BUREAU OF RECLAMATION

2022 Colorado River Annual Operating Plan

Colorado River Management Work Group

First Consultation

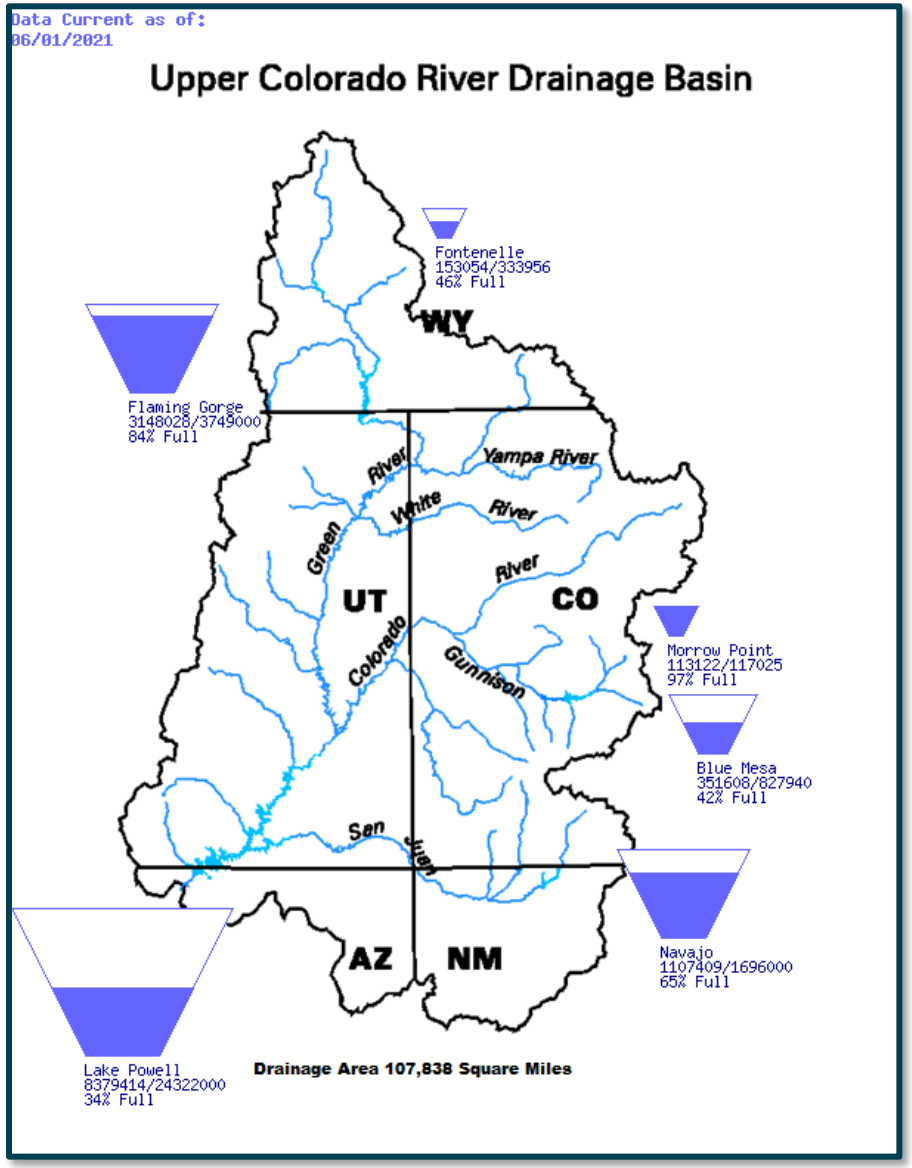
June 3, 2021

