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Glen Canyon Monthly Operations Call

Basin Hydrology and Operations

November 23, 2020

Background

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

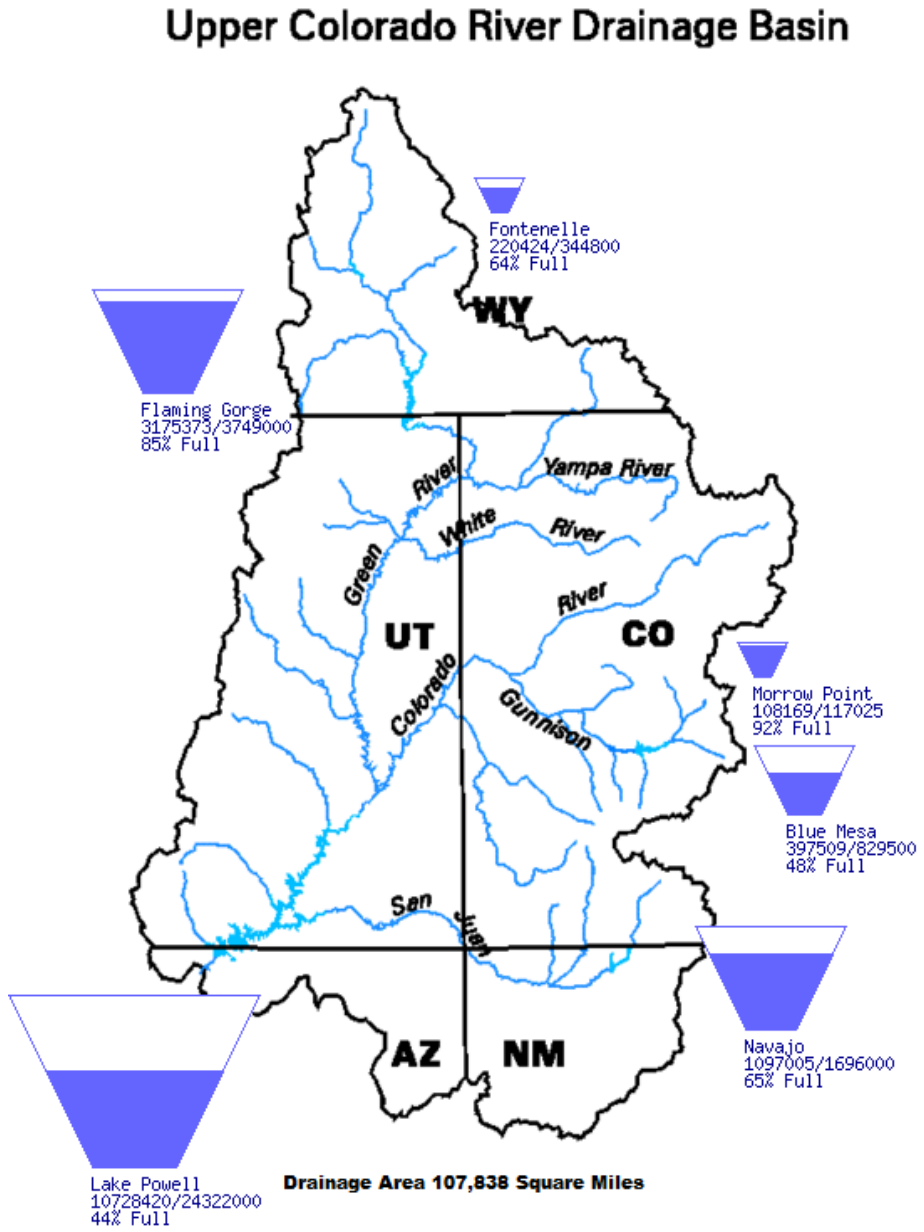
"Annually, Reclamation will develop a hydrograph based on the characteristics above. Reclamation will seek consensus on the annual hydrograph through monthly operational coordination calls with governmental entities, and regular meetings of the GCDAMP Technical Working Group (TWG) and AMWG. Reclamation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

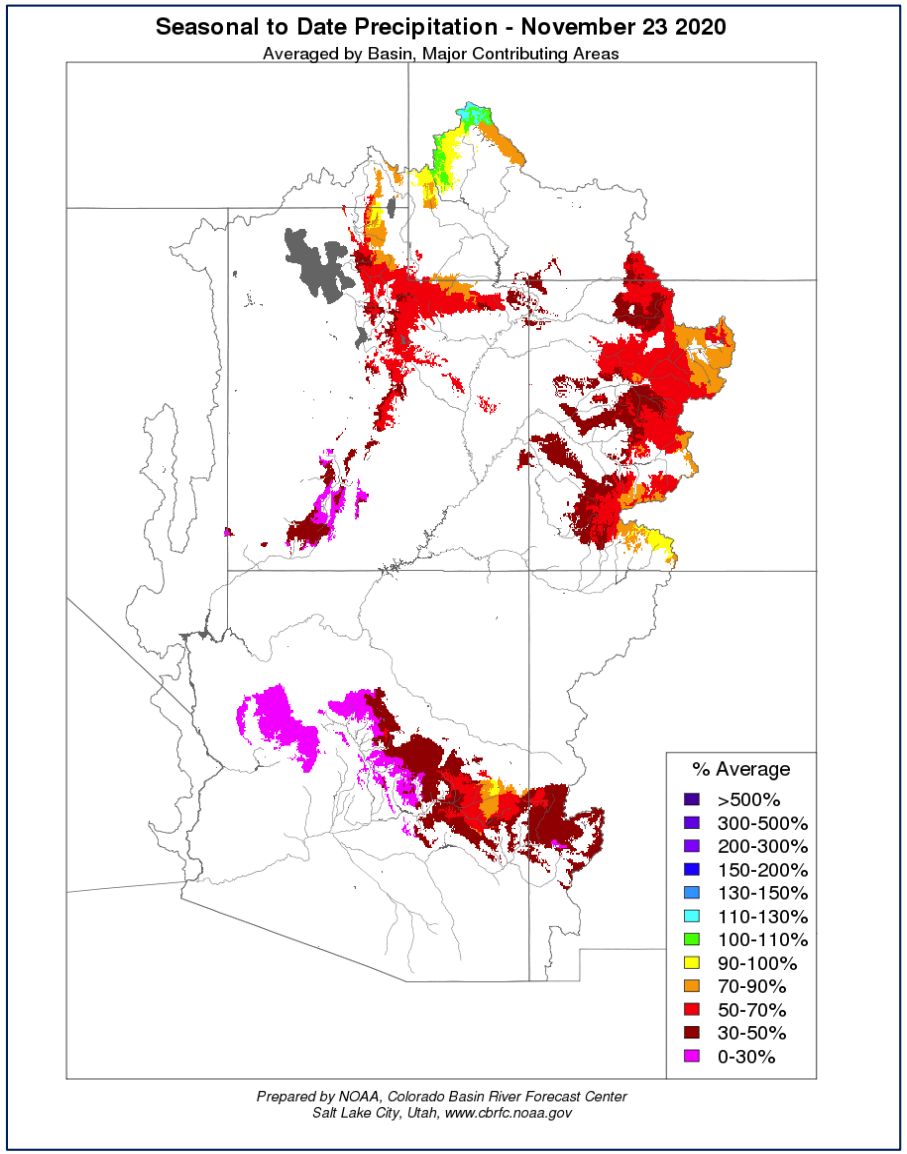
Projected Operations for Water Year 2021 Based on November 2020 Modeling

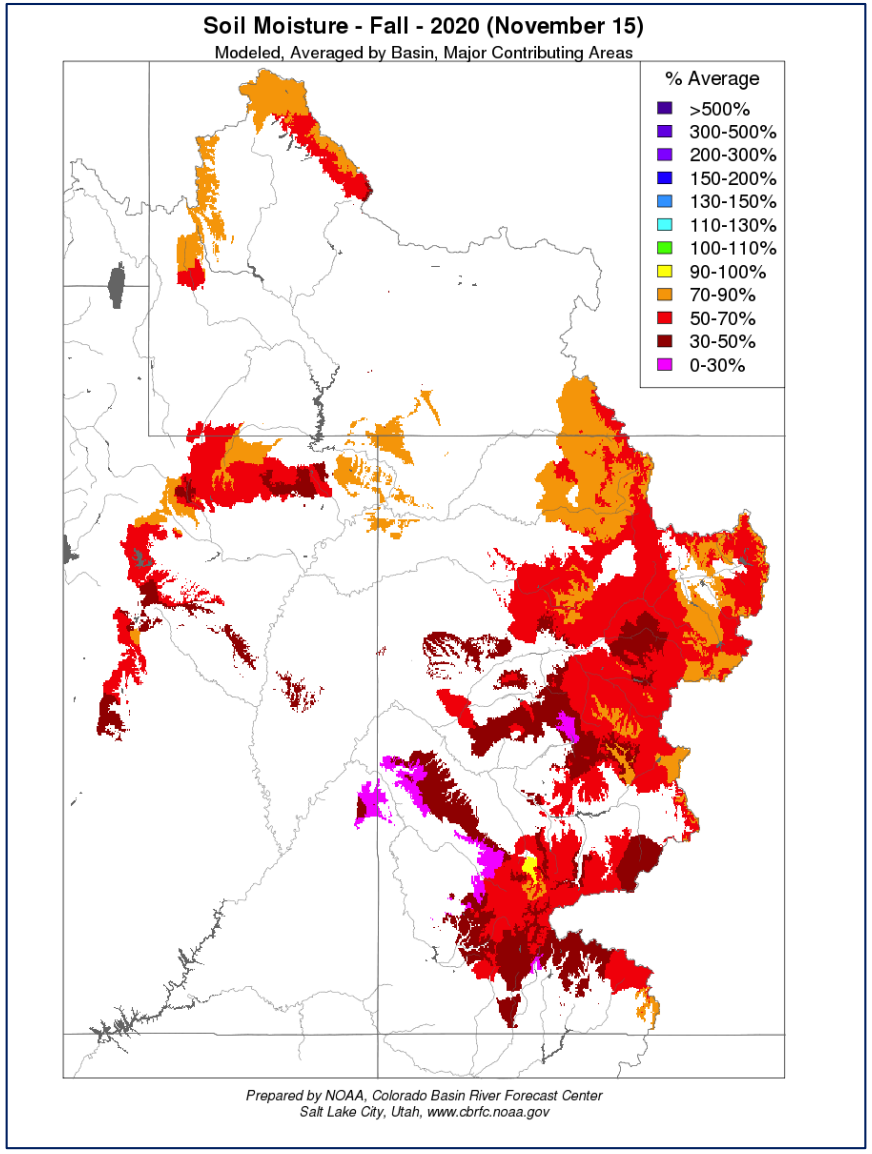
Upper Basin Storage (as of November 22, 2020)

