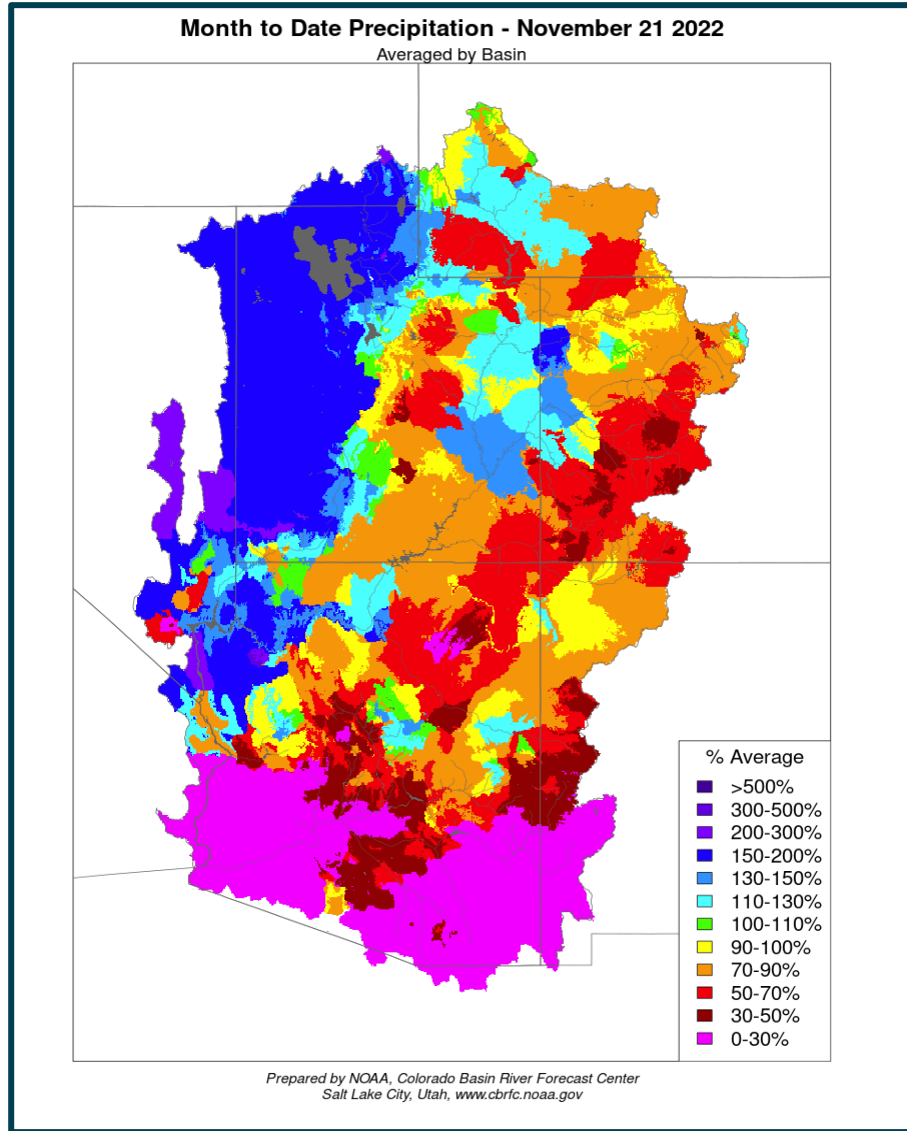


Soil Moisture – November 15, 2020

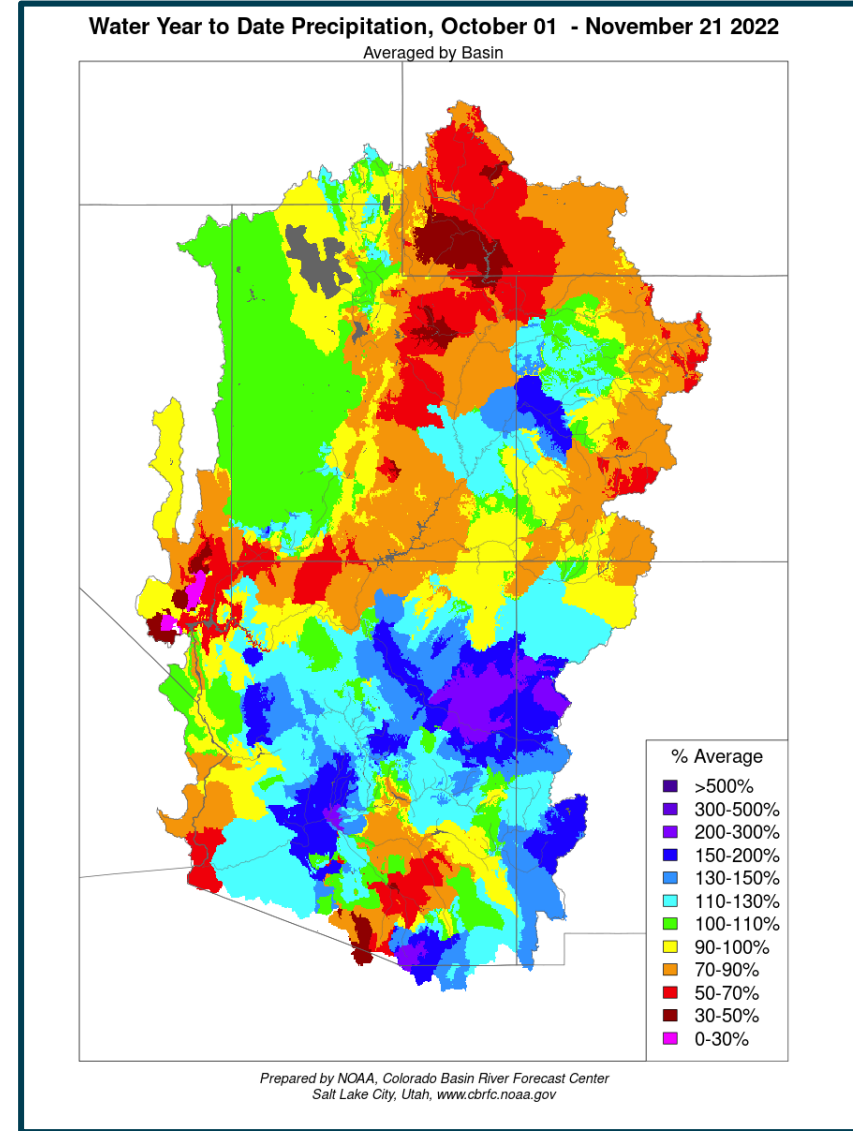


November Month and WY Precipitation

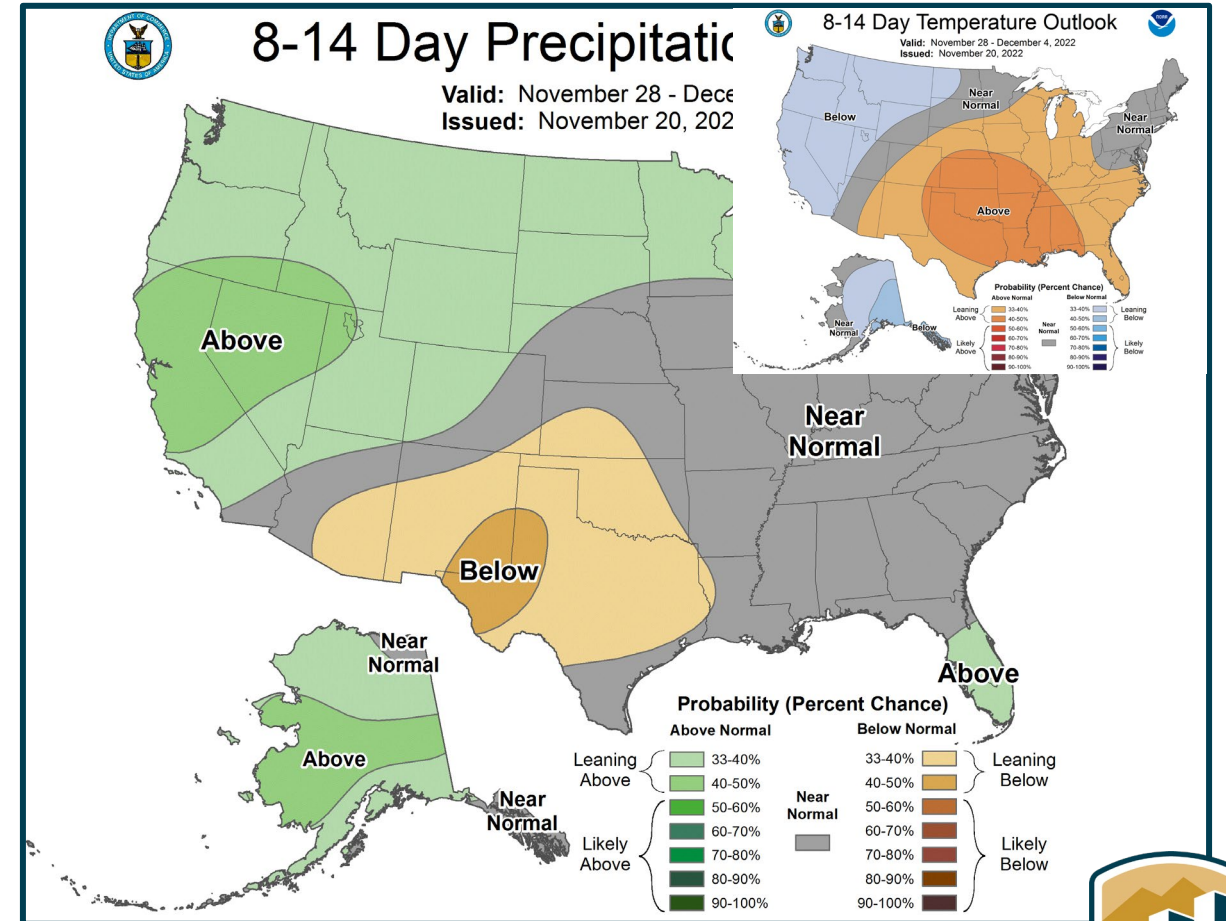
