

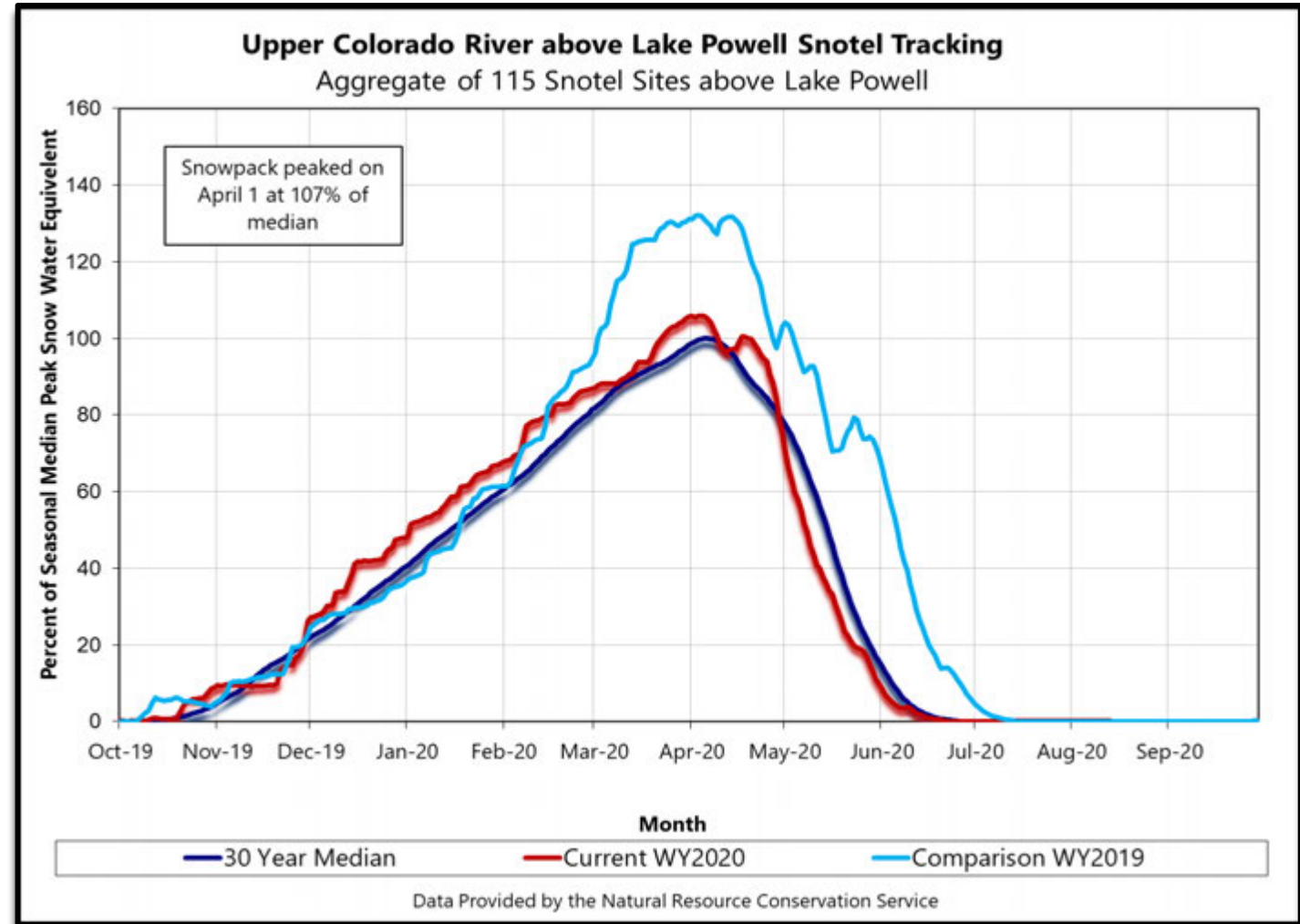
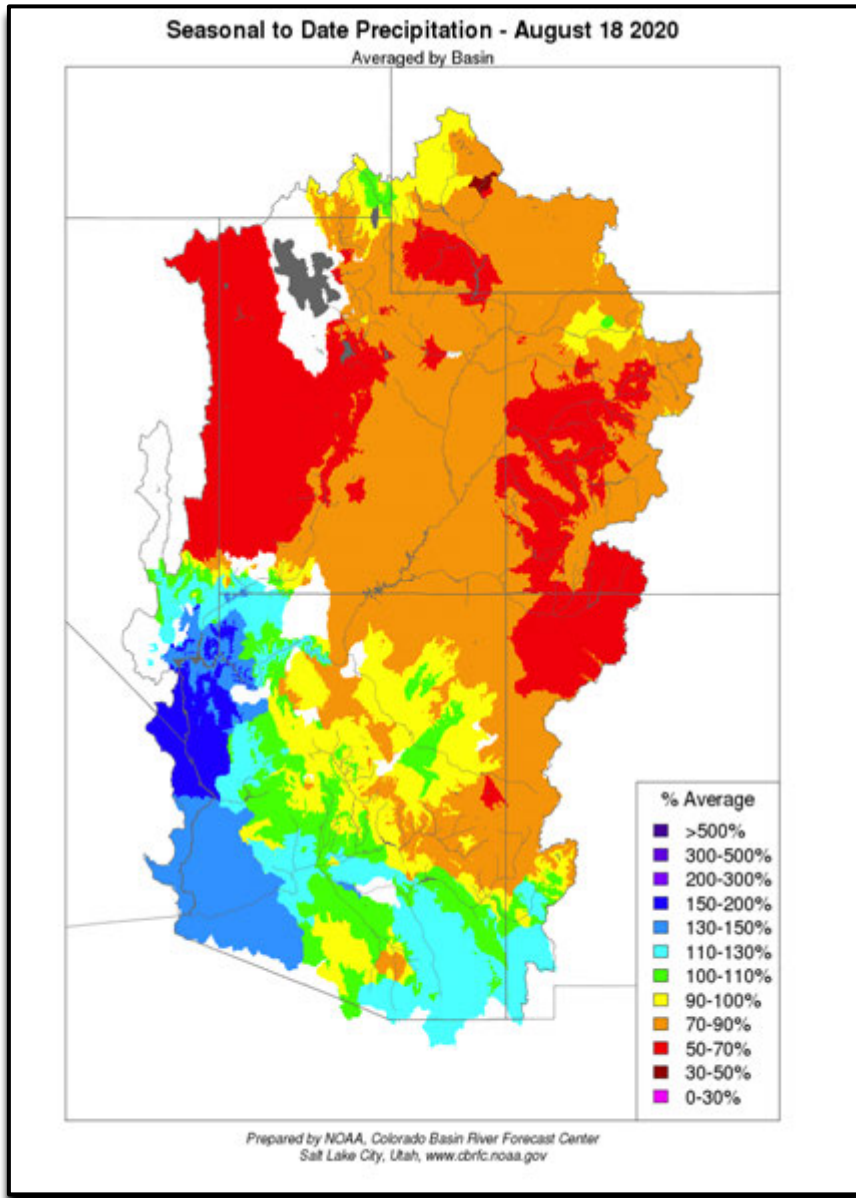