Reservoir	Percent Full	Storage (maf)	Elevation (feet)
Fontenelle	64	0.220	6,488.87
Flaming Gorge	85	3.17	6,025.39
Blue Mesa	48	0.398	7,464.25
Navajo	65	1.10	6,038.51
Lake Powell	44	10.72	3,588.87

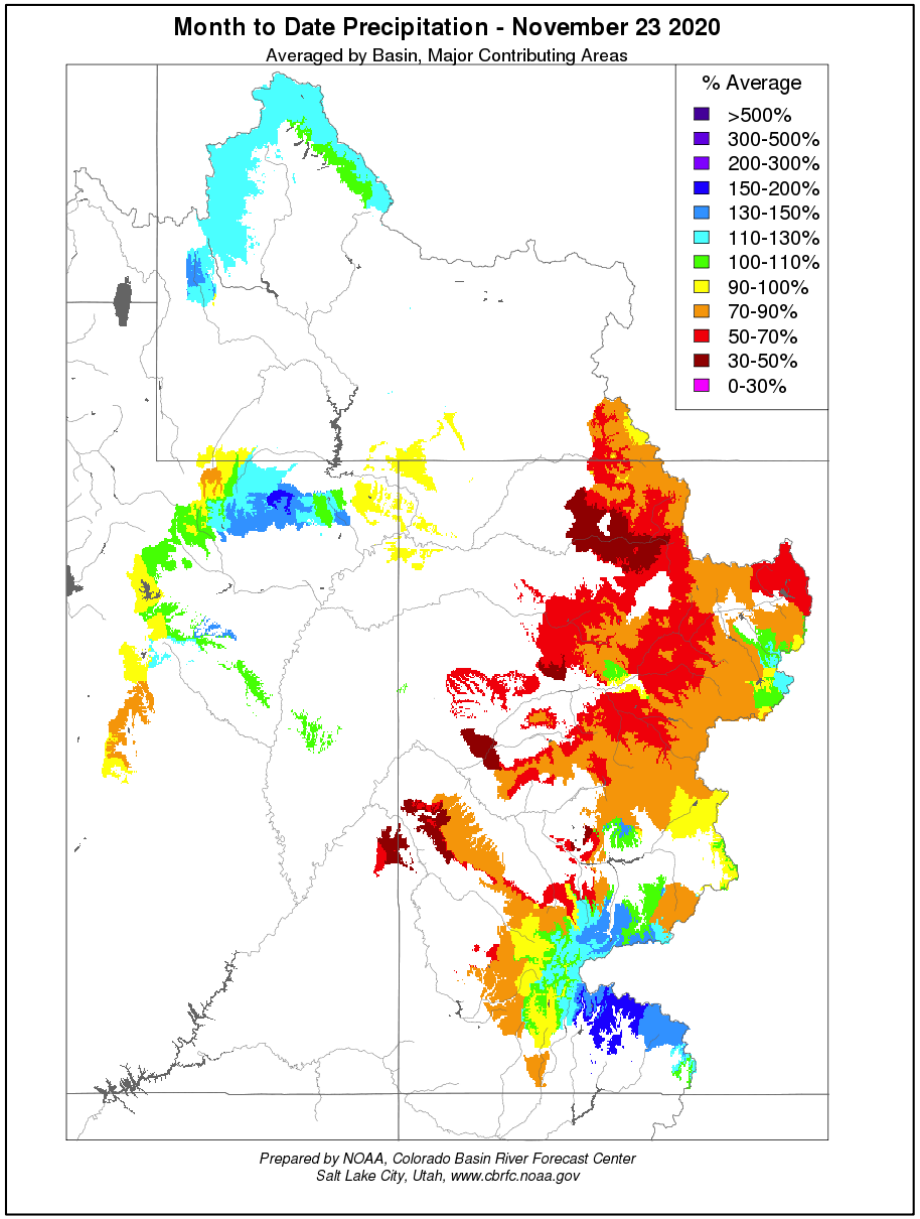


Seasonal Precipitation and Soil Moisture





November Precipitation and WY2021 Forecast

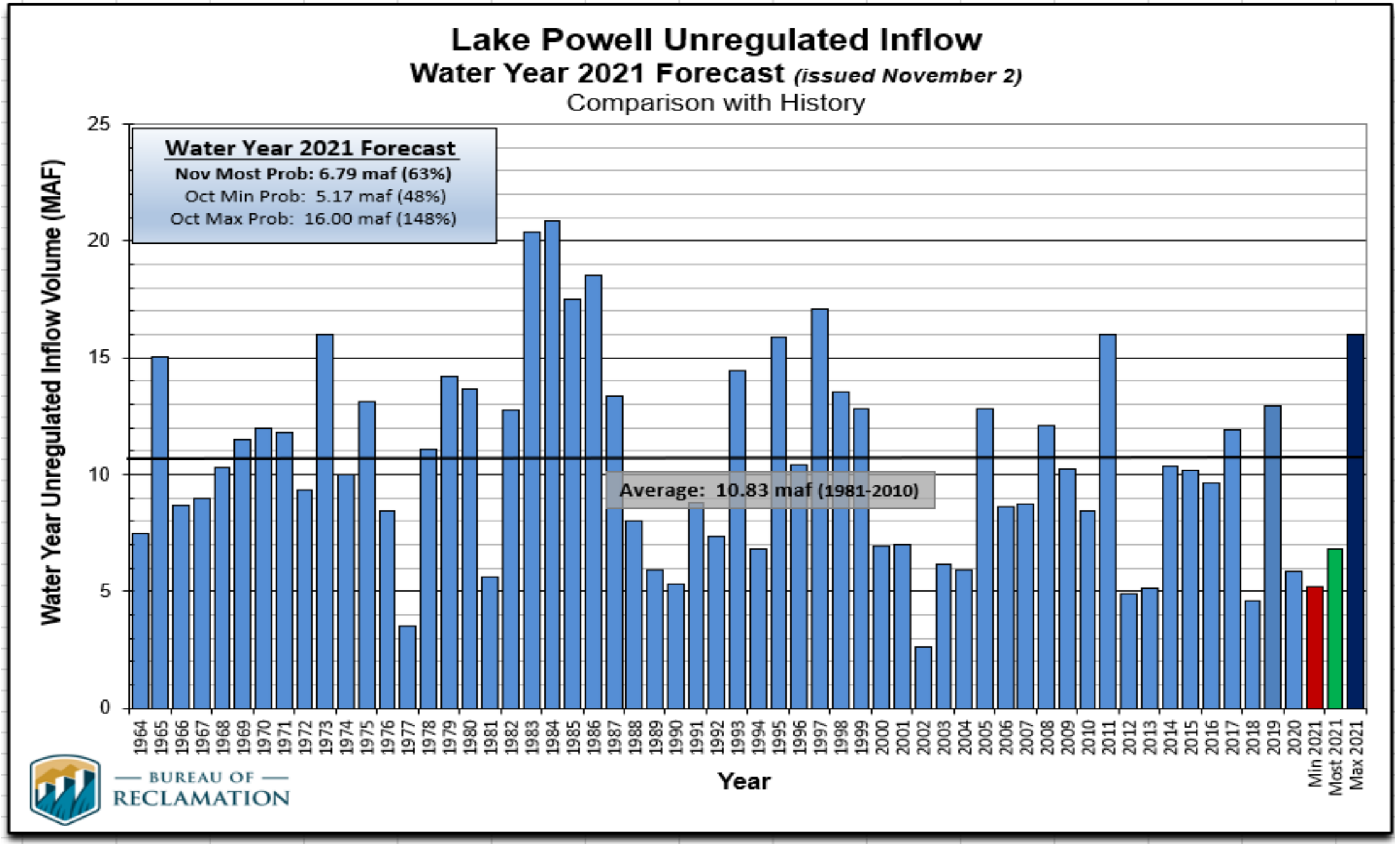


Water Year 2021
Forecasted Unregulated Inflow
as of November 2, 2020

Reservoir	Unregulated Inflow (kaf)	Percent of Average[1]
Fontenelle	837	77
Flaming Gorge	1,036	71
Blue Mesa	650	68
Navajo	612	57
Powell	6,791	63

[1] Percent of average based on the period of record from 1981-2010.