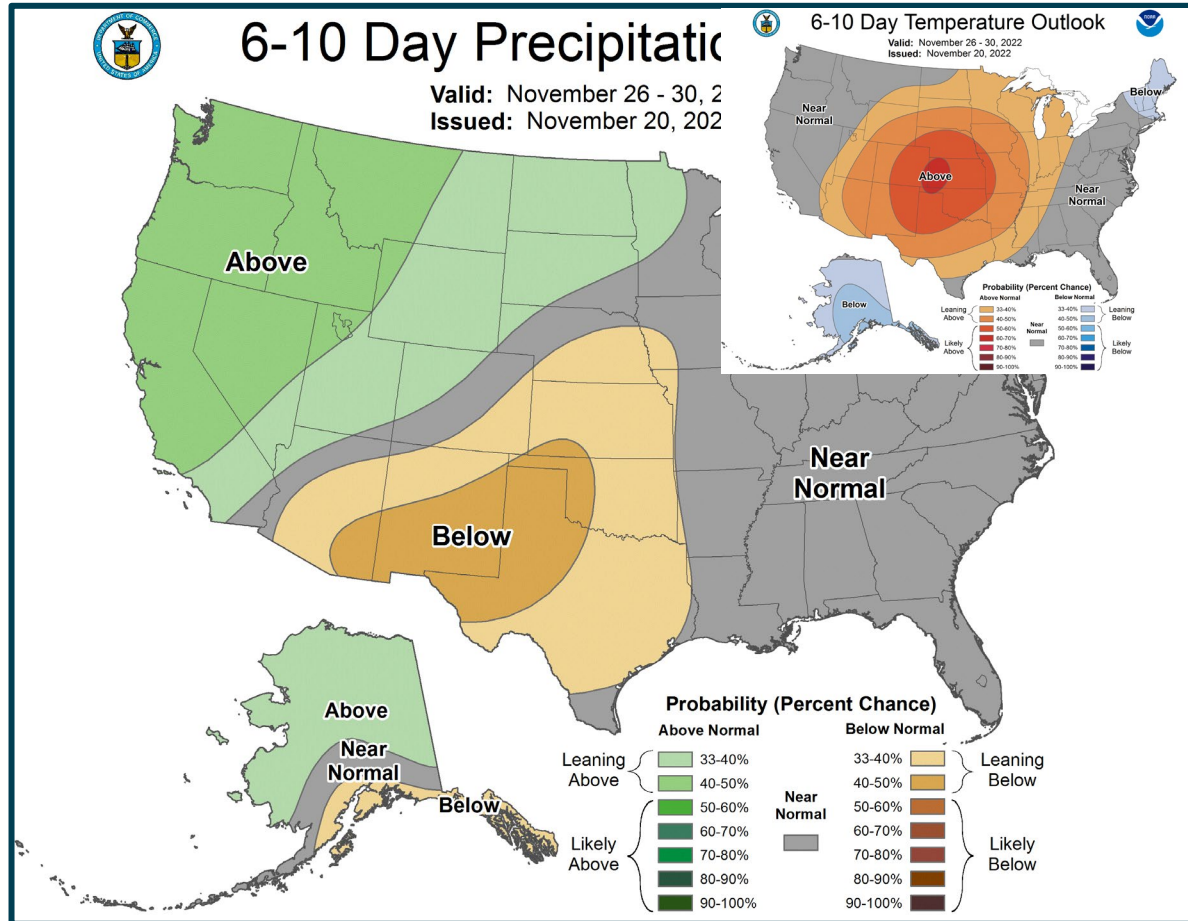
Month to Date Precipitation



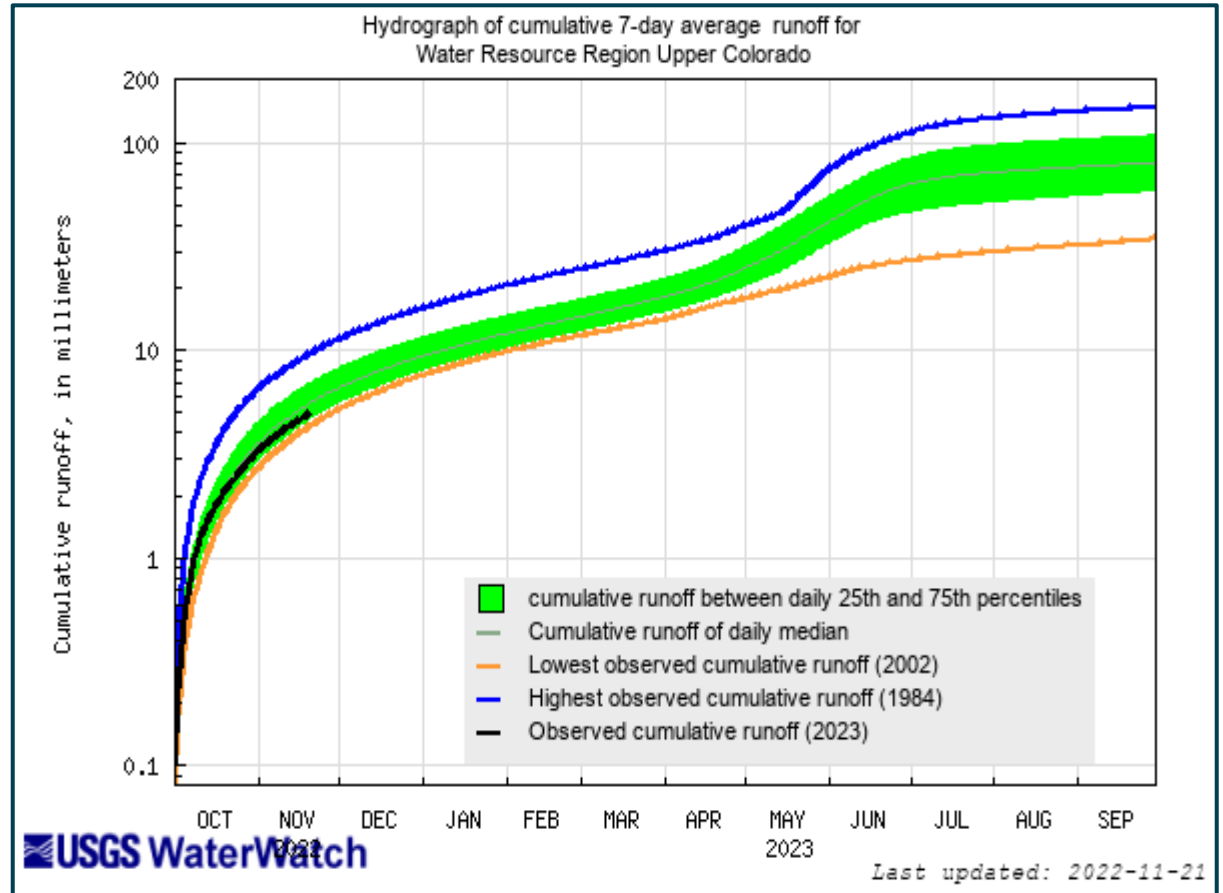
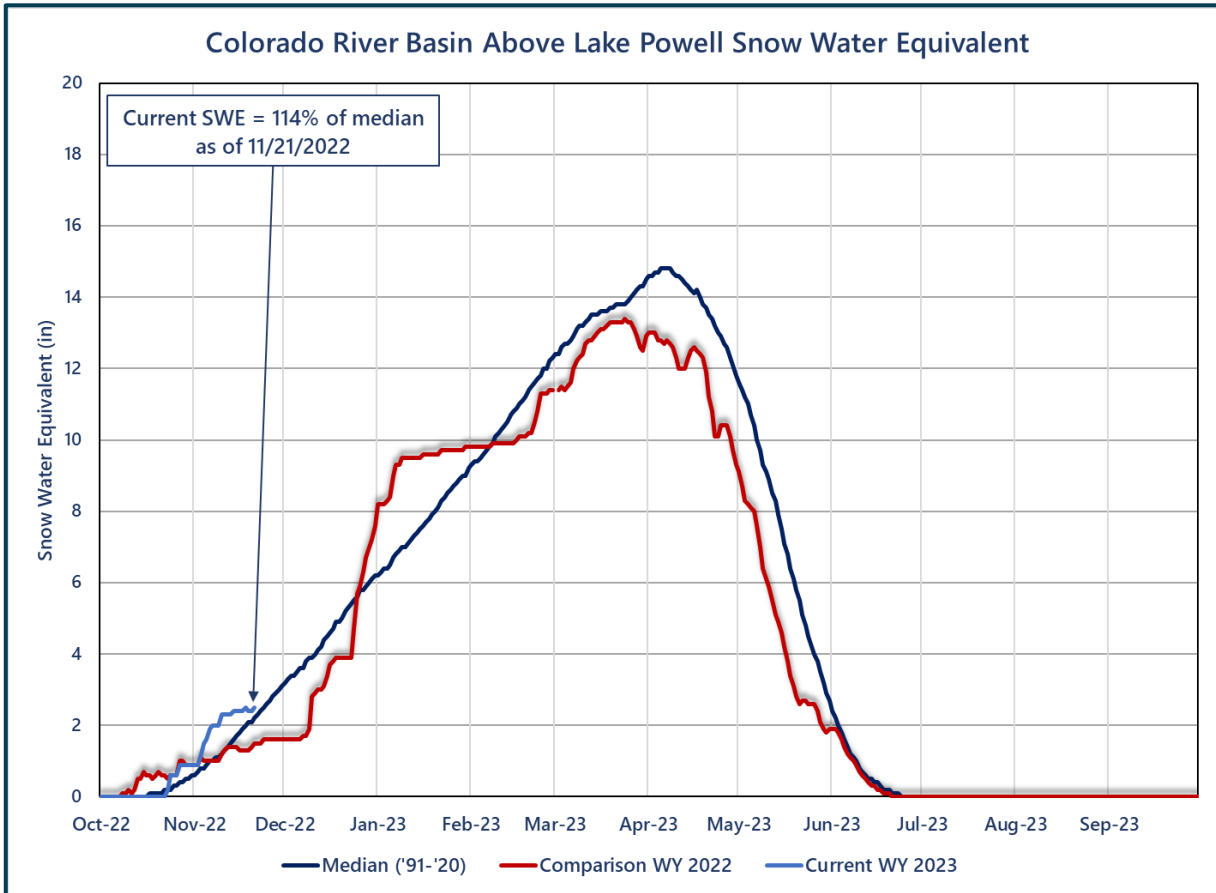
WY to Date Precipitation