Upper Colorado Basin

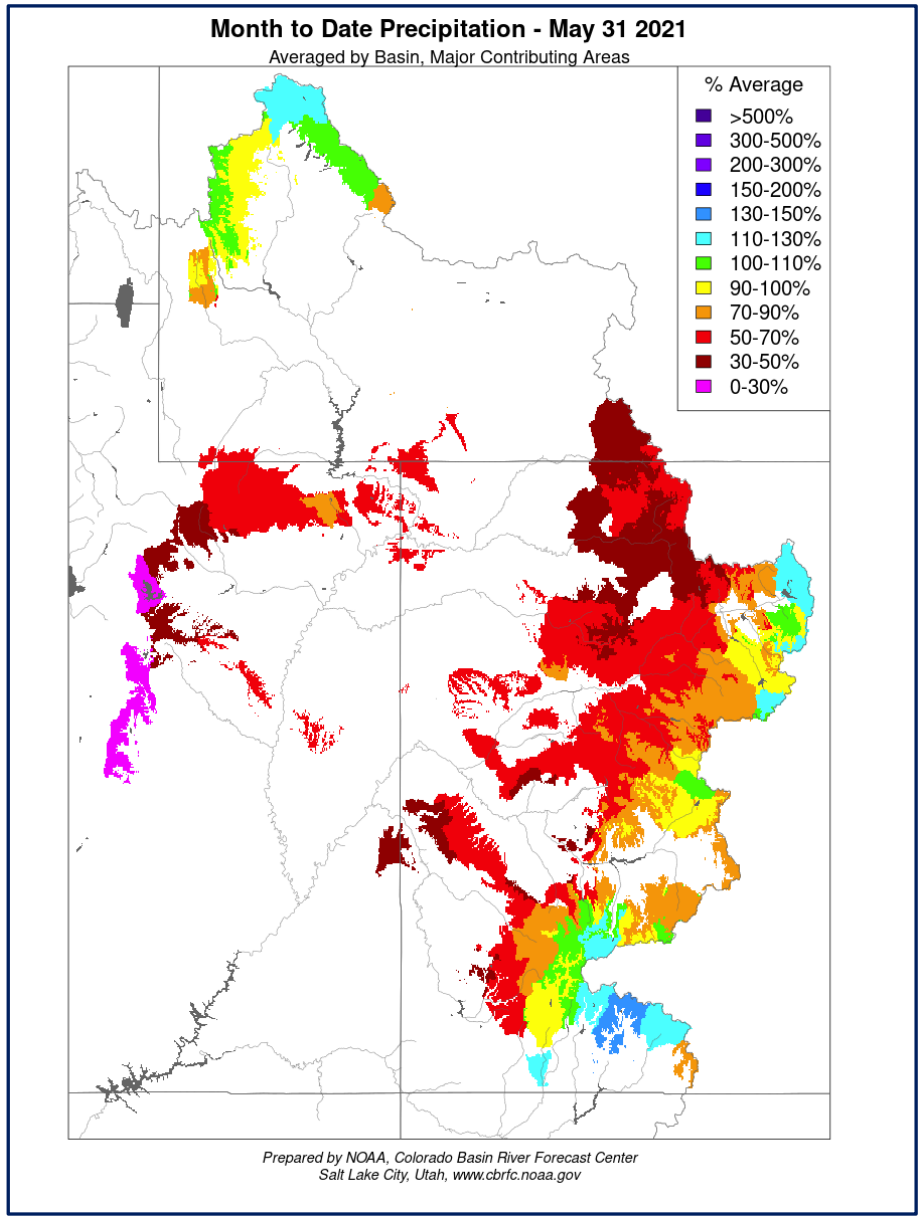
Water Year 2021 Hydrology

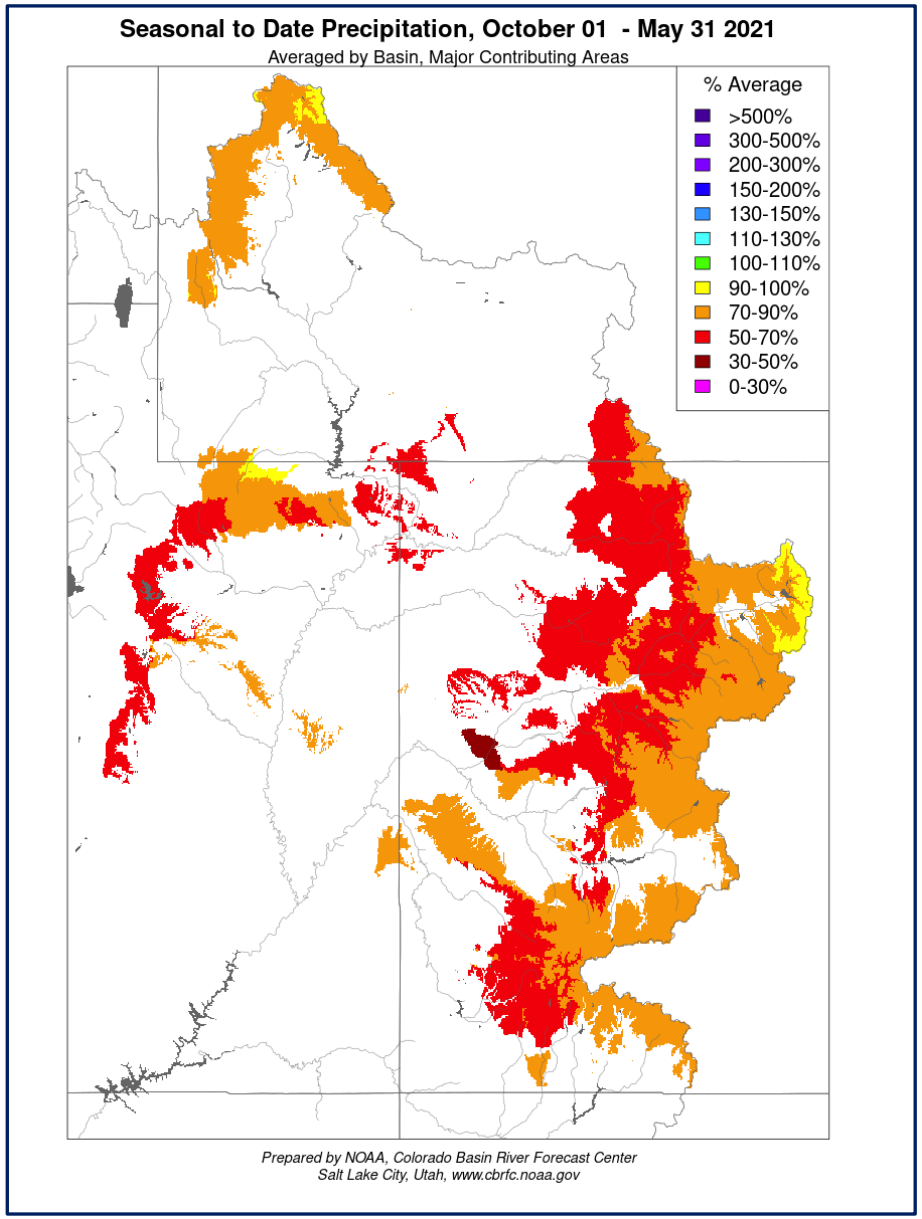
Upper Basin Storage (as of June 1, 2021)

Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	46	0.15	0.33	6,478.95
Flaming Gorge	84	3.15	3.75	6,024.67
Blue Mesa	42	0.35	0.83	7,457.42
Navajo	65	1.11	1.70	6,039.50
Lake Powell	34	8.38	24.32	3,560.74
UC System Storage	43	13.27	31.09	

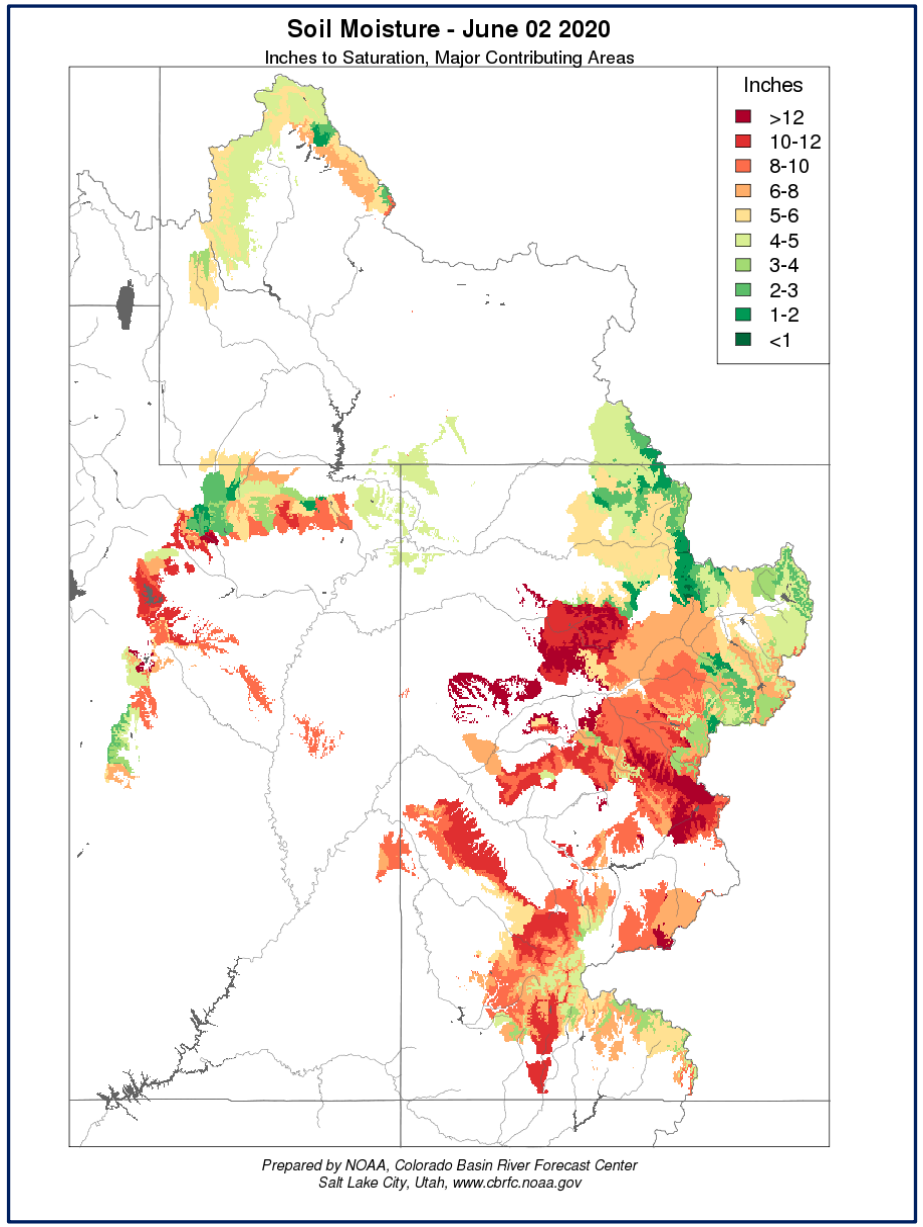