Lake Powell Unregulated Inflow
Water Year 2021 Forecast *(issued November 2)*
Comparison with History



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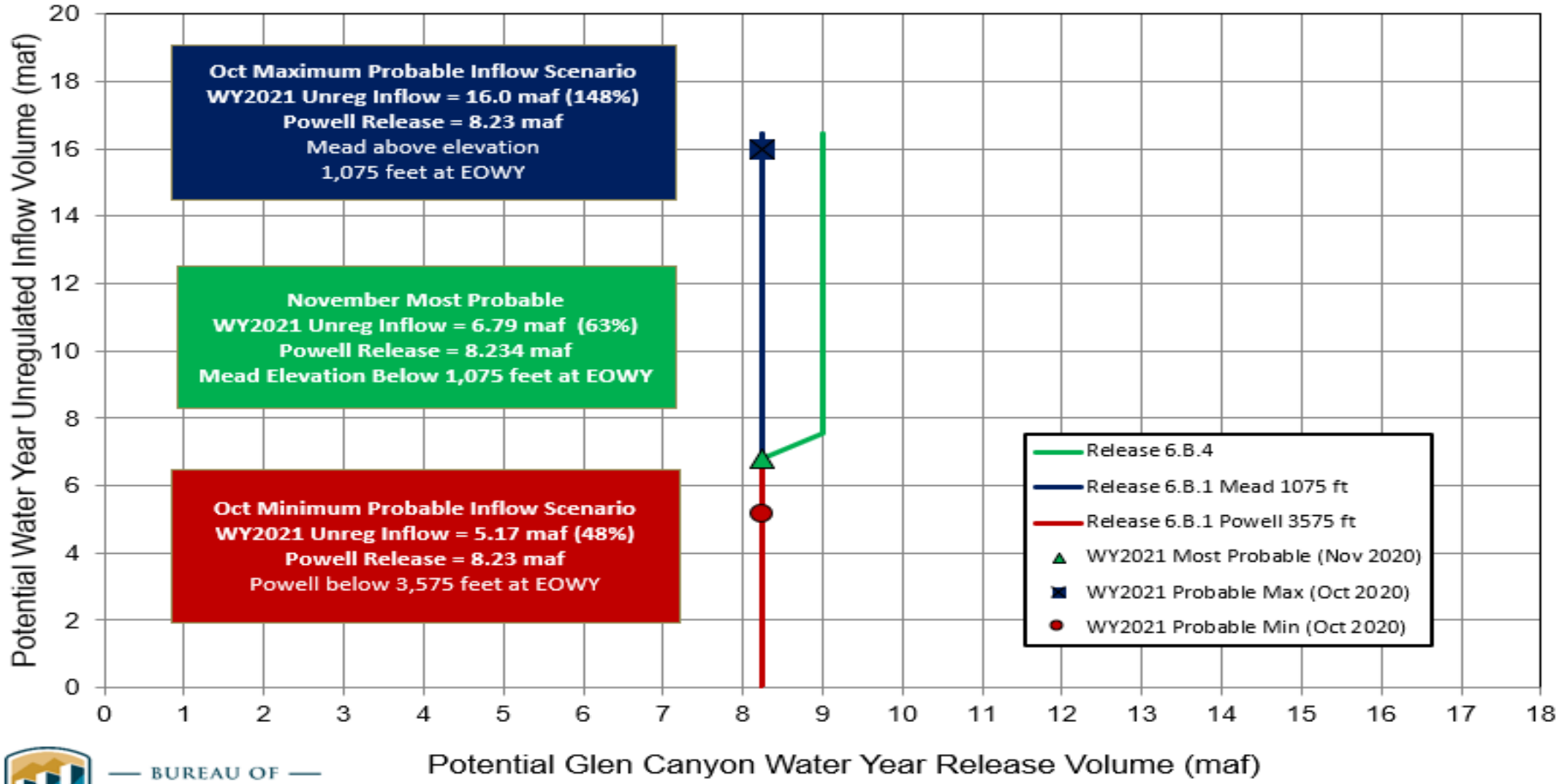
Lake Powell Release Scenarios under Section 6.B

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



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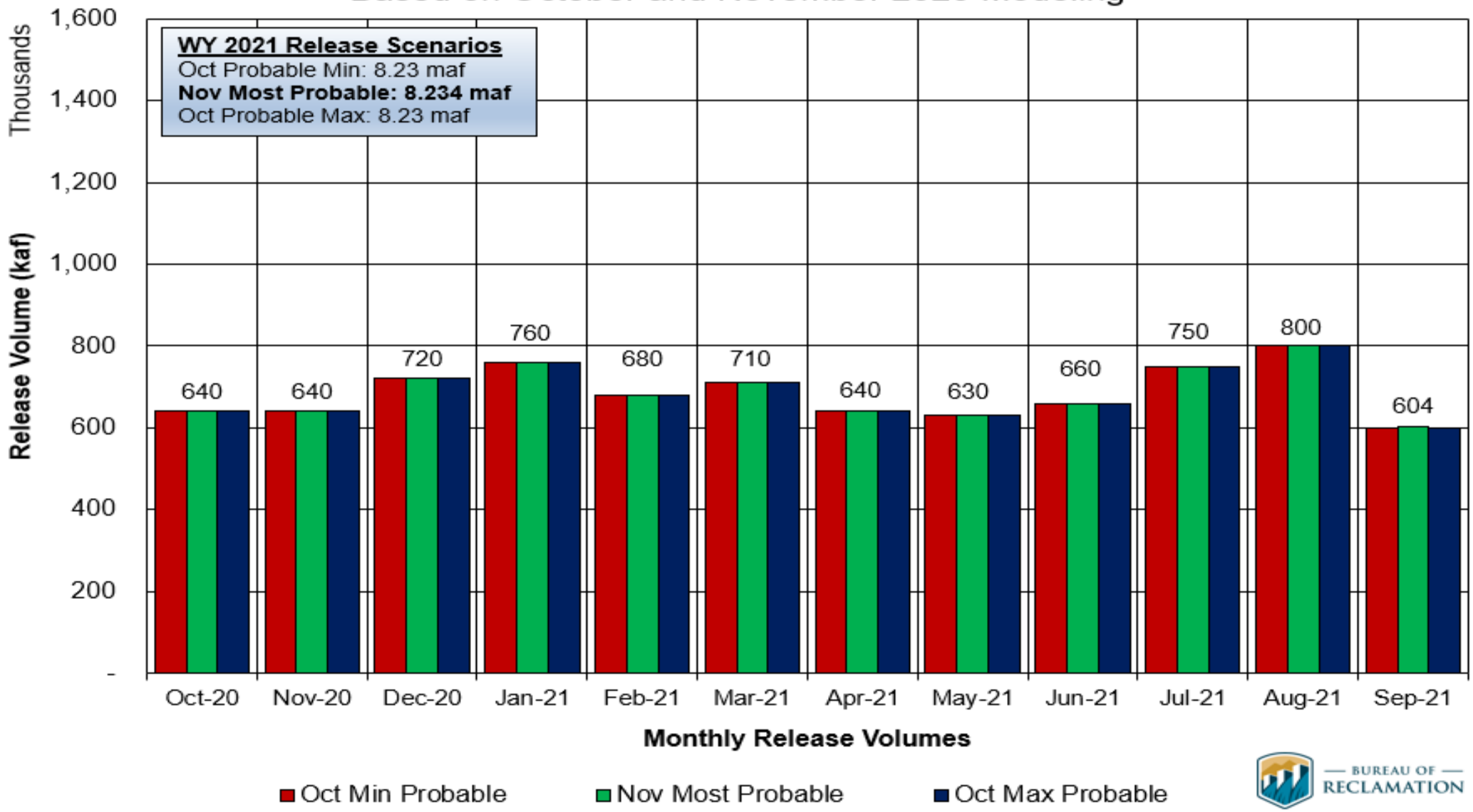
Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2021
Based on October and November 2020 Modeling



LTEMP Operational Flexibility

1.2 OPERATIONAL FLEXIBILITY UNDER ALTERNATIVE D

Reclamation retains the authority to utilize operational flexibility at Glen Canyon Dam because hydrologic conditions of the Colorado River Basin (or the operational conditions of Colorado River reservoirs) cannot be completely known in advance. Consistent with current operations, Reclamation, in consultation with WAPA, will make specific adjustments to daily and monthly release volumes during the water year. Monthly release volumes may be rounded for practical implementation or for maintenance needs. In addition, when releases are actually implemented, minor variations may occur regularly for a number of operational reasons that cannot be projected in advance.