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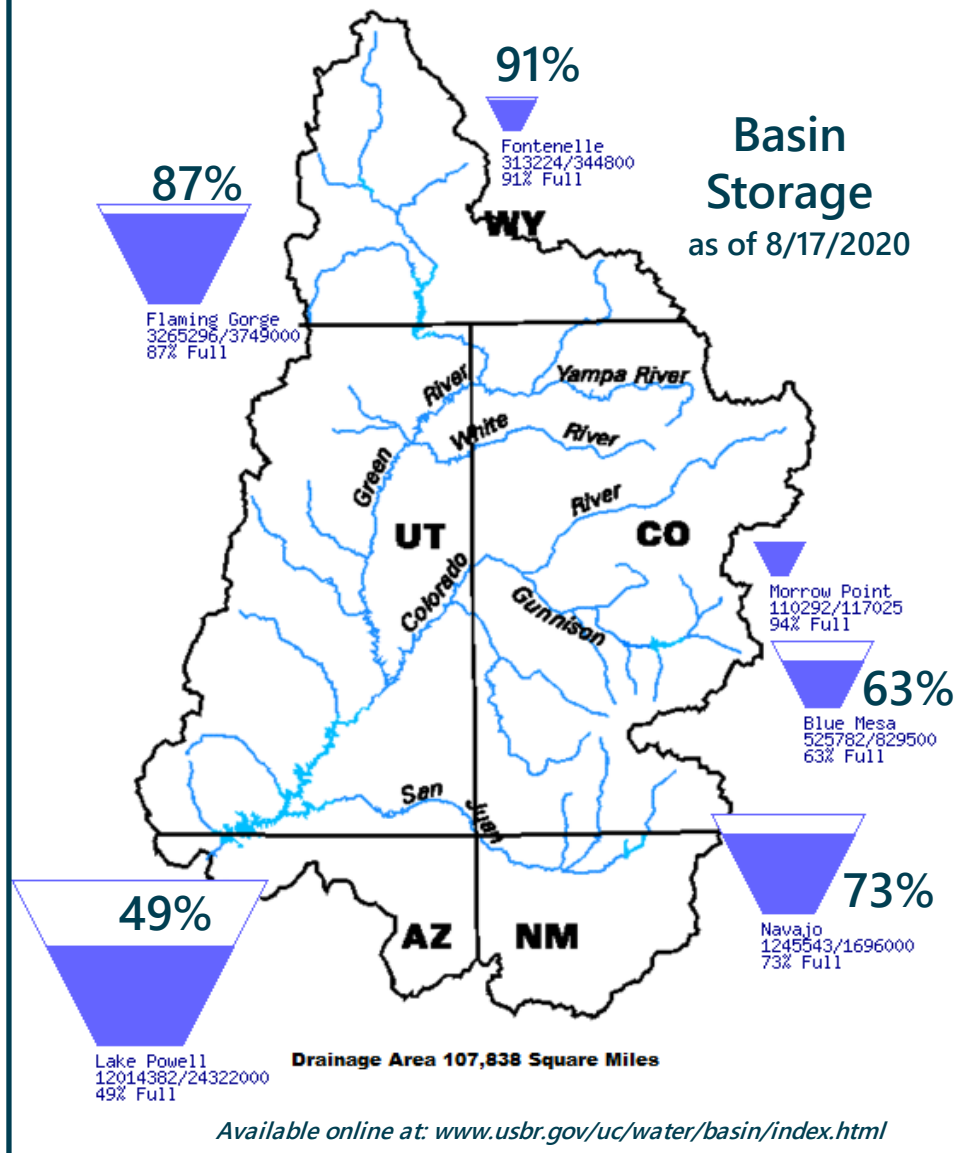
# Basin Hydrology, Reservoir Operations 2020 and 2021 Hydrograph

August 19, 2020

# Precipitation and Snow Conditions



# Upper Basin Storage



## Observed 2020 April – July Unregulated Inflow as of August 17, 2020

Reservoir	Preliminary Observed (kaf)	Percent of Average <sup>1</sup>
Fontenelle	677	93
Flaming Gorge	833	85
Blue Mesa	388	57
Navajo	347	47
Powell	3,758	52

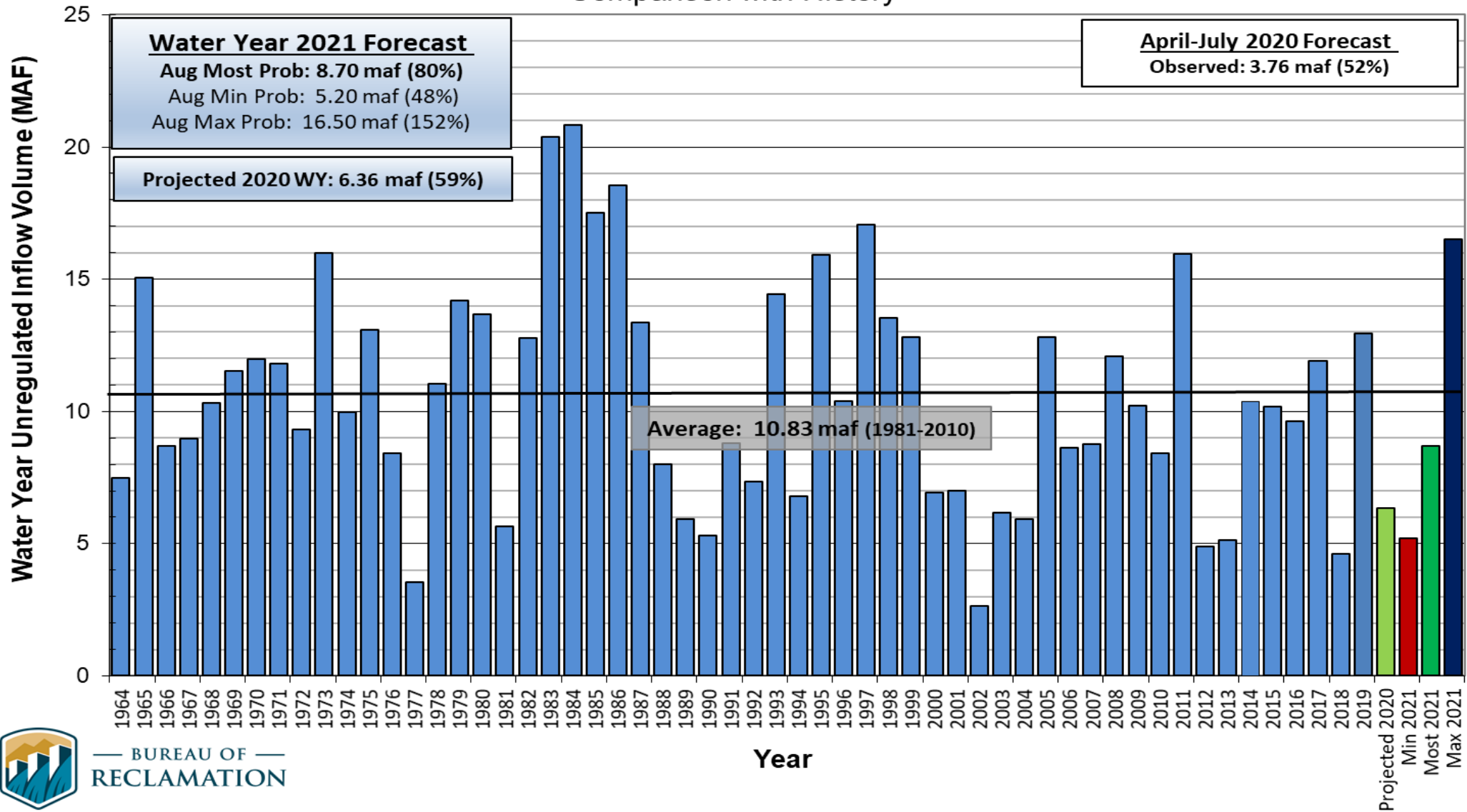
<sup>1</sup> Percent of average based on the period of record from 1981-2010.