Climate Prediction Center Short-Term Precipitation Forecast



Upper Colorado SWE and Observed Inflows



Available online at: https://waterwatch.usgs.gov/index.php?id=wwdur_cumrunoff



Most Probable November Forecast Water Years 2023

April – July 2023
Forecasted Unregulated Inflow
as of November 2, 2022²

Reservoir	Inflow (kaf)	Percent of Avg ¹
Fontenelle	610	83
Flaming Gorge	790	82
Blue Mesa	577	91
Navajo	530	84
Powell	5,285	83

Water Year 2023
Unregulated Inflow Forecast
as of November 2, 2022²

Reservoir	Inflow (kaf)	Percent of Avg ¹
Fontenelle	901	84
Flaming Gorge	1,159	82
Blue Mesa	805	89
Navajo	765	84
Powell	8,000	83

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

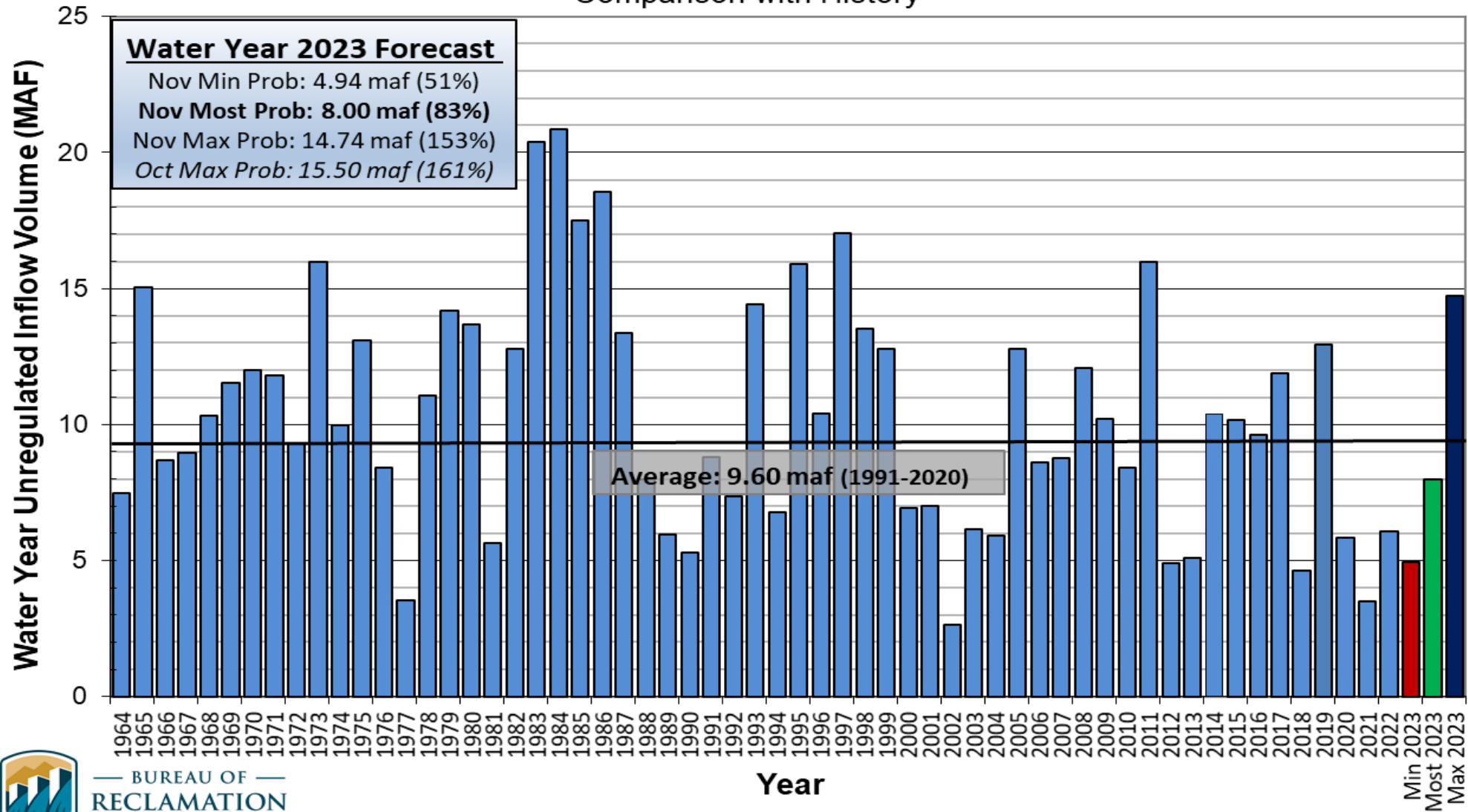
²November midmonth WY forecast remained the same for Powell, Blue Mesa and Navajo. Fontenelle and Flaming Gorge increased slightly.



Lake Powell Unregulated Inflow

Water Year 2023 Forecast (issued November 2)

Comparison with History





Upper Colorado Basin

Hydrology and Operations
Projections Based on
October and November 2022
24-Month Study



Upper Basin Drought Response Actions

- The Bureau of Reclamation announced on May 3, 2022, two separate urgent drought response actions that will help prop up Lake Powell by nearly 1 million acre-feet (maf) of water over the next 12 months (May 2022 through April 2023). To protect Lake Powell, more water will flow into the lake from upstream reservoirs and less water will be released downstream:
 - Under a Drought Contingency Plan adopted in 2022, approximately 500 thousand acre-feet (kaf) of water will come from Flaming Gorge Reservoir, located approximately 455 river miles upstream of Lake Powell (2022 Plan).
 - For more information: <https://www.usbr.gov/uc/DocLibrary/Plans/20220429-2022DroughtResponseOperationsPlan-ApprovalMemo-508-DOI.pdf>.
 - Another 480 kaf will be left in Lake Powell by reducing Glen Canyon Dam's annual release volume from 7.48 maf to 7.00 maf (GC Operational Adjustment), in accordance with Sections 6 and 7.D of the 2007 Interim Guidelines.
 - For more information: <https://www.usbr.gov/uc/DocLibrary/Plans/20220503-2022DROA-GlenCanyonDamOperationsDecisionLetter-508-DOI.pdf>



Drought Response Operations Agreement (DROA)