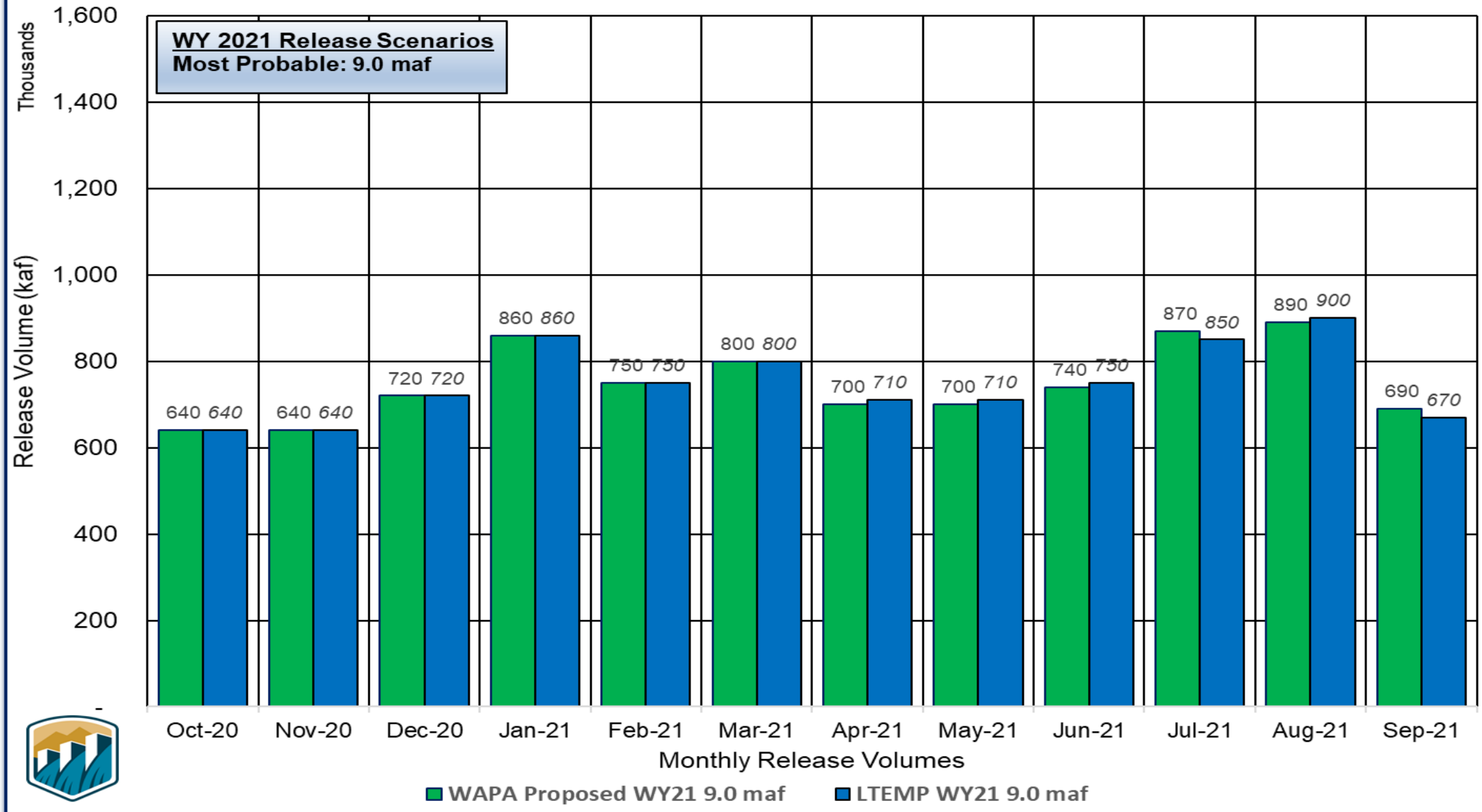
Reclamation also will make specific adjustments to daily and monthly release volumes, in consultation with other entities as appropriate, for a number of reasons, including operational, resource-related, and hydropower-related issues. Examples of these adjustments may include, but are not limited to, the following:

- For water distribution purposes, volumes may be adjusted to allocate water between the Upper and Lower Basins consistent with the Law of the River as a result of changing hydrology;
- For resource-related issues that may occur uniquely in a given year, release adjustments may be made to accommodate nonnative species removal, to assist with aerial photography, or to accommodate other resource considerations separate from experimental treatments under the LTEMP;
- For hydropower-related issues, adjustments may occur to address issues such as electrical grid reliability, actual or forecasted prices for purchased power, transmission outages, and experimental releases from other Colorado River Storage Project dams.

In addition, Reclamation may make modifications under circumstances that may include operations that are prudent or necessary for the safety of dams, public health and safety, other emergency situations, or other unanticipated or unforeseen activities arising from actual operating experience (including, in coordination with the Basin States, actions to respond to low reservoir conditions as a result of drought in the Colorado River Basin). In addition, the Emergency Exception Criteria established for Glen Canyon Dam will continue under this alternative. (See, e.g., Section 3 of the Glen Canyon Operating Criteria at 62 FR 9448, March 3, 1997.)

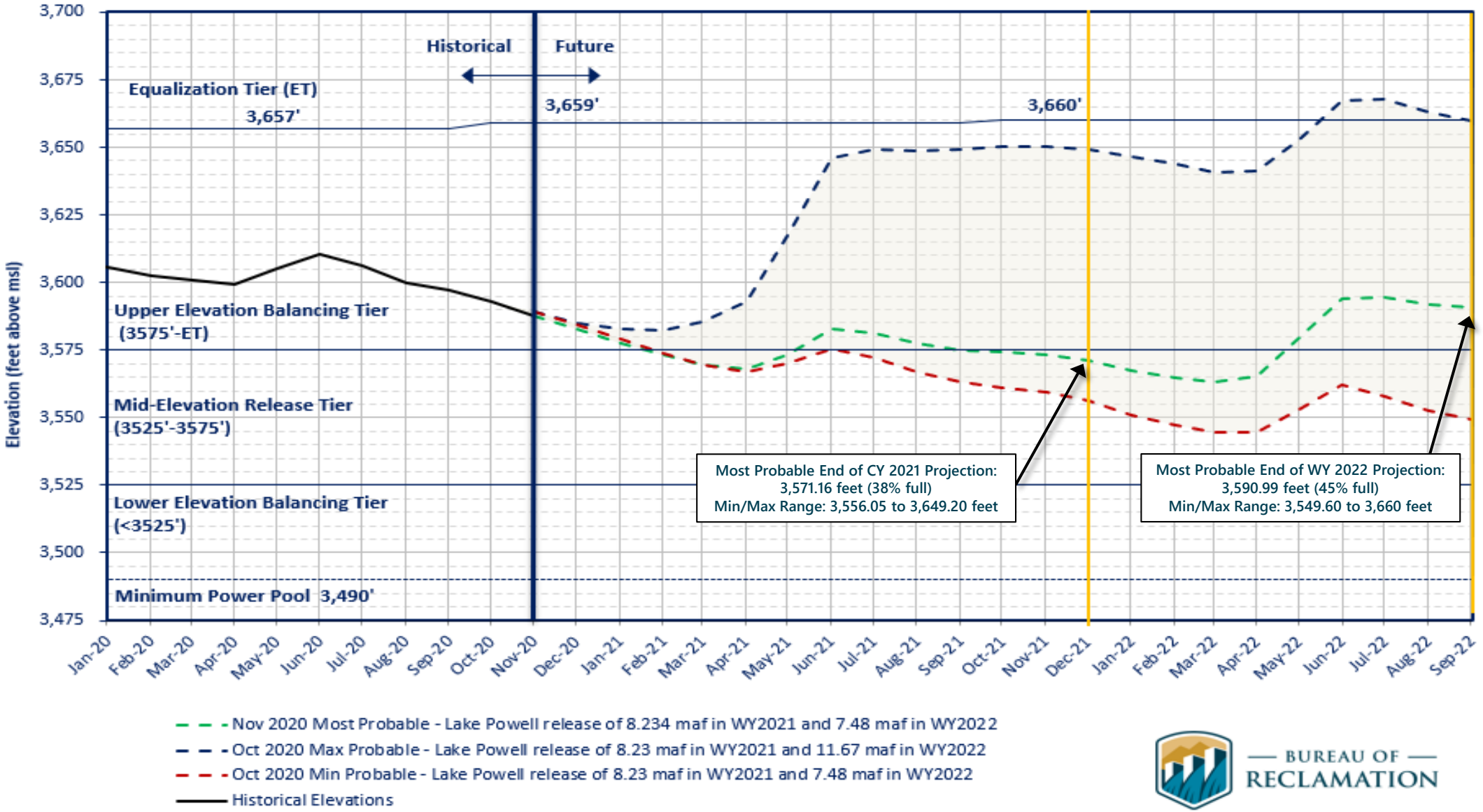
Lake Powell Monthly Release Volume Distribution