# Lake Powell Unregulated Inflow

## Water Year 2021 Forecast (issued August 3)

### Comparison with History



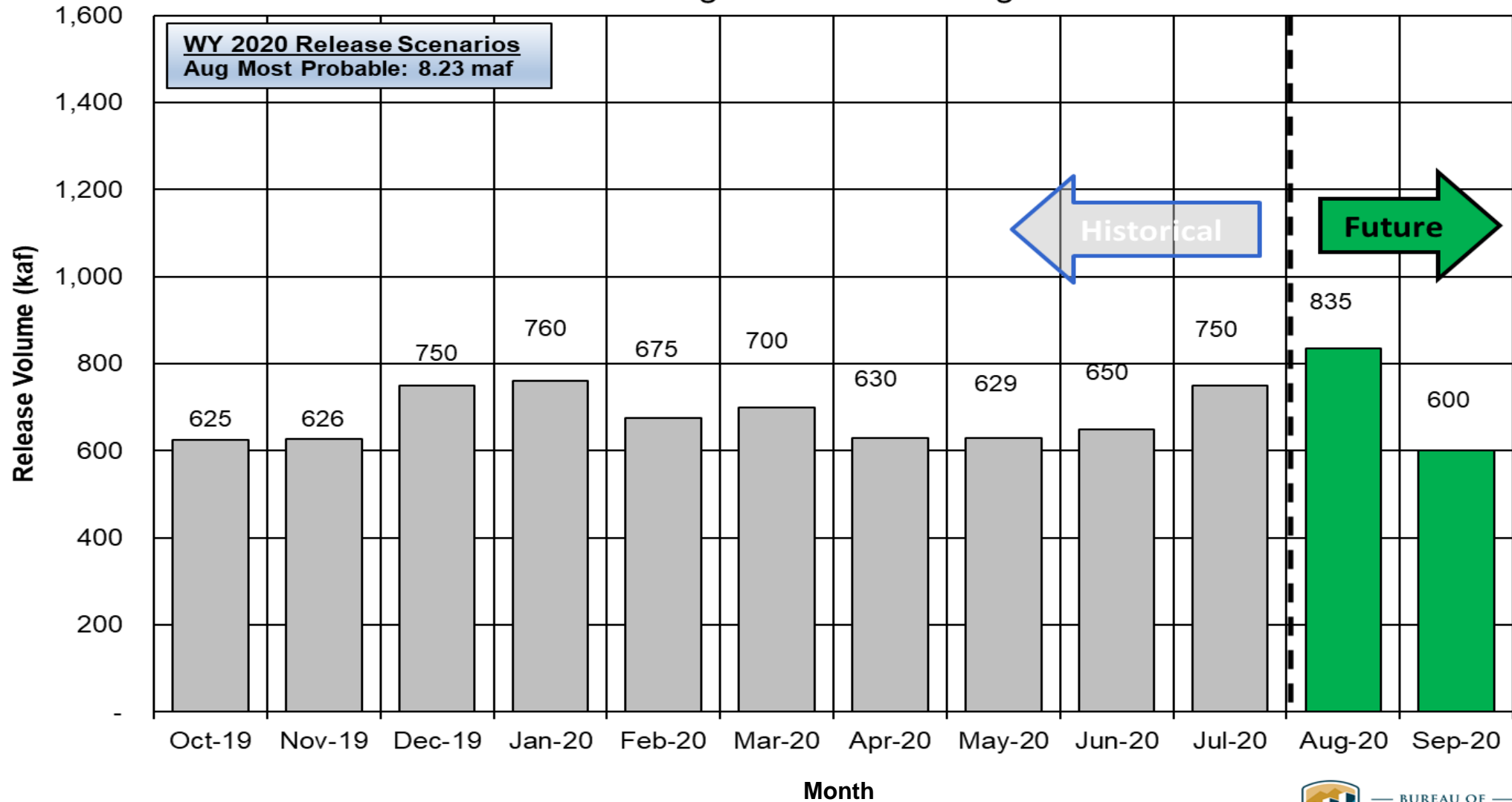
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# Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2020

Based on August 2020 Modeling



# August 24-Month Study Projections Upper Colorado Basin Region Operations



# Timing of Operational Decisions

- August 24-Month Study projections of January 1 elevations sets the operating tiers for Lake Powell and Lake Mead
- When Lake Powell is in Upper Elevation Balancing Tier, April 24-Month Study projections of September 30 elevations may result in an adjustment to Powell's operations



# Lake Powell & Lake Mead Operational Table

## Operational Tiers for Water/Calendar Year 2021<sup>1</sup>

Lake Powell			Lake Mead		
Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) <sup>1</sup>	Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) <sup>1</sup>
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 <sup>3</sup> Release 8.23 maf;	15.5 - 19.3 (2008-2026)	1,200 (approx.) <sup>2</sup>	Domestic Surplus or ICS Surplus Condition Deliver > 7.5 maf	22.9 (approx.) <sup>2</sup>
	3,591.60 ft Jan 1, 2021 projection if Lake Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf		1,145	Normal or ICS Surplus Condition Deliver ≥ 7.5 maf	15.9
3,575	Mid-Elevation Release Tier Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.5	1,105		11.9
3,525			1,075	Shortage Condition Deliver 7.167 <sup>4</sup> maf	9.4
			1,050	Shortage Condition Deliver 7.083 <sup>5</sup> maf	7.5
3,490	Lower Elevation Balancing Tier Balance contents with a min/max release of 7.0 and 9.5 maf	4.0	1,025	Shortage Condition Deliver 7.0 <sup>6</sup> maf Further measures may be undertaken <sup>7</sup>	5.8
3,370		0	1,000		4.3
			895		0

Diagram not to scale

<sup>1</sup> Acronym for million acre-feet

<sup>2</sup> 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.

<sup>3</sup> Subject to April adjustments which may result in a release according to the Equalization Tier

<sup>4</sup> Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

<sup>5</sup> Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

<sup>6</sup> Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

<sup>7</sup> 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.



## B. Upper Elevation Balancing Tier

1. In Water Years when the projected January 1 Lake Powell elevation is below the elevation stated in the Lake Powell Equalization Elevation Table and at or above 3,575 feet, the Secretary shall release 8.23 maf from Lake Powell if the projected January 1 Lake Mead elevation is at or above 1,075 feet.
2. If the projected January 1 Lake Powell elevation is below the elevation stated in the Lake Powell Equalization Elevation Table and at or above 3,575 feet and the projected January 1 Lake Mead elevation is below 1,075 feet, the Secretary shall balance the contents of Lake Mead and Lake Powell, but shall release not more than 9.0 maf and not less than 7.0 maf from Lake Powell in the Water Year.
3. When operating in the Upper Elevation Balancing Tier, if the April 24-Month Study projects the September 30 Lake Powell elevation to be greater than the elevation in the Lake Powell Equalization Elevation Table, the Equalization Tier will govern the operation of Lake Powell for the remainder of the Water Year (through September).
4. When operating under Section 6.B.1, if the April 24-Month Study projects the September 30 Lake Mead elevation to be below 1,075 feet and the September 30 Lake Powell elevation to be at or above 3,575 feet, the Secretary shall balance the contents of Lake Mead and Lake Powell, but shall release not more than 9.0 maf and not less than 8.23 maf from Lake Powell in the Water Year.
5. When Lake Powell is projected to be operating under Section 6.B.2. and more than 8.23 maf is projected to be released from Lake Powell during the upcoming Water Year, the Secretary shall recalculate the August 24-Month Study projection of the January 1 Lake Mead elevation to include releases above 8.23 maf that are scheduled to be released from Lake Powell during the months of October, November, and December of the upcoming Water Year, for the purposes of determining Normal or Shortage conditions pursuant to Sections 2.A. or 2.D. of these Guidelines.

August  
Determination

April  
Determination



# Lake Powell & Lake Mead Operational Table

## Operational Tiers for Water/Calendar Year 2021<sup>1</sup>

Lake Powell			Lake Mead		
Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) <sup>1</sup>	Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) <sup>1</sup>
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)	3,591.60 ft <i>Jan 1, 2021 projection</i> 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.) <sup>2</sup>	Domestic Surplus or ICS Surplus Condition Deliver > 7.5 maf	22.9 (approx.) <sup>2</sup>
			1,145	Normal or ICS Surplus Condition Deliver ≥ 7.5 maf <b>1,085.28 ft</b> <i>Jan 1, 2021 projection</i>	15.9
3,575	Mid-Elevation Release Tier Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.5	1,105		11.9
3,525	Lower Elevation Balancing Tier Balance contents with a min/max release of 7.0 and 9.5 maf	5.9	1,075	Shortage Condition Deliver 7.167 <sup>4</sup> maf	9.4
3,490			1,050	Shortage Condition Deliver 7.083 <sup>5</sup> maf	7.5
3,370		0	1,025	Shortage Condition Deliver 7.0 <sup>6</sup> maf Further measures may be undertaken <sup>7</sup>	5.8
			1,000		4.3
			895		0

Diagram not to scale

<sup>1</sup> Acronym for million acre-feet

<sup>2</sup> 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.