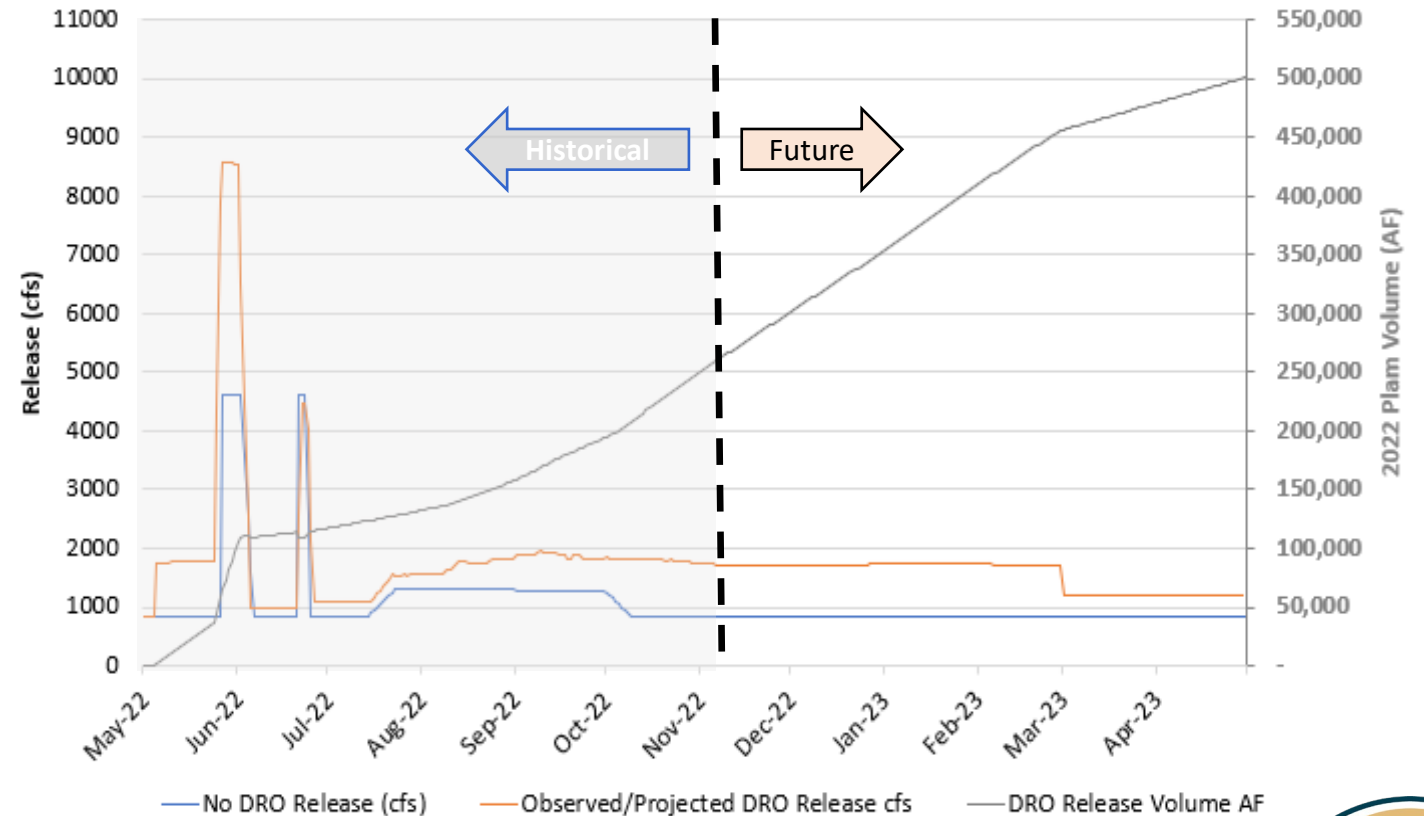
DROA Volumes Released¹

Reservoir	2021 DROA Volume (kaf)	2022 DROA Volume (kaf)	Total DROA Volume (kaf)
Flaming Gorge	125	500	625
Blue Mesa	36	0	36
Navajo	0	0	0
Volume in Powell	161	500	661

¹DROA operational year is from May through April.

Flaming Gorge 2022 Plan Daily Releases

Flaming Gorge wDRO & woDRO -- DRO Volume



Flaming Gorge DROA release as of November 21 = 283 kaf



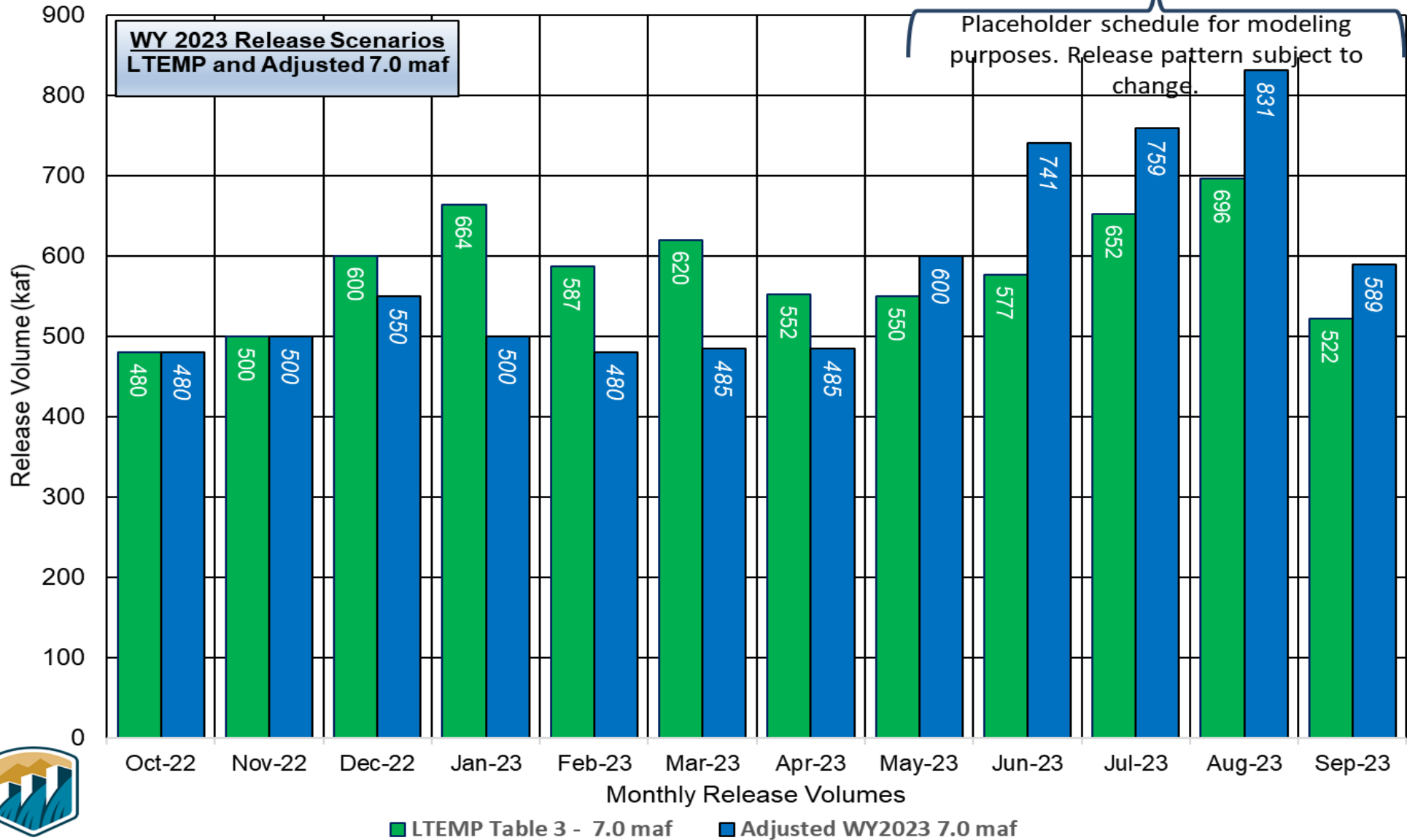
Upper Basin Reservoir Operations in Water Year 2023

- 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's projected end of calendar year (CY) 2022 "tier determination" elevation in the August 2022 24-Month Study determines Lake Powell's operating tier in CY 2023
 - Lake Powell 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
- 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.
 - The Glen Canyon Dam annual release has initially been set to 7.00 maf, and in April 2023 Reclamation will evaluate hydrologic conditions to determine if balancing releases may be appropriate under the conditions established in the 2007 Interim Guidelines;
 - Balancing releases will be limited (with a minimum of 7.00 maf) to protect Lake Powell from declining below elevation 3,525 feet at the end of December 2023;
 - Balancing releases will take into account operational neutrality of the 0.480 maf that was retained in Lake Powell under the May 2022 action1. Any Lake Powell balancing release volume will be calculated as if the 0.480 maf had been delivered to Lake Mead in WY 2022; and
 - The modeling approach for WY 2023 will apply to 2024.



Lake Powell Monthly Release Volume Distribution

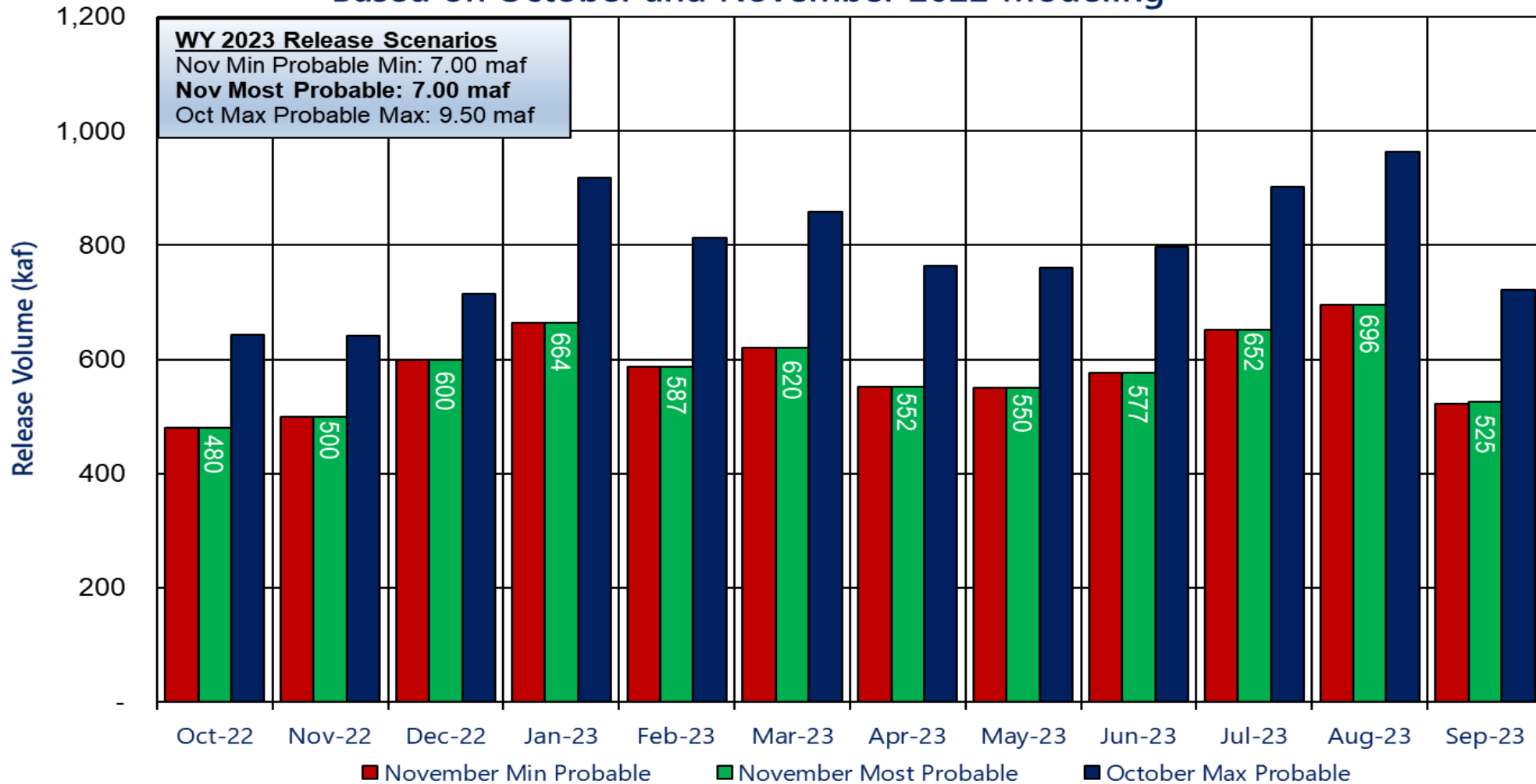
7.0 maf Pattern for Water Year 2023



Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2023

Based on October and November 2022 Modeling



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.