WAPA Proposed 9.0 maf Pattern for Water Year 2021



Lake Powell End of Month Elevations

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



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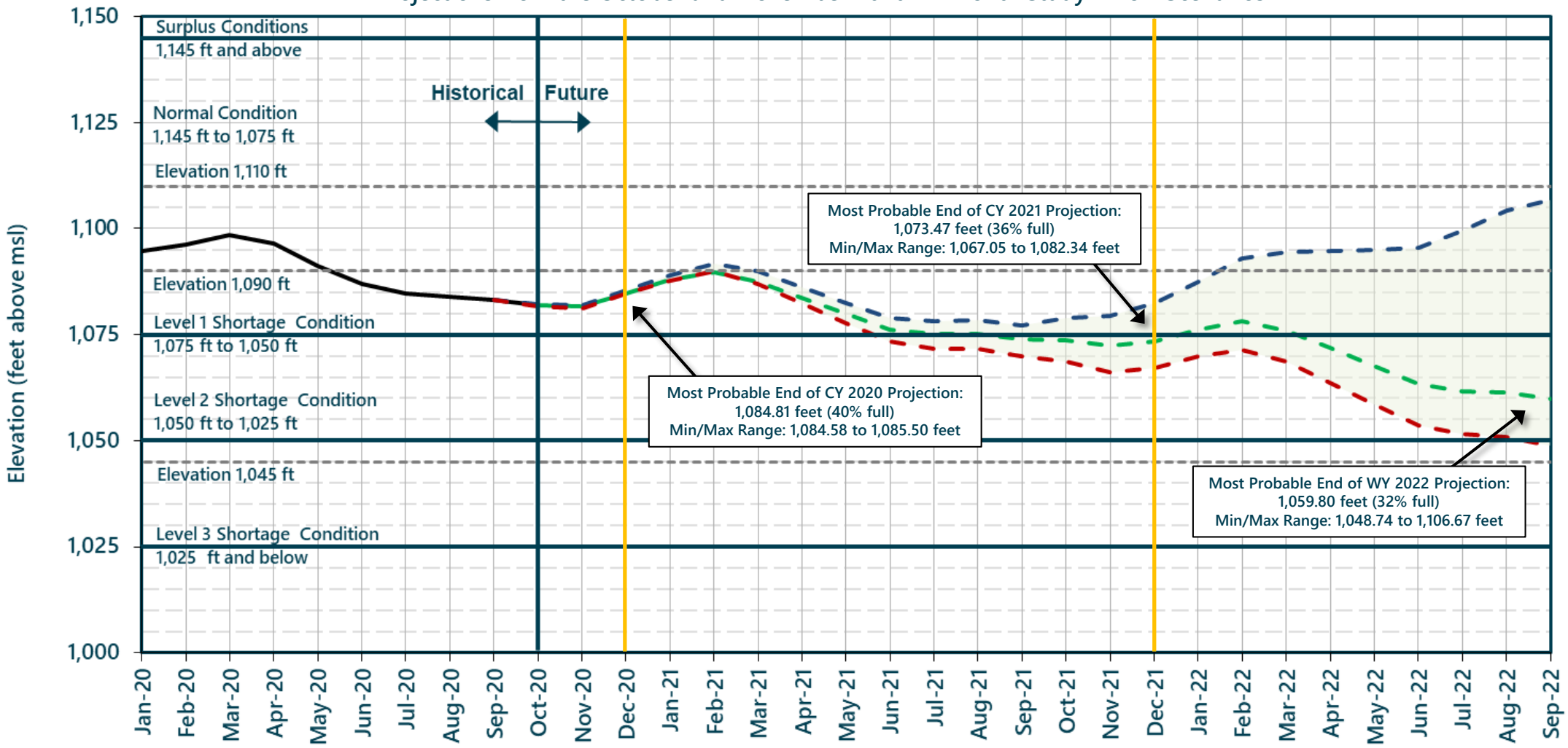
Lake Mead End of Month Elevations

Projections from the October and November 2020 24-Month Study Inflow Scenarios



Historical Elevations

November 2020 Most Probable Inflow with a Lake Powell release of 8.234 maf in WY 2021 and 7.48 maf in WY 2022

October 2020 Maximum Probable Inflow with a Lake Powell release of 8.23 maf in WY 2021 and 11.67 maf in WY 2022

October 2020 Minimum Probable Inflow with a Lake Powell release of 8.23 maf in WY 2021 and 7.48 maf in WY 2022

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	5/4	6	6	6	6	6	6	6	6	6	6/4	
Capacity (cfs)	16,400	16,400 /12,200	19,800	19,700	19,500	19,400	19,400	19,500	19,800	19,700	19,600	19,600 /12,400	NOV MOST[3]
Capacity (kaf/month)	1,040	1,140	1,250	1,220	1,100	1,220	1,220	1,270	1,260	1,310	1,340	1,100	OCT MAX
Max (kaf) [2]	640	640	720	760	680	710	640	630	660	750	800	600	8.23
Most (kaf) [1]	640	640	720	760	680	710	640	630	660	750	800	604	8.234
Min (kaf) [2]	640	640	720	760	680	710	640	630	660	750	800	600	8.23
										(updated 11-20-2020)			

1 Projected release, based on November 2020 Most Probable Inflow Projections and 24-Month Study model runs.
2 Projected release, based on October 2020 Min and Max Probable Inflow Projections and 24-Month Study model runs.
3 Dependent upon availability to shift contingency reserves, which will increase capacity by 30-40MW (3%) at current efficiency.

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Glen Canyon Power Plant Planned Unit Outage Schedule for Water Year 2022

Unit Number	Oct 2021	Nov 2021	Dec 2021	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	
1													
2													
3													
4													
5													
6													
7													
8													
Units Available	4	4/5	6	6	4	6	8	7	8	8	8	8/6	
Capacity (cfs)	12,400	12,400 /15,900	15,900	19,400 /12,300	12,200	19,300	26,400	23,300	27,400	27,400	27,300	20,100	NOV MOST[3]
Capacity (kaf/month)	870	970	1,350	1,770	1,210	1,390	1,720	1,600	1,760	1,820	1,810	1,340	OCT MAX
Max (kaf) [2]	640	640	720	950	950	1,100	1,050	1,050	1,075	1,250	1,280	968	11.67
Most (kaf) [1]	480	500	600	720	640	675	600	600	630	710	760	565	7.48
Min (kaf) [2]	480	500	600	720	640	675	600	600	630	710	760	565	7.48
										(updated 11-20-2020)			

1 Projected release, based on November 2020 Most Probable Inflow Projections and 24-Month Study model runs.
2 Projected release, based on October 2020 Min and Max Probable Inflow Projections and 24-Month Study model runs.
3 Dependent upon availability to shift contingency reserves, which will increase capacity by 30-40MW (3%) at current efficiency.