<sup>3</sup> Subject to April adjustments which may result in a release according to the Equalization Tier

<sup>4</sup> Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

<sup>5</sup> Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

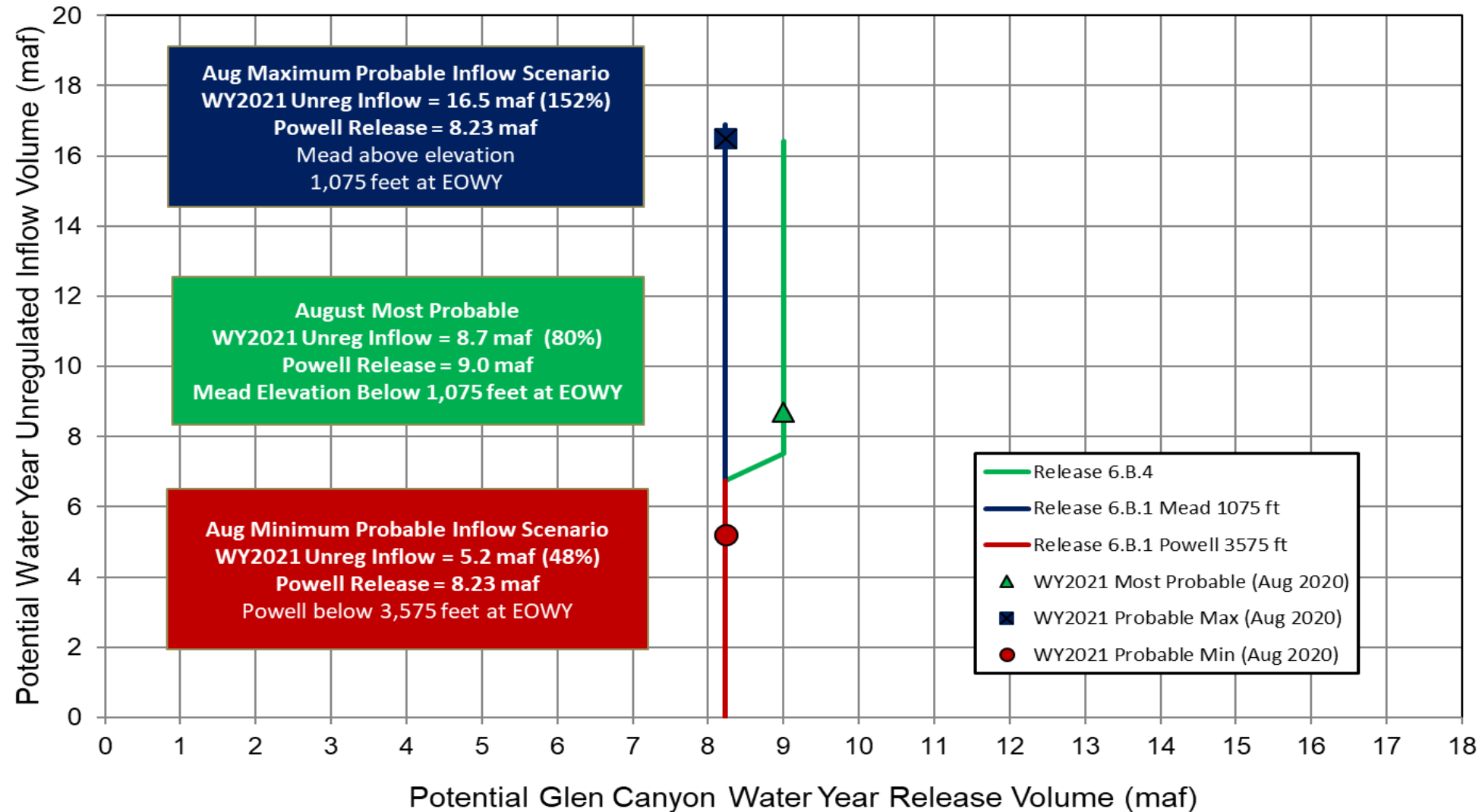
<sup>6</sup> Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

<sup>7</sup> 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.



## Lake Powell Release Scenarios under Section 6.B

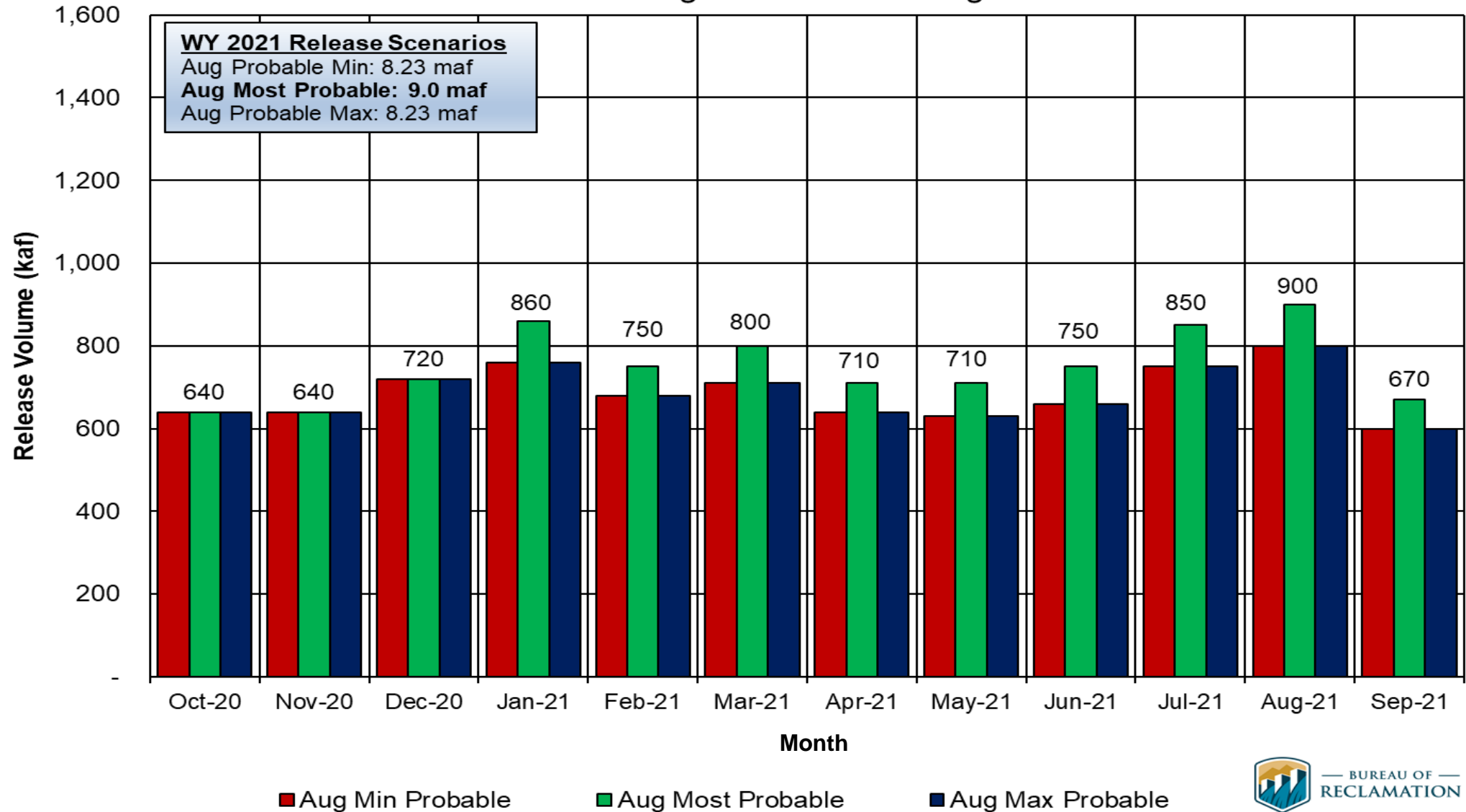
Water Year 2021 Release Volume as a Function of Upper Elevation Balancing Tier  
based on August 2020 24-Month Study Conditions