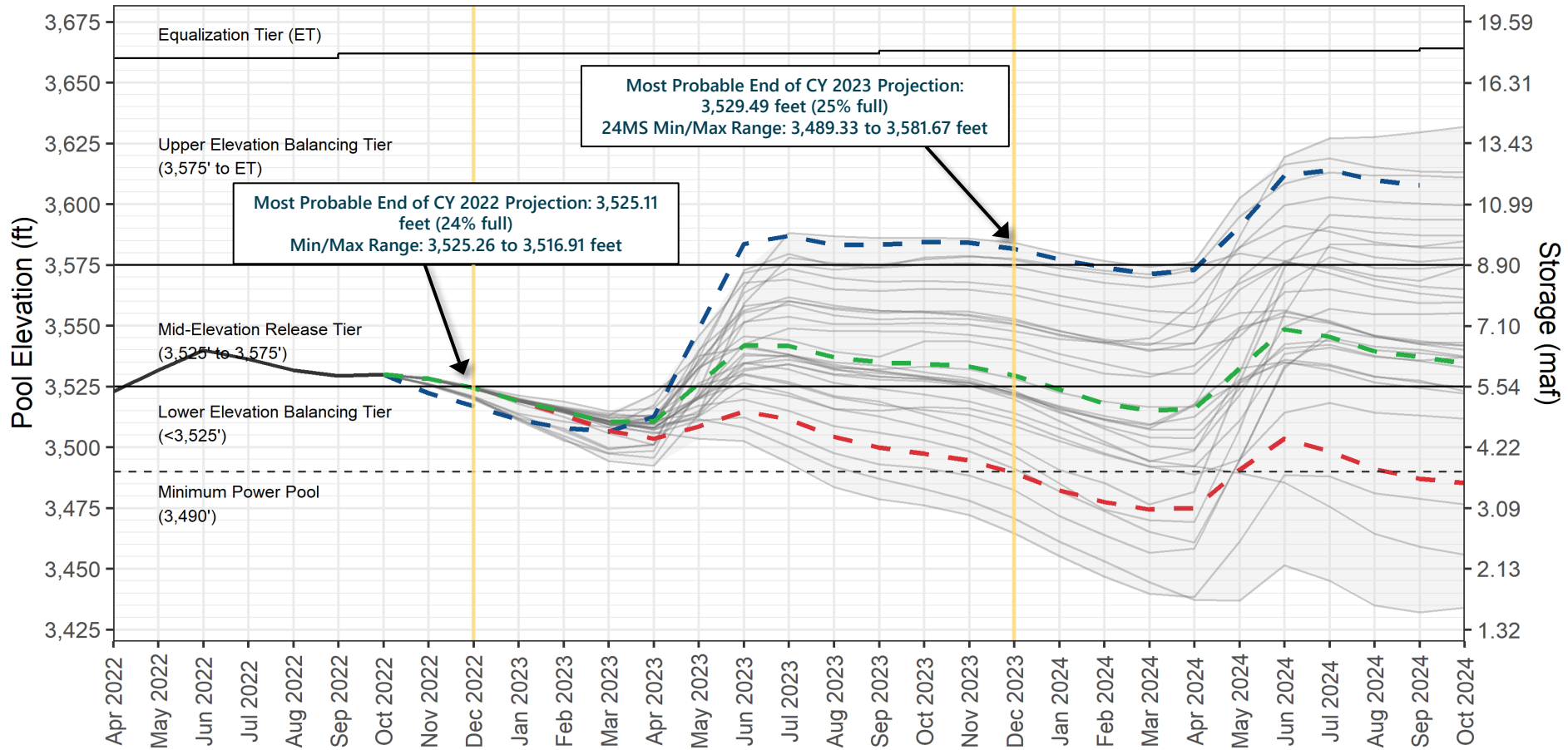
Reclamation Operational Modeling Model Comparison

	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 Elevations¹

CRMMS Projections from October and November 2022



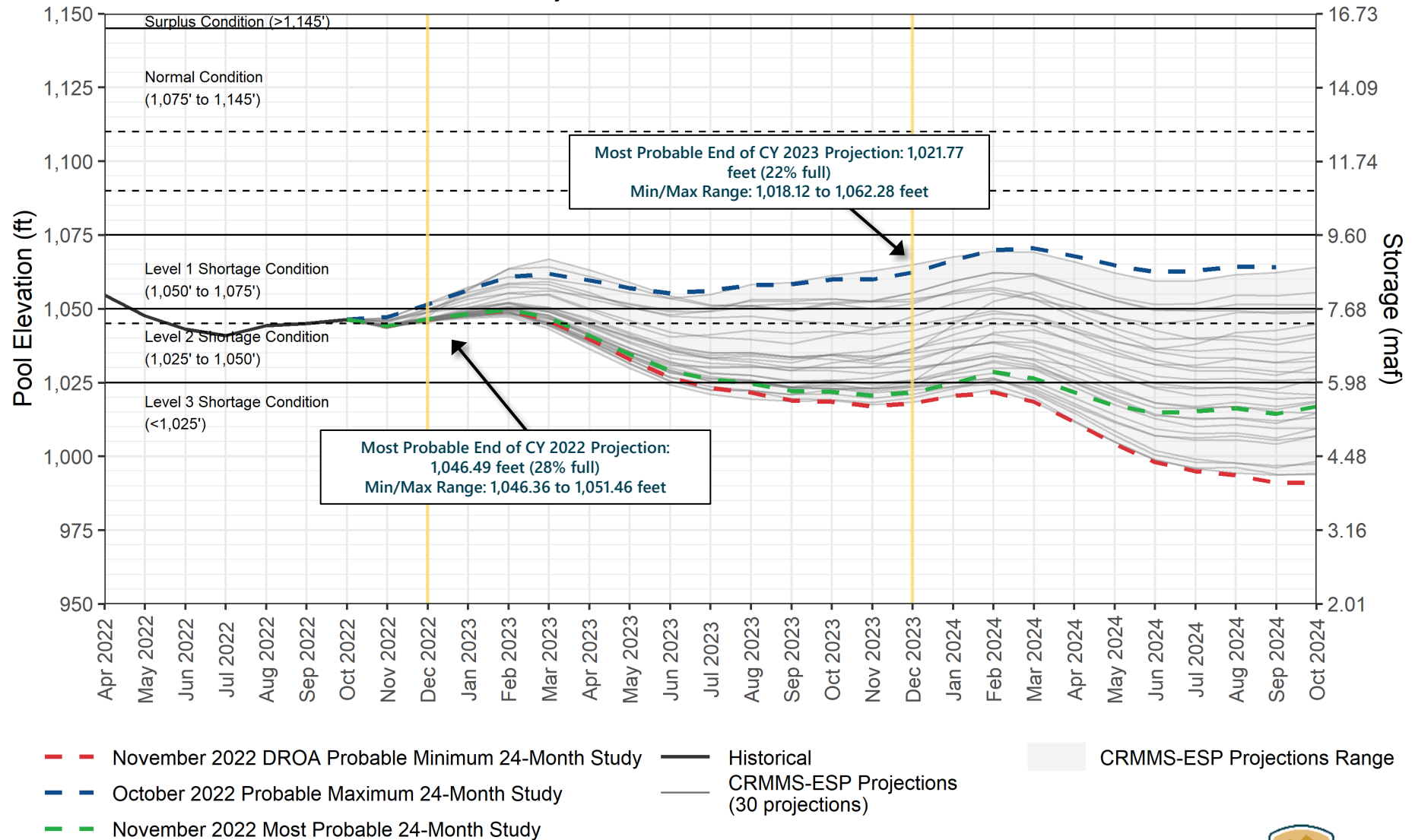
- - - November 2022 DROA Probable Minimum 24-Month Study
- - - October 2022 Probable Maximum 24-Month Study
- - - November 2022 Most Probable 24-Month Study
- Historical
- CRMMS-ESP Projections (30 projections)
- CRMMS-ESP Projections Range

¹ Projected Lake Powell end-of-month physical elevations from the latest CRMMS-ESP and 24-Month Study inflow scenarios.



Lake Mead End-of-Month Elevations¹

CRMMS Projections from October and November 2022



¹ Projected Lake Mead end-of-month physical elevations from the latest CRMMS-ESP and 24-Month Study inflow scenarios.