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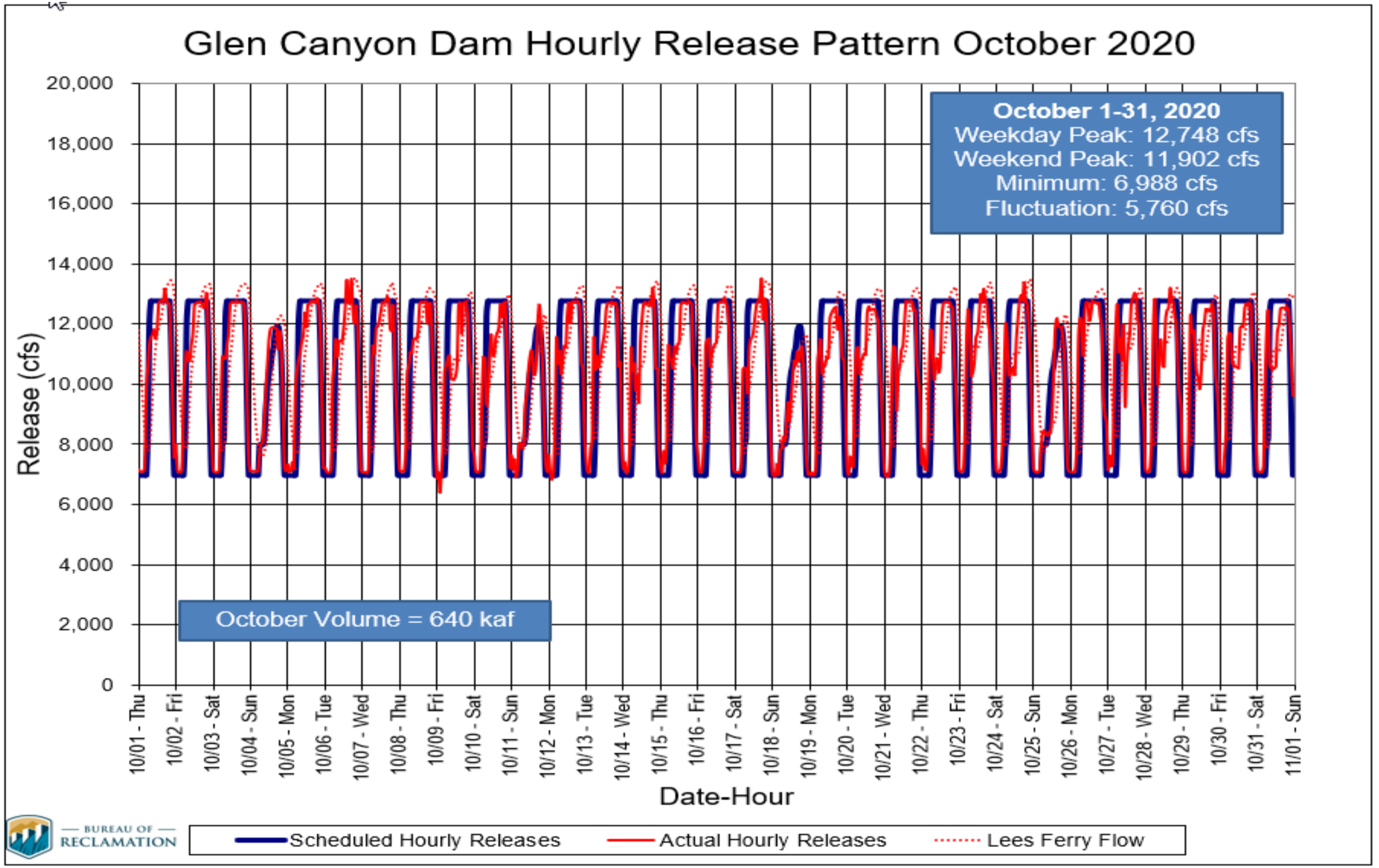
Glen Canyon Dam Hourly Release Pattern October 2020
October 1-31, 2020
Weekday Peak: 12,748 cfs
Weekend Peak: 11,902 cfs
Minimum: 6,988 cfs
Fluctuation: 5,760 cfs
October Volume = 640 kaf
Release (cfs)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
10/01 - Thu
10/02 - Fri
10/03 - Sat
10/04 - Sun
10/05 - Mon
10/06 - Tue
10/07 - Wed
10/08 - Thu
10/09 - Fri
10/10 - Sat
10/11 - Sun
10/12 - Mon
10/13 - Tue
10/14 - Wed
10/15 - Thu
10/16 - Fri
10/17 - Sat
10/18 - Sun
10/19 - Mon
10/20 - Tue
10/21 - Wed
10/22 - Thu
10/23 - Fri
10/24 - Sat
10/25 - Sun
10/26 - Mon
10/27 - Tue
10/28 - Wed
10/29 - Thu
10/30 - Fri
10/31 - Sat
11/01 - Sun
Date-Hour
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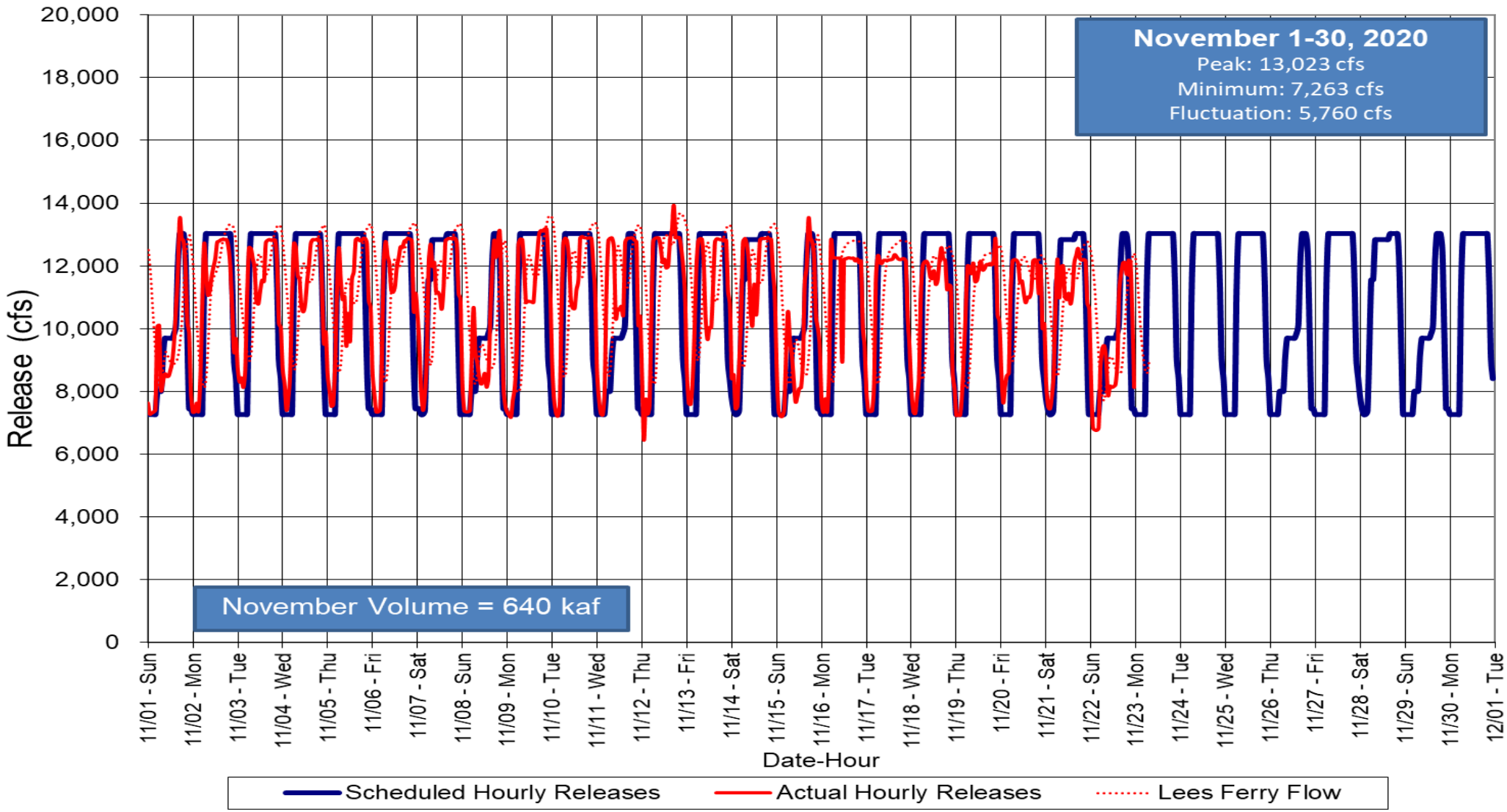
Scheduled Hourly Releases
Actual Hourly Releases
Lees Ferry Flow

Glen Canyon Dam Hourly Release Pattern November 2020



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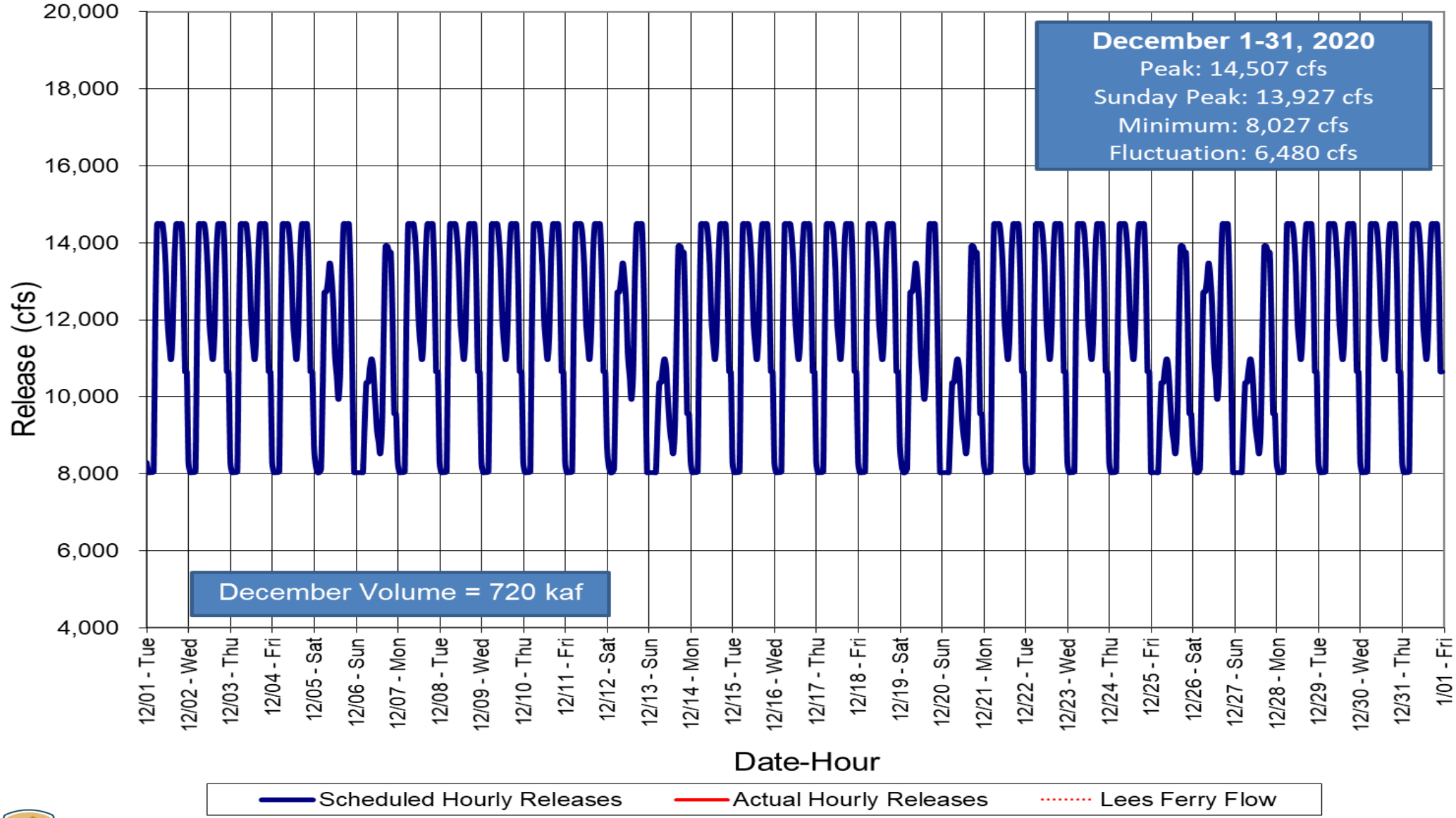
Glen Canyon Dam Hourly Release Pattern December 2020