# Potential Lake Powell Monthly Release Volume Distribution

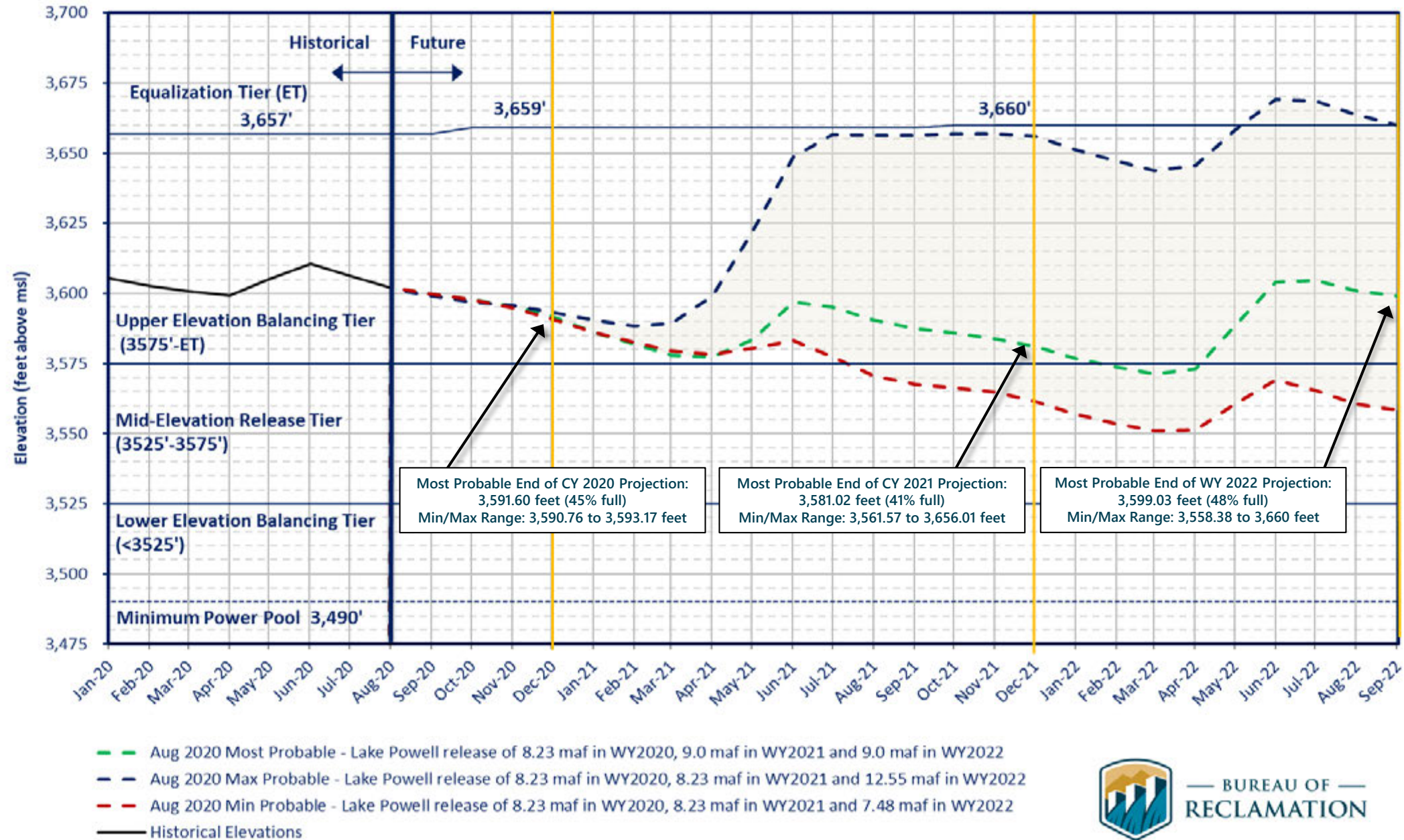
Release Scenarios for Water Year 2021

Based on August 2020 Modeling



# Lake Powell End of Month Elevations

Historic and Projected based on August 2020 24-Month Study Inflow Scenarios

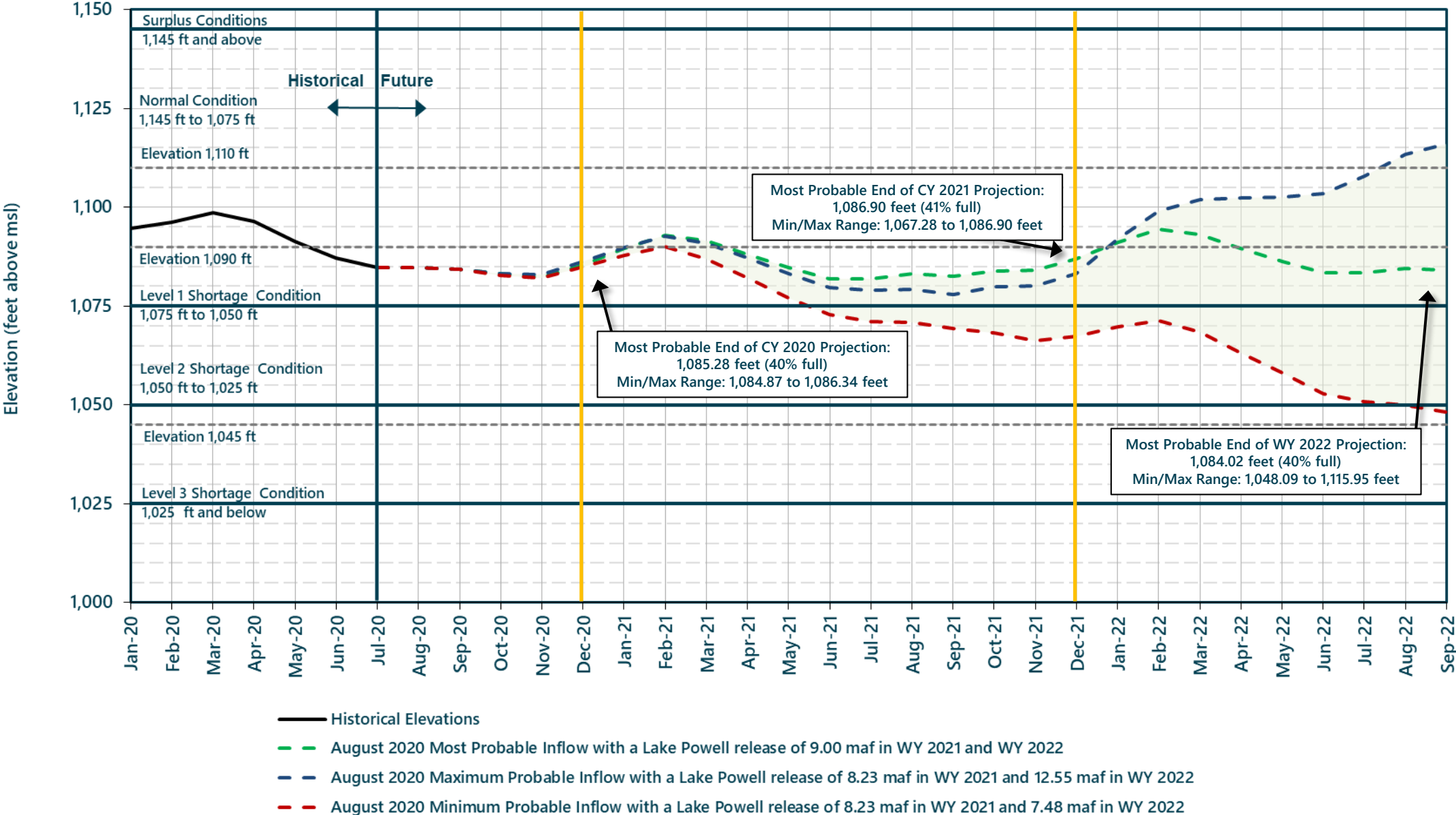


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# Lake Mead End of Month Elevations

Projections from the August 2020 24-Month Study Inflow Scenarios



## Glen Canyon Power Plant Planned Unit Outage Schedule for Water Year 2020

Unit Number	Oct 2019	Nov 2019	Dec 2019	Jan 2020	Feb 2020	Mar 2020	Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2020	Sep 2020
1												
2												
3												
4												
5												
6												
7												
8												
Units Available	5	6	6	6	6	5	6	6	6	6	6	6/5
Capacity (cfs)	16,800	20,500	20,400	20,400	20,300	16,500	20,200	20,400	20,600	20,400	20,200	20,200 /16,500
Capacity (kaf/month)	1,060	1,160	1,420	1,250	1,180	1,100	1,210	1,300	1,390	1,670	1,240	980
Max (kaf) <sup>2</sup>	625	625	750	760	675	700	630	630	650	750	835	600
Most (kaf) <sup>1</sup>	625	625	750	760	675	700	630	630	650	750	835	600
Min (kaf) <sup>2</sup>	625	625	750	760	675	700	630	630	650	750	835	600
											(updated 08-18-2020)	