Upper Colorado Basin

Hydropower Maintenance



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	6	6	6	6	6	4	6	6	6	6	6	4	
Capacity (cfs)	18,200	18,150	18,050	18,000	17,850	11,220	17,850	18,350	18,750	18,700	18,450	11,600	NOV MOST ²
Capacity (kaf/month)	1,120	1,080	1,110	1,120	1,020	750	1,060	1,130	1,110	1,150	1,140	760	NOV MOST
Max (kaf) ¹	643	642	715	919	813	858	764	791	798	902	963	722	9.5 maf
Most (kaf) ¹	480	500	550	500	480	485	485	600	741	759	831	589	7.0 maf
Min (kaf) ¹	480	500	550	500	480	485	485	600	741	759	831	589	7.0 maf
													(updated 11-07-2022)

1 Projected release, based on November 2022 for the minimum and most and October 2022 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 WY2024

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	5	5	7	8	6	7	5	6	6	6	6	4
Capacity (cfs)	14,900	14,800	23,500	24,220	17,450	20,400	14,000	17,850	18,450	18,300	18,000	11,300
Capacity (kaf/month)	950	940	1,270	1,490	1,120	740	970	1,180	1,140	1,130	1,070	740
Max (kaf) ¹	643	642	715	857	758	801	713	710	745	842	900	674
Most (kaf) ¹	643	642	715	870	770	820	730	720	760	860	920	694
Min (kaf) ¹	480	500	600	664	587	620	552	550	577	652	696	522

NOV MOST²

NOV MOST

9.0 maf

9.14 maf

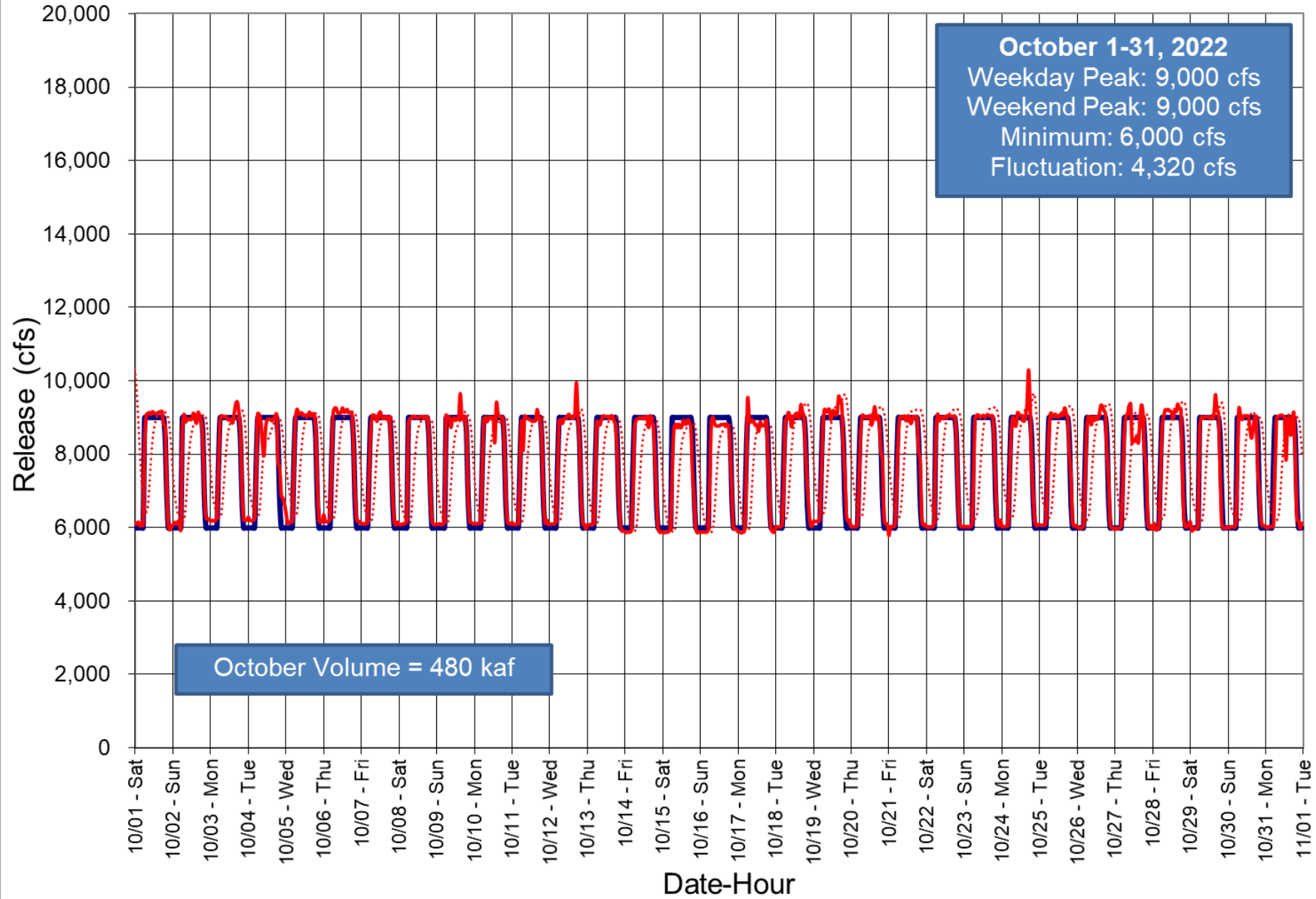
7.0 maf

(updated 11-07-2022)

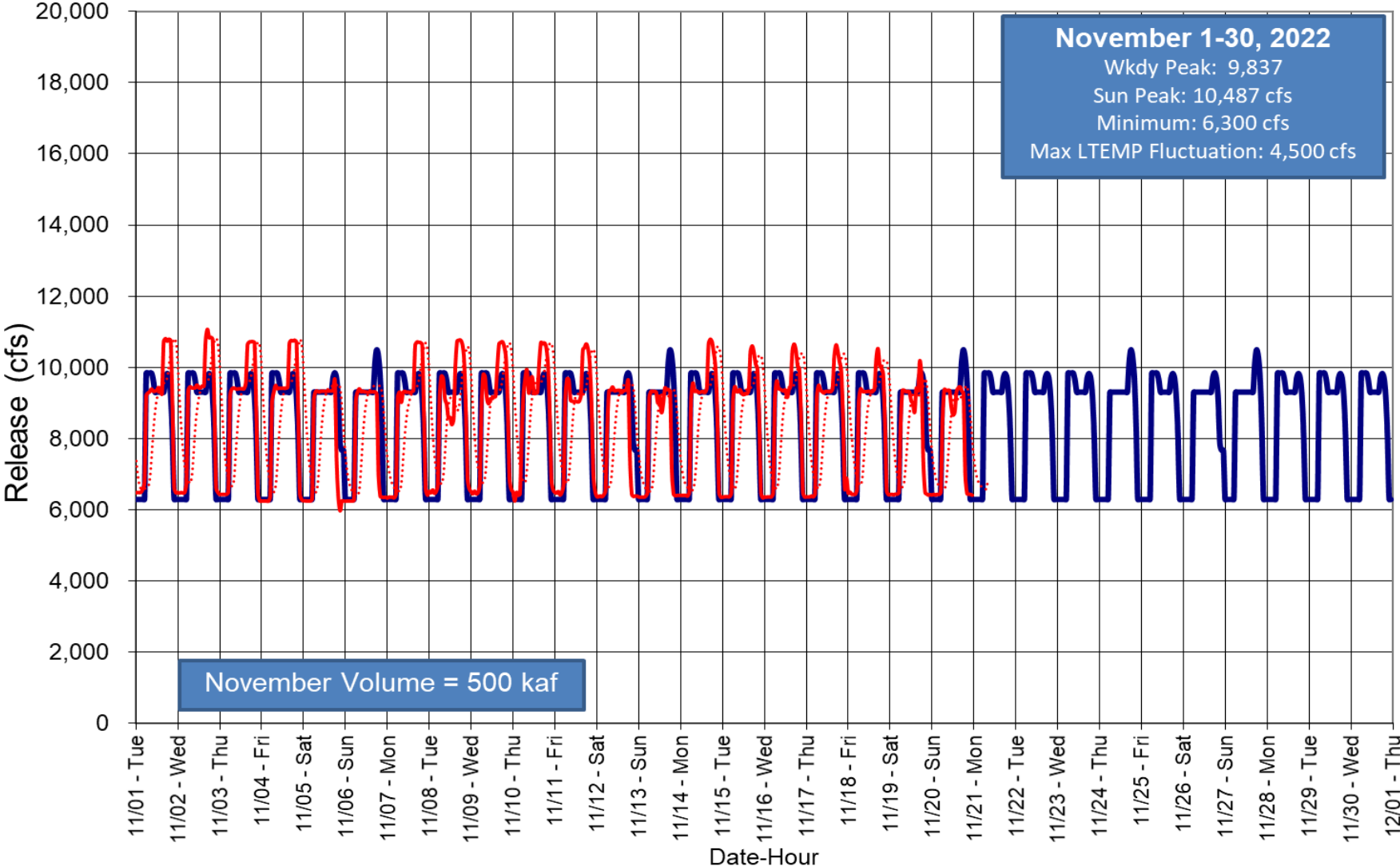
1 Projected release, based on November 2022 for the minimum and most and October 2022 maximum probable inflow projections and 24-Month Study model runs.
 2 Dependent upon availability to shift contingency reserves, which will increase capacity by 30-40MW (3%) at current efficiency.