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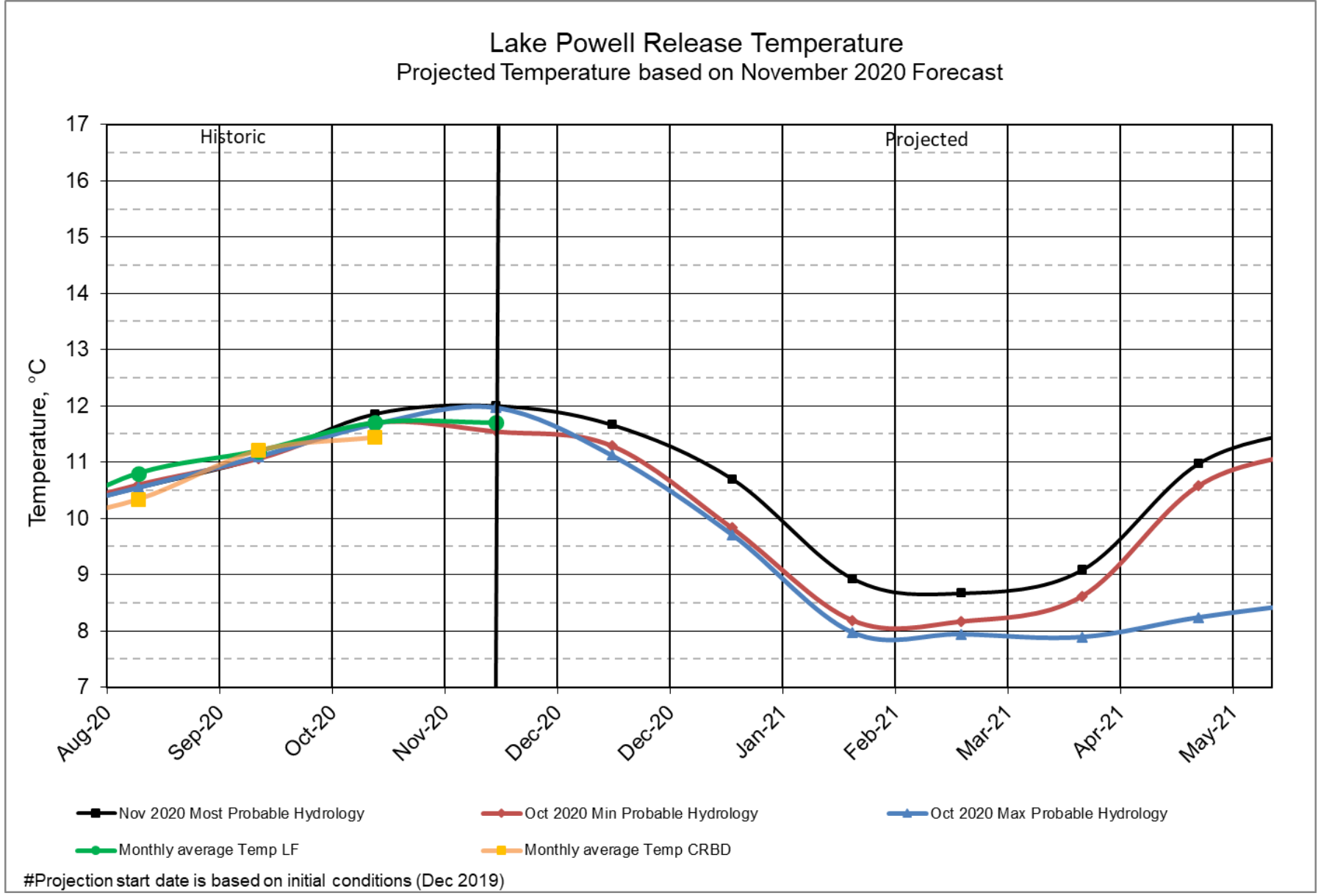
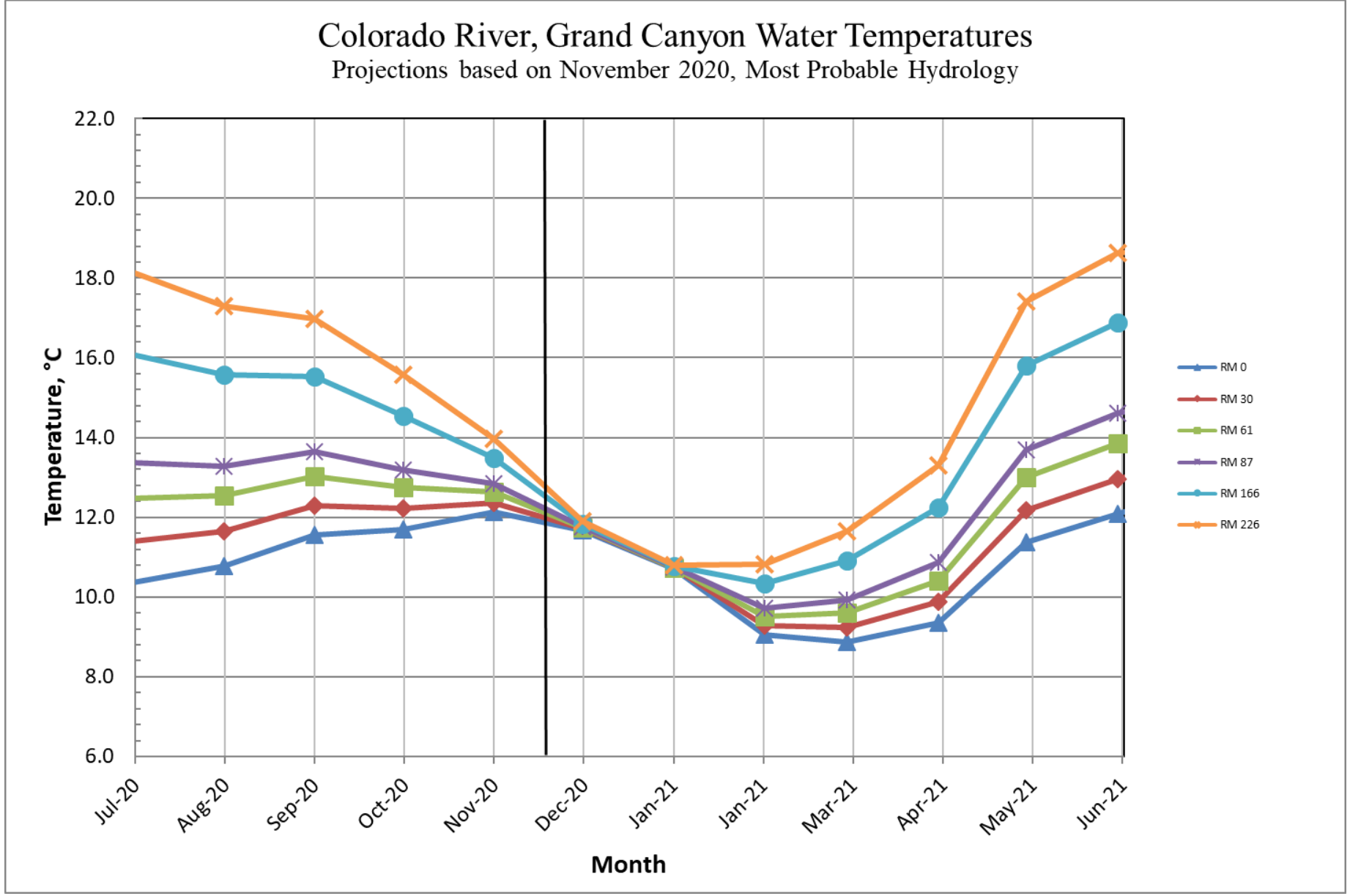
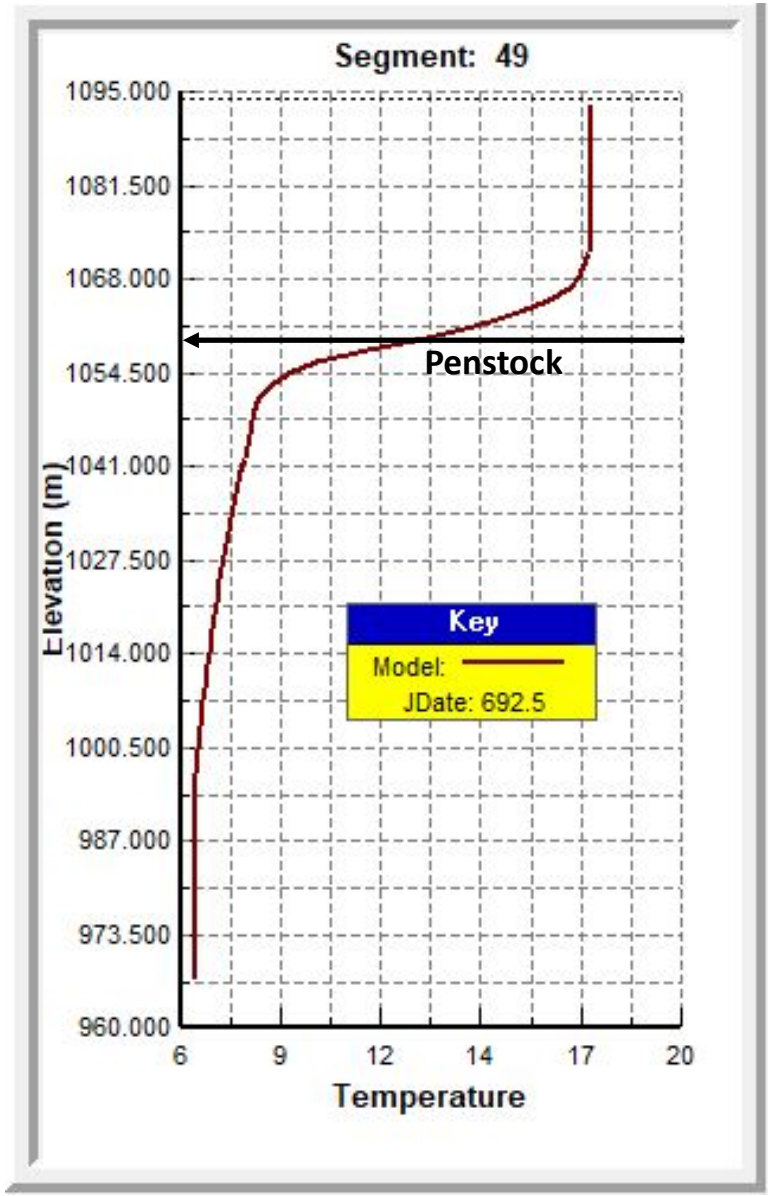
Water Quality