AUG  
MOST<sup>3</sup>

AUG  
MAX

8.23

8.23

8.23

- 1 Projected release, based on August 2020 MOST Probable Inflow Projections and 24-Month Study model runs
- 2 Projected release, based on August 2020 Min and Max Probable Inflow Projections and 24-Month Study model runs
- 3 \*Dependent upon availability to shift reserves



## Glen Canyon Power Plant Planned Unit Outage Schedule for Water Year 2021

Unit Number	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021	Mar 2021	Apr 2021	May 2021	Jun 2021	Jul 2021	Aug 2021	Sep 2021
1												
2												
3												
4												
5												
6												
7												
8												
Units Available	5	6/5	6	6	6	6	6	6	6	6	6	6/4
Capacity (cfs)	16,400	20,000 / 16,350	19,900	19,800	19,700	19,600	19,800	20,100	20,100	20,000	19,900	19,900 / 12,600
Capacity (kaf/month)	1,110	1,200	1,260	1,230	1,110	1,230	1,230	1,270	1,270	1,320	1,350	1,110
Max (kaf) <sup>2</sup>	640	640	720	760	680	710	640	630	660	750	800	600
Most (kaf) <sup>1</sup>	640	640	720	860	750	800	710	710	750	850	900	670
Min (kaf) <sup>2</sup>	640	640	720	760	680	710	640	630	660	750	800	600
										(updated 08-18-2020)		

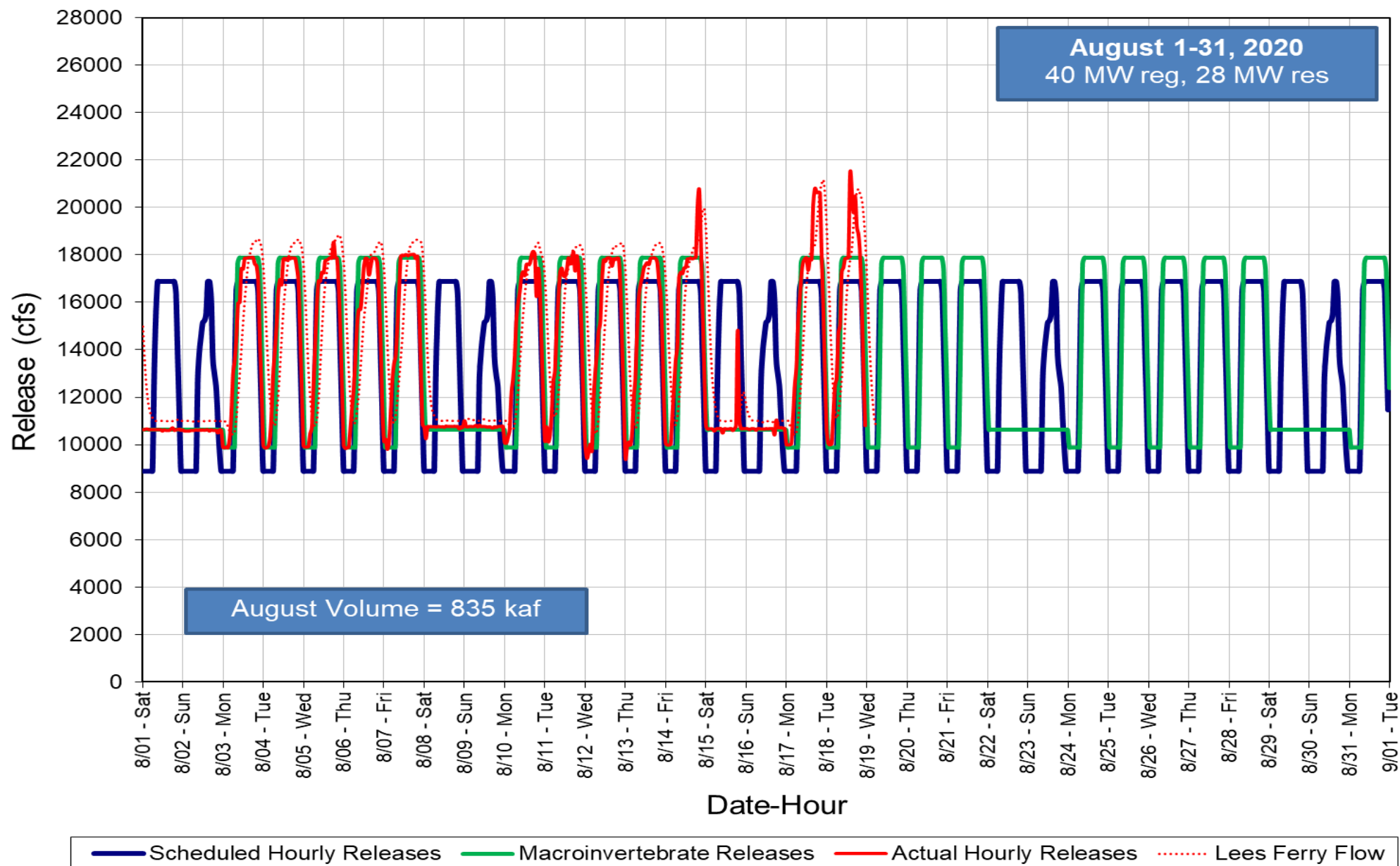
1 Projected release, based on August 2020 Most Probable Inflow Projections and 24-Month Study model runs