Glen Canyon Dam Hourly Release Pattern October 2022



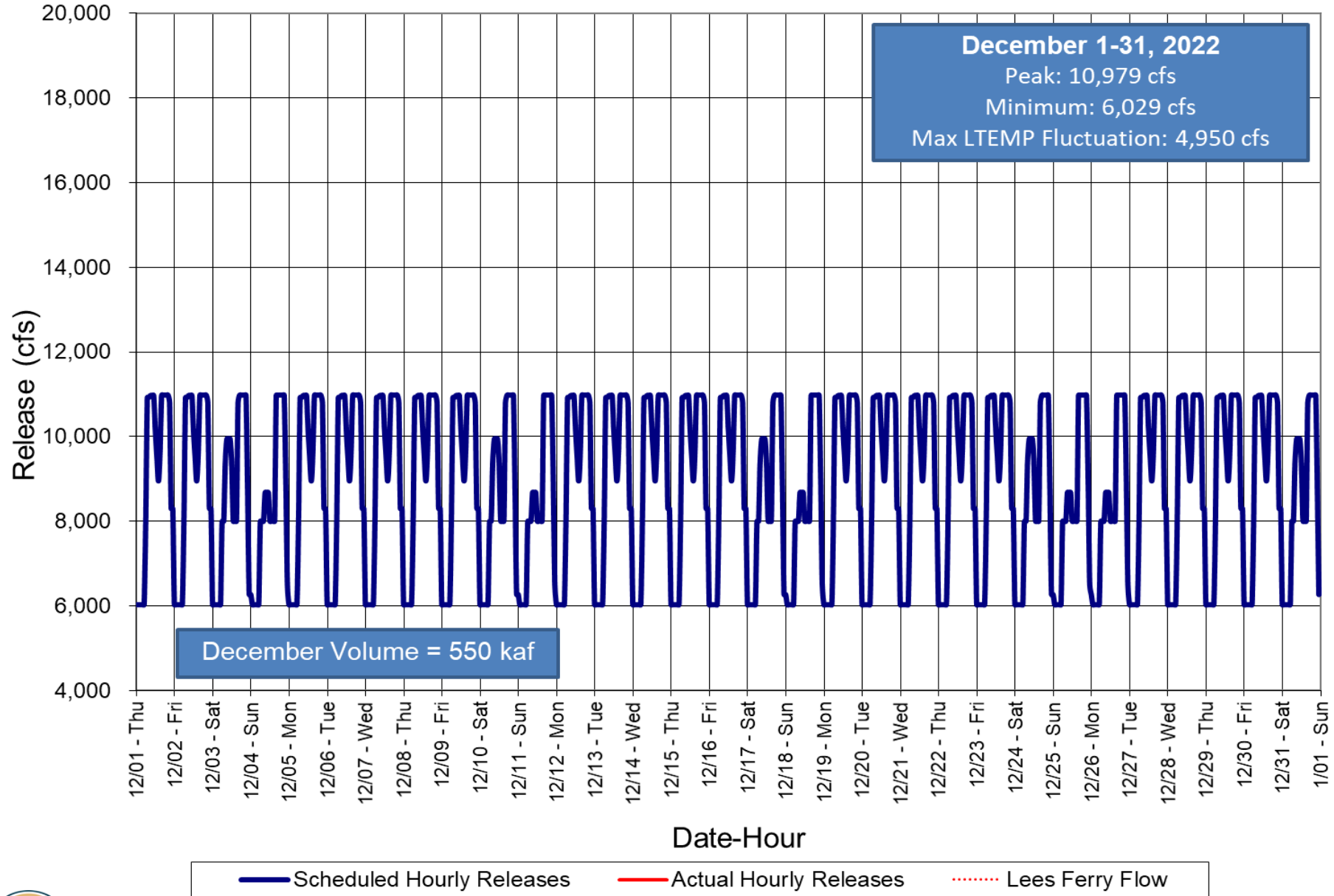
Glen Canyon Dam Hourly Release Pattern November 2022



— Scheduled Hourly Releases
 — Actual Hourly Releases
 ⋯ Lees Ferry Flow



Glen Canyon Dam Hourly Release Pattern December 2022



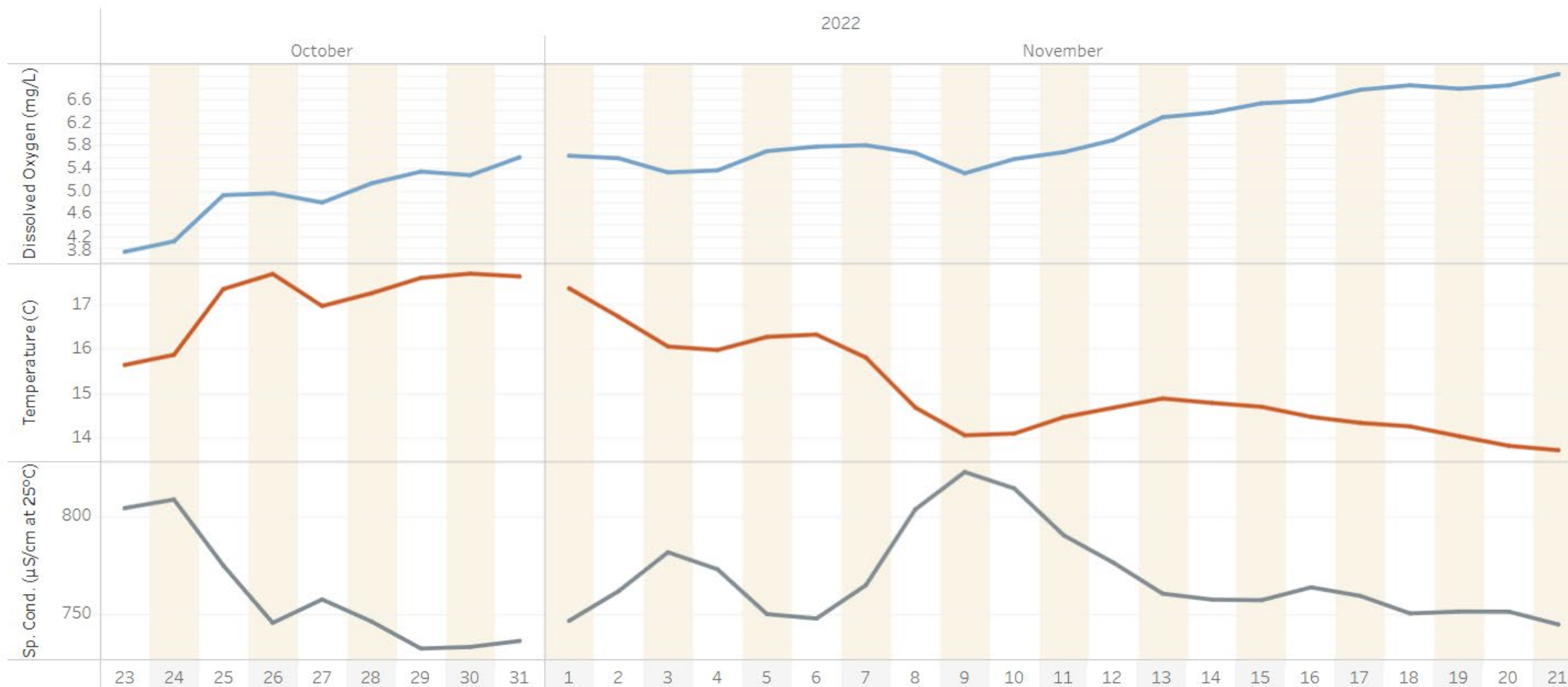
Water Quality



Daily Water Quality Data at Glen Canyon Dam

[Download PDF](#)