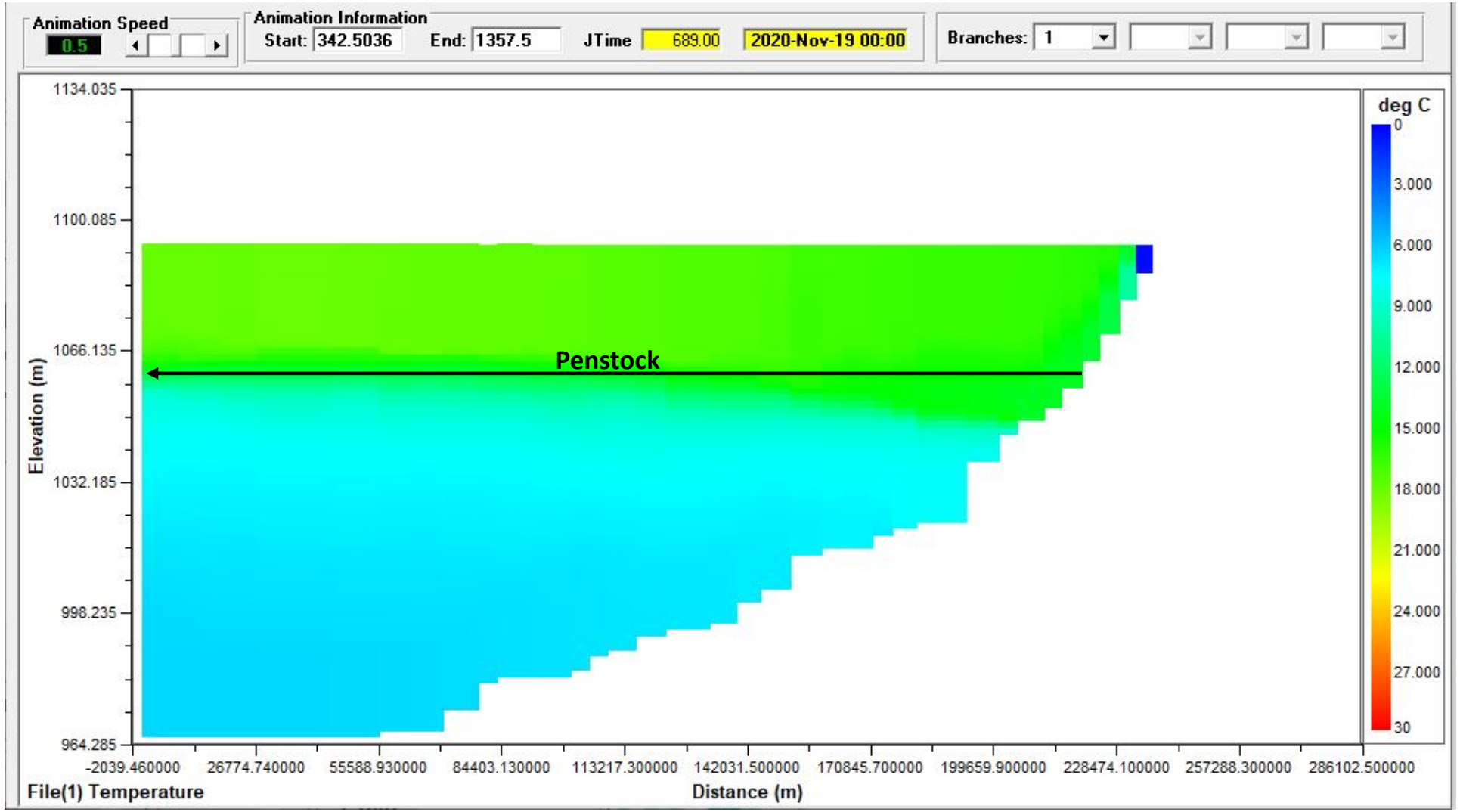

Lake Powell Release Temperature
Projected Temperature based on November 2020 Forecast
Historic
Projected
Temperature, °C
17
16
15
14
13
12
11
10
9
8
7
Aug-20
Sep-20
Oct-20
Nov-20
Dec-20
Dec-20
Jan-21
Feb-21
Mar-21
Apr-21
May-21
Nov 2020 Most Probable Hydrology
Oct 2020 Min Probable Hydrology
Oct 2020 Max Probable Hydrology
Monthly average Temp LF
Monthly average Temp CRBD
#Projection start date is based on initial conditions (Dec 2019)

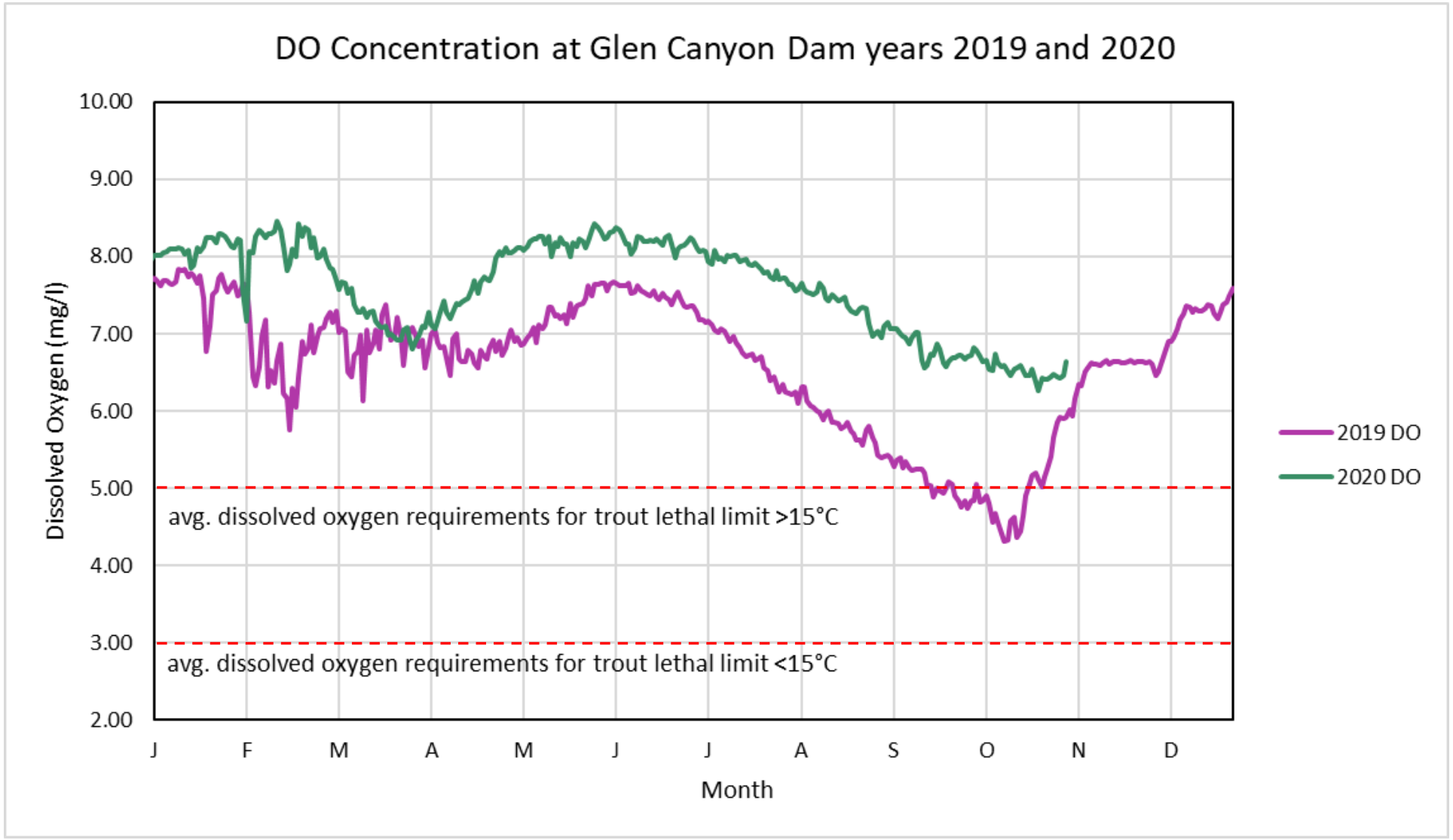

Colorado River, Grand Canyon Water Temperatures
Projections based on November 2020, Most Probable Hydrology
Temperature, °C
22.0
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
Jul-20
Aug-20
Sep-20
Oct-20
Nov-20
Dec-20
Jan-21
Jan-21
Mar-21
Apr-21
May-21
Jun-21
Month
RM 0
RM 30
RM 61
RM 87
RM 166
RM 226

Temperature Profile of Lake Powell near Glen Canyon Dam
11/22/2020



Cross Sectional Temperature Profile of Lake Powell
11/19/2020




DO Concentration at Glen Canyon Dam years 2019 and 2020
Dissolved Oxygen (mg/l)
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
avg. dissolved oxygen requirements for trout lethal limit >15°C
avg. dissolved oxygen requirements for trout lethal limit <15°C
J
F
M
A
M
J
J
A
S
O
N
D
Month
2019 DO
2020 DO

Questions/Discussion

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