2 Projected release, based on August 2020 Min and Max Probable Inflow Projections and 24-Month Study model runs

3 Dependent upon availability to shift reserves

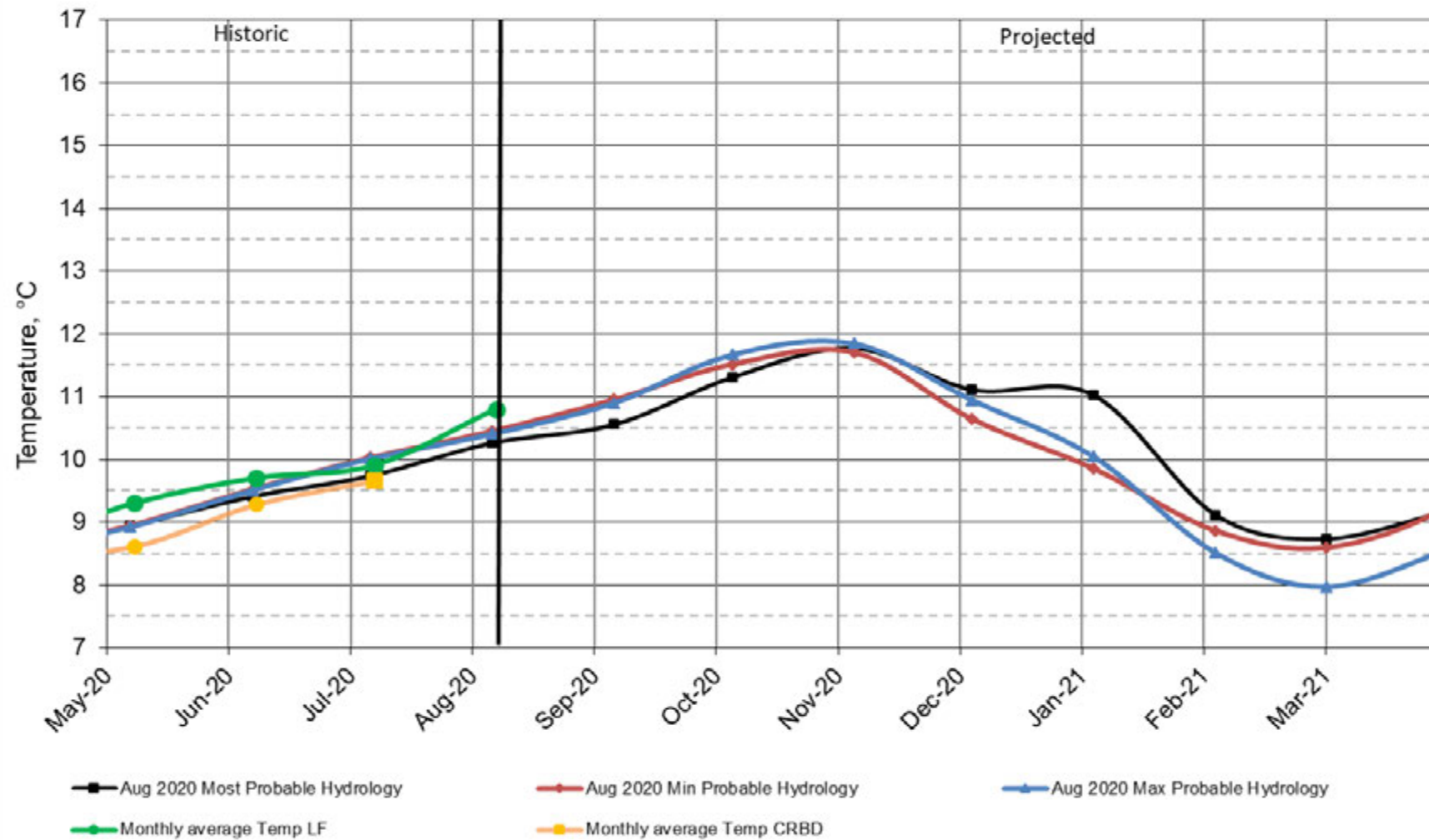


# Glen Canyon Dam Hourly Release Pattern August 2020



# Lake Powell Release Temperature

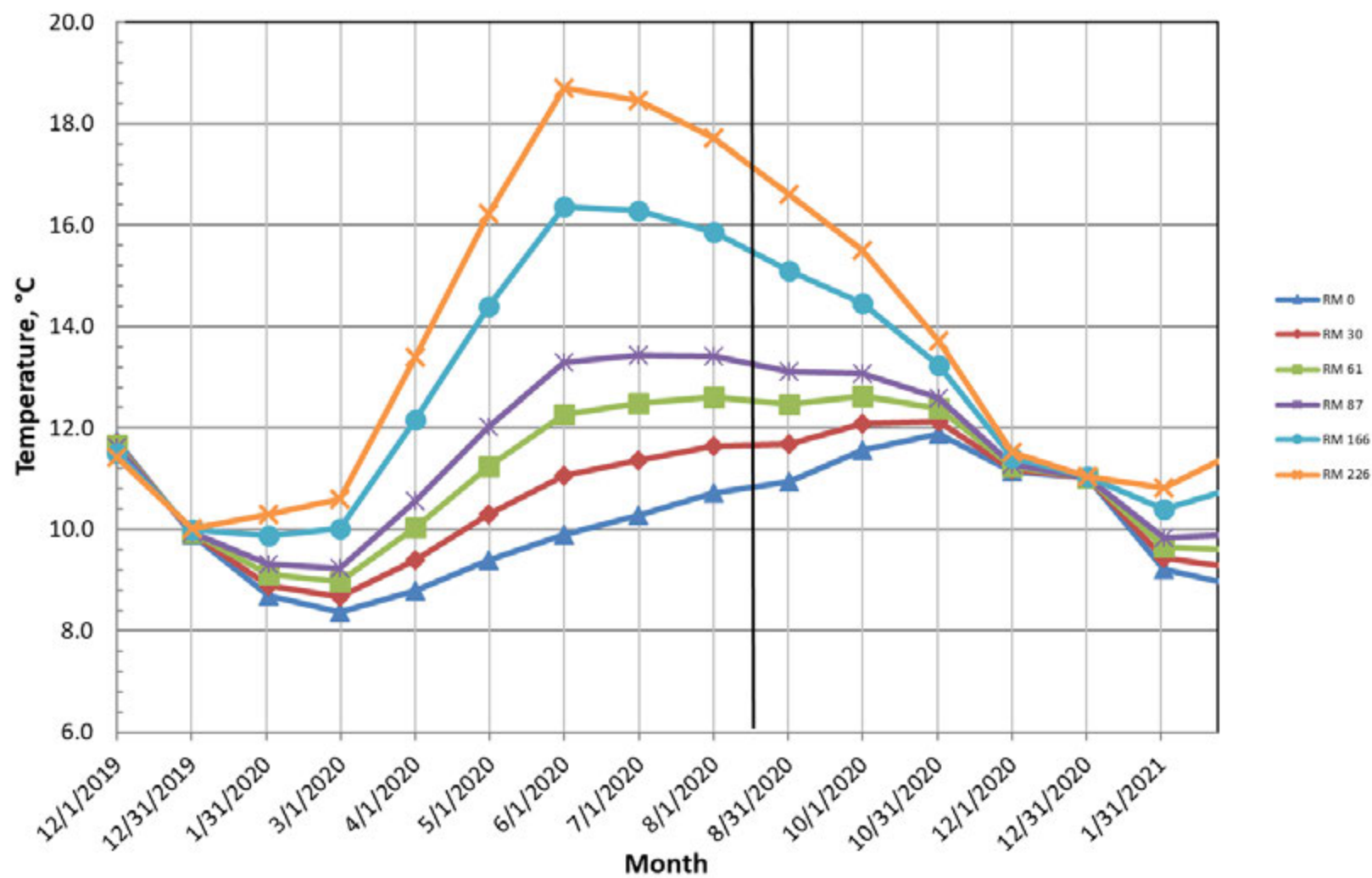
## Projected Temperature based on Aug 2020 Forecast



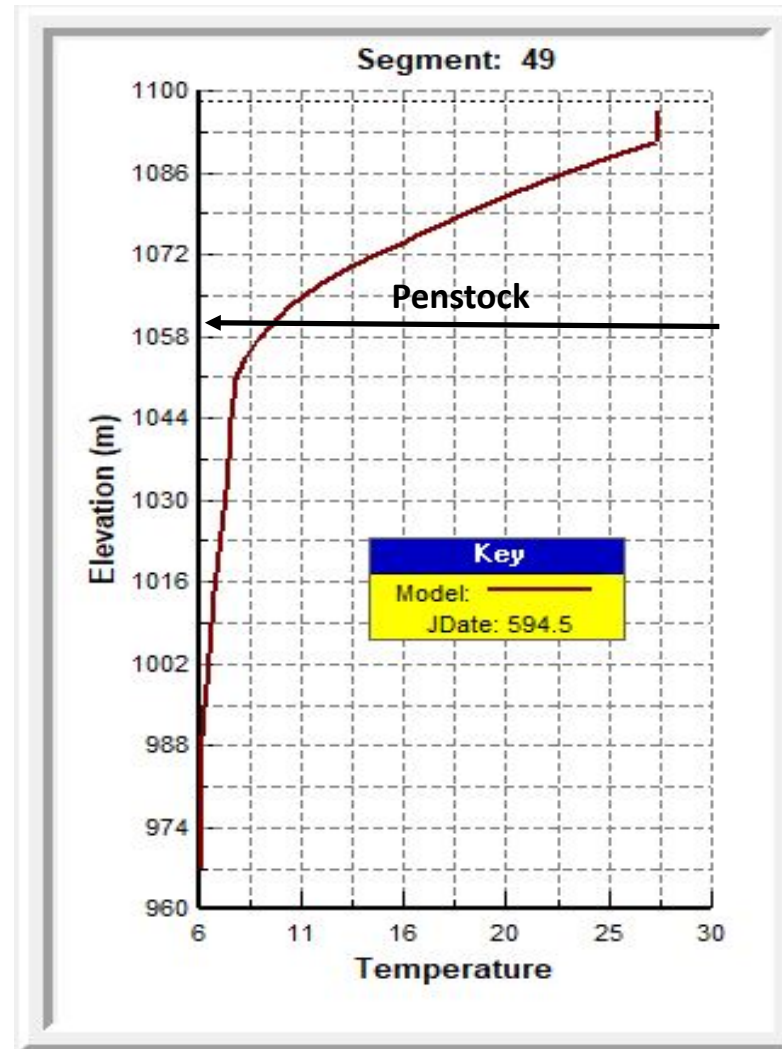
#Projection start date is based on initial conditions (Dec 2019)