Daily Dissolved Oxygen & Temperature Values

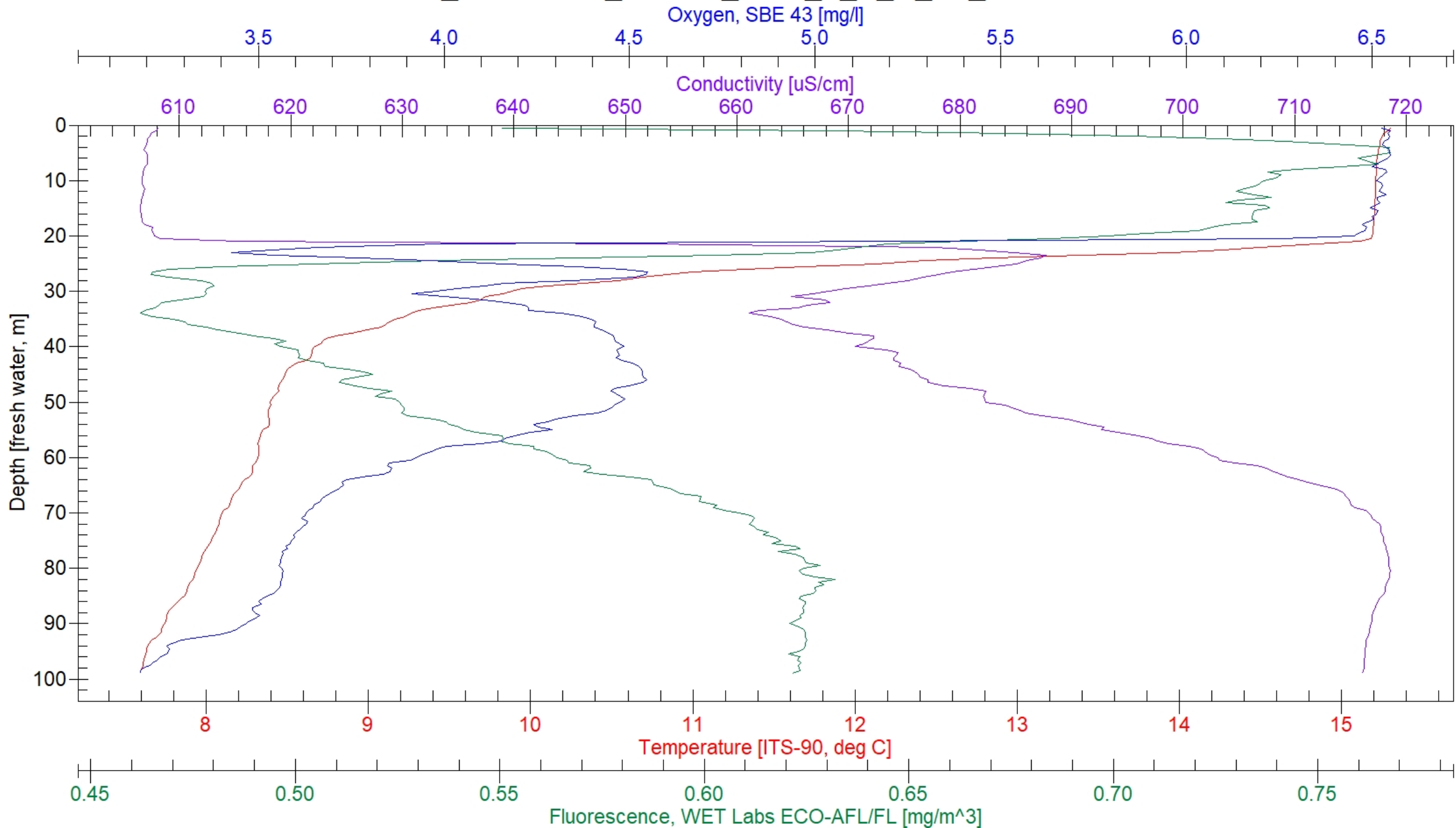


The trends of daily average Dissolved Oxygen, Temperature and Specific Conductance shown for the past 30 days.

Select Date Extent

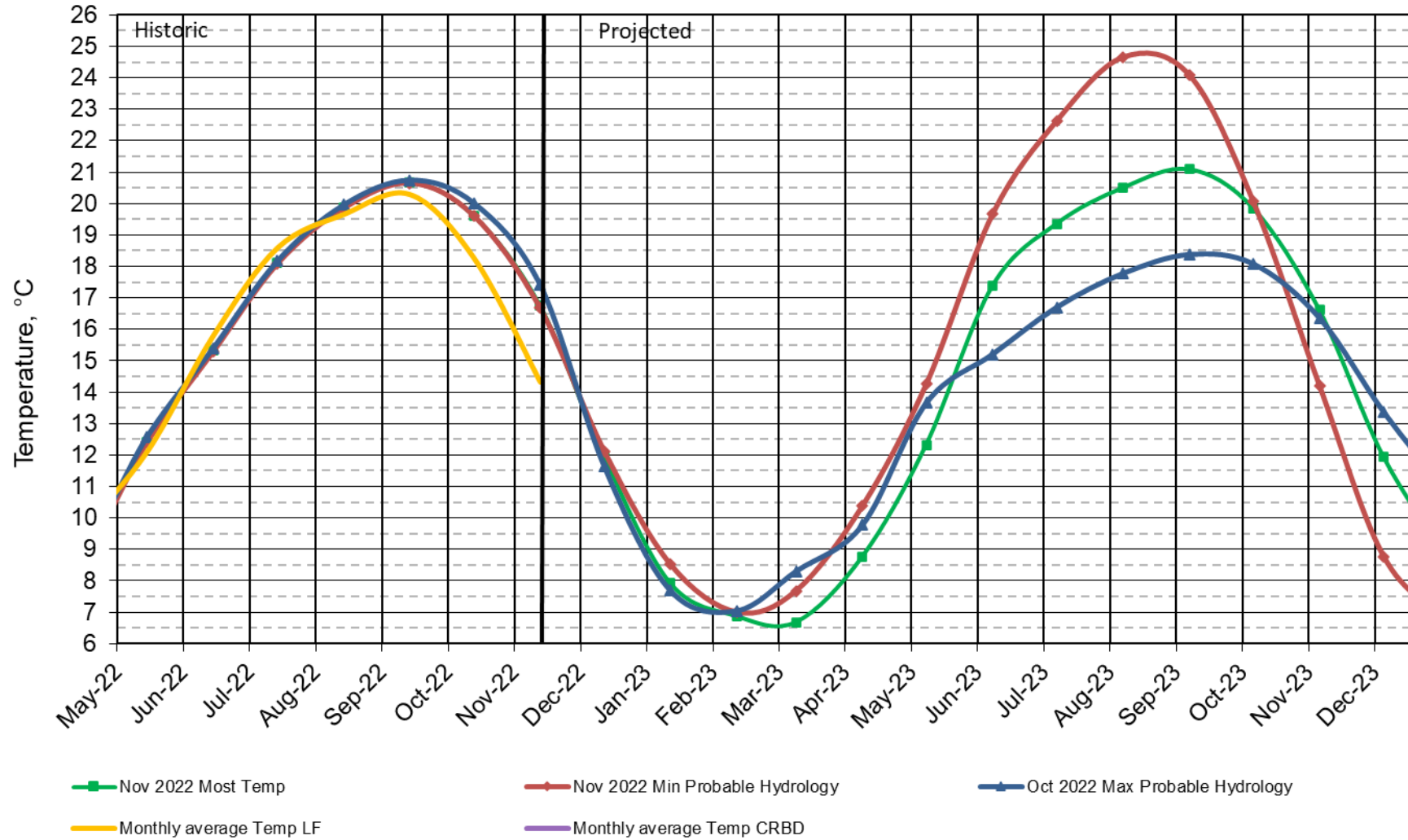
These data are preliminary or provisional and are subject to revision. They are being provided to meet the need for timely best science. The data have not received final approval by the U.S. Geological Survey (USGS) and are provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the data. Please visit GCMRC's Discharge, Sediment and Water Quality web site for a QA/QC version

1_LPCR0024_221114_6657_F_A_D_LE_bin.cnv



Lake Powell Release Temperature

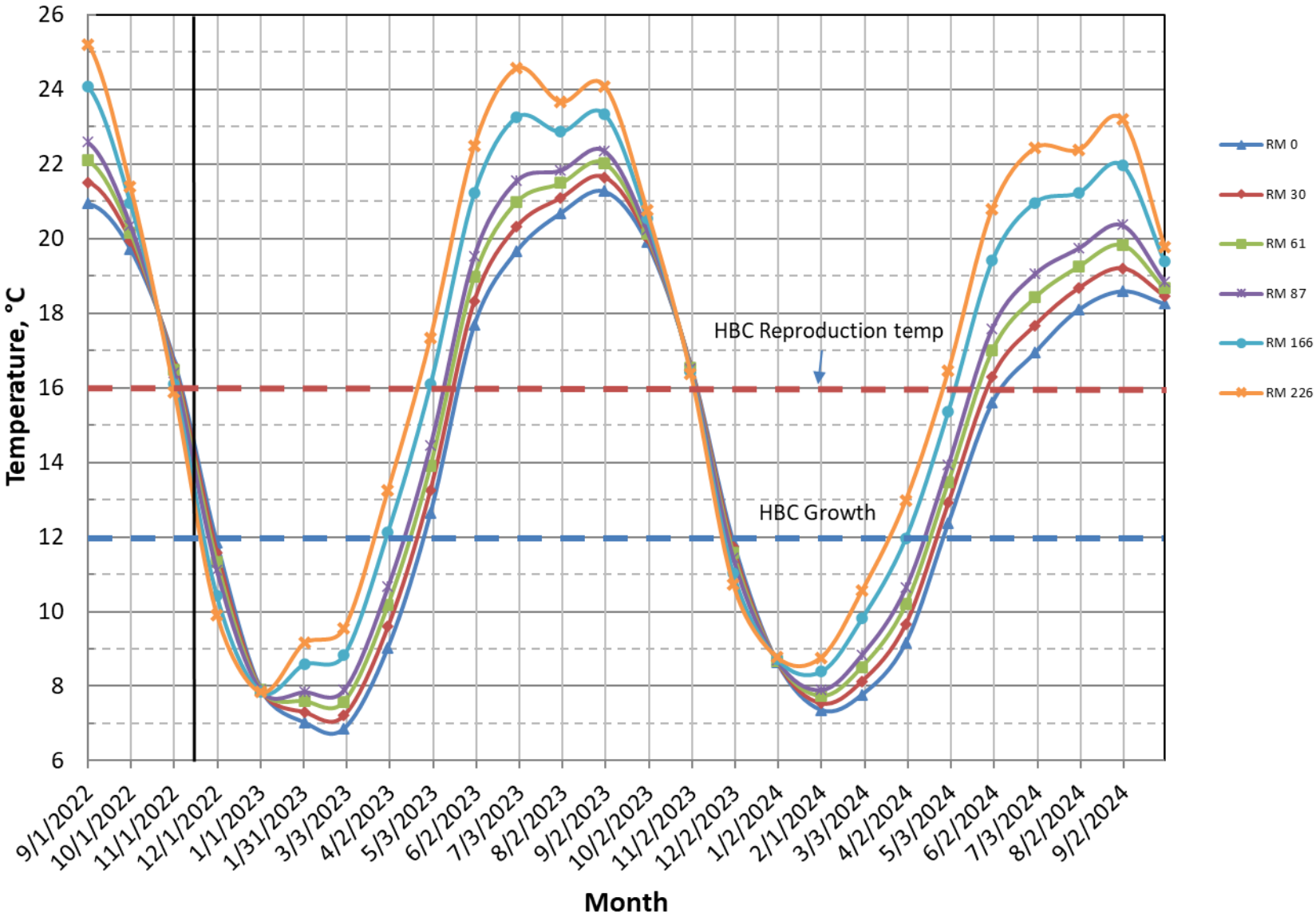
Projected Temperature based on November 2022 Forecast



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

Colorado River, Grand Canyon Water Temperatures

Projections based on November 2022, Most Probable Hydrology



Questions?



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