## Colorado River, Grand Canyon Water Temperatures

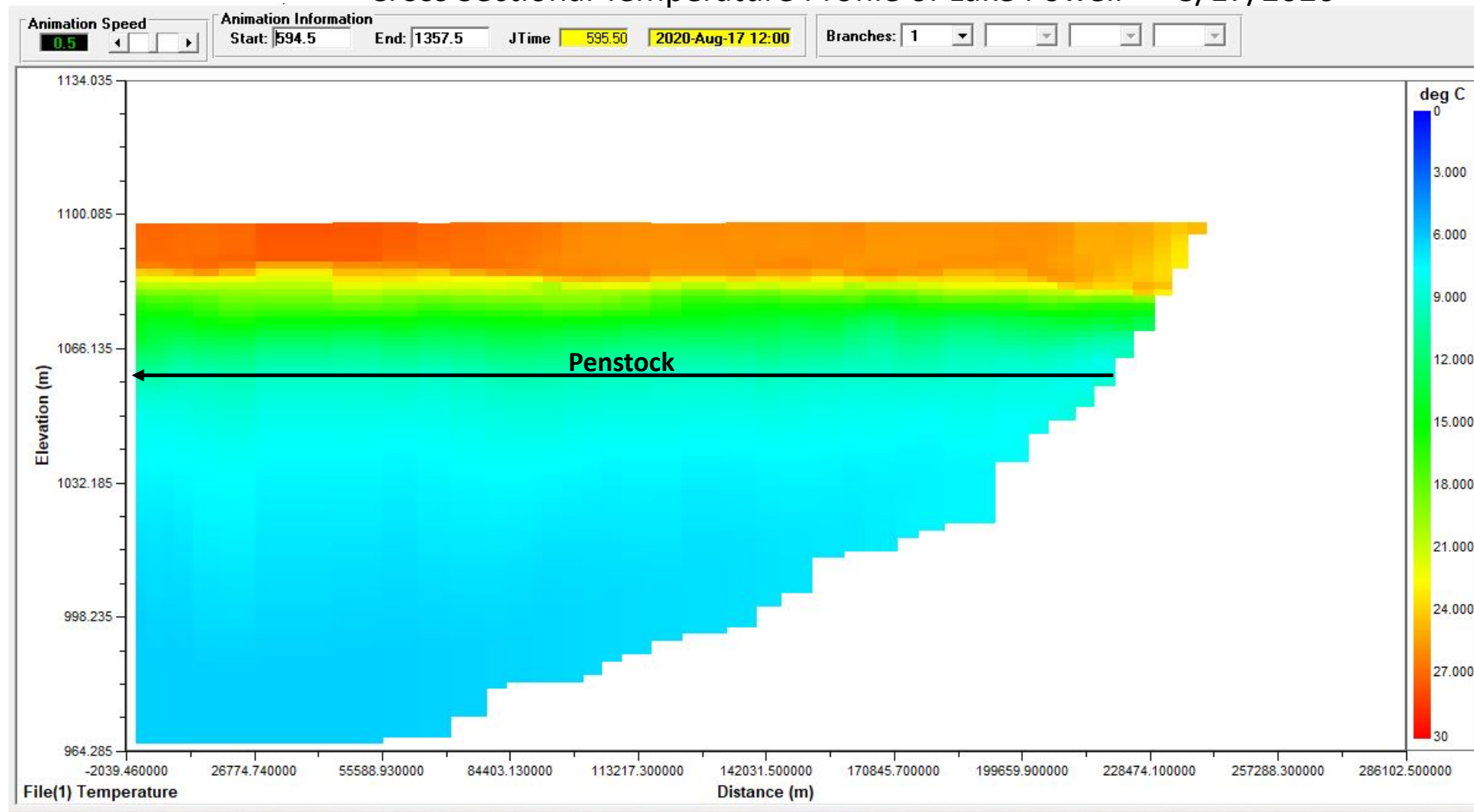
Projections based on August 2020, Most Probable Hydrology



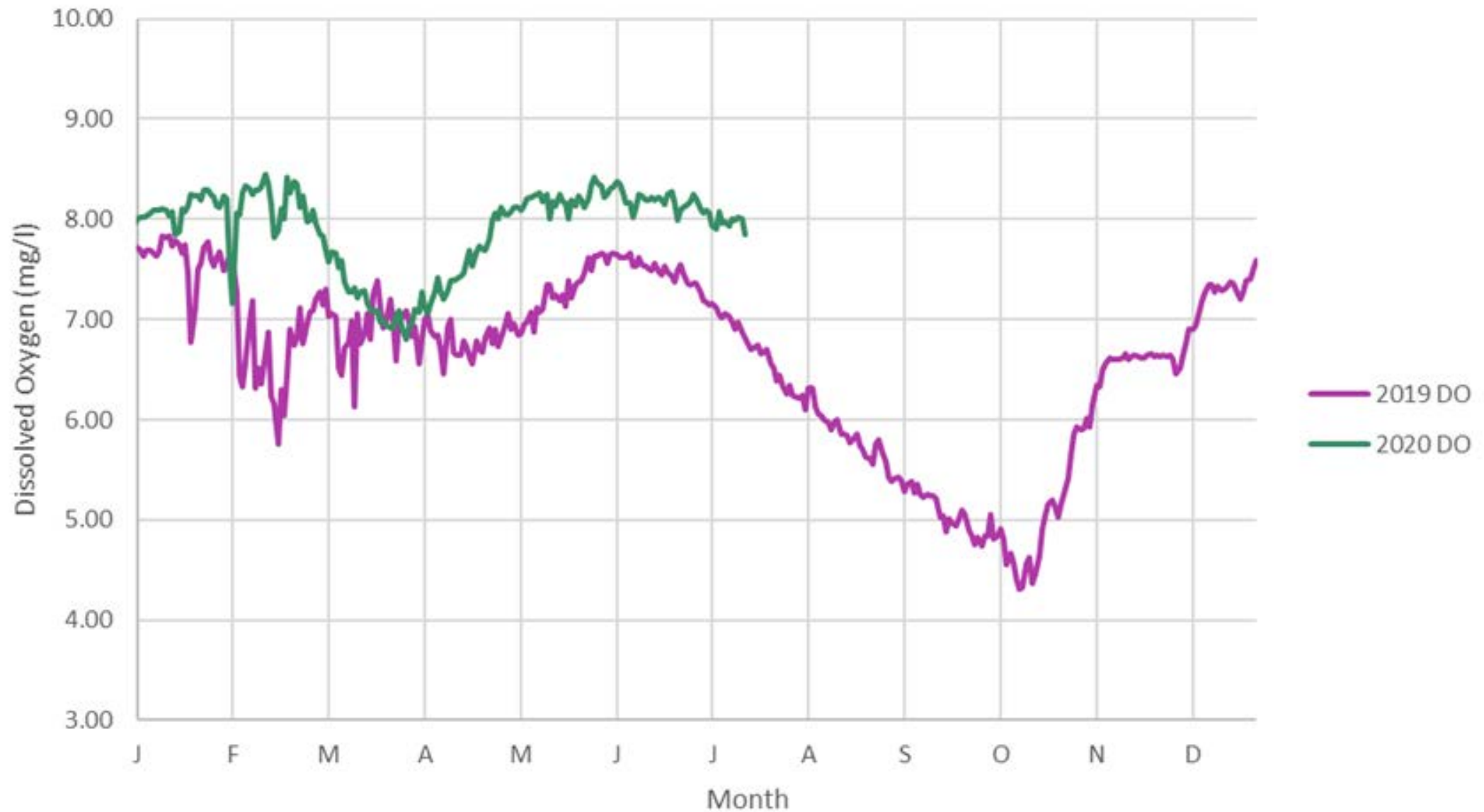
Temperature Profile of Lake Powell near GC Dam  
8/17/2020



# Cross Sectional Temperature Profile of Lake Powell 8/17/2020



DO Concentration at Glen Canyon Dam years 2019 and 2020



# Questions/Discussion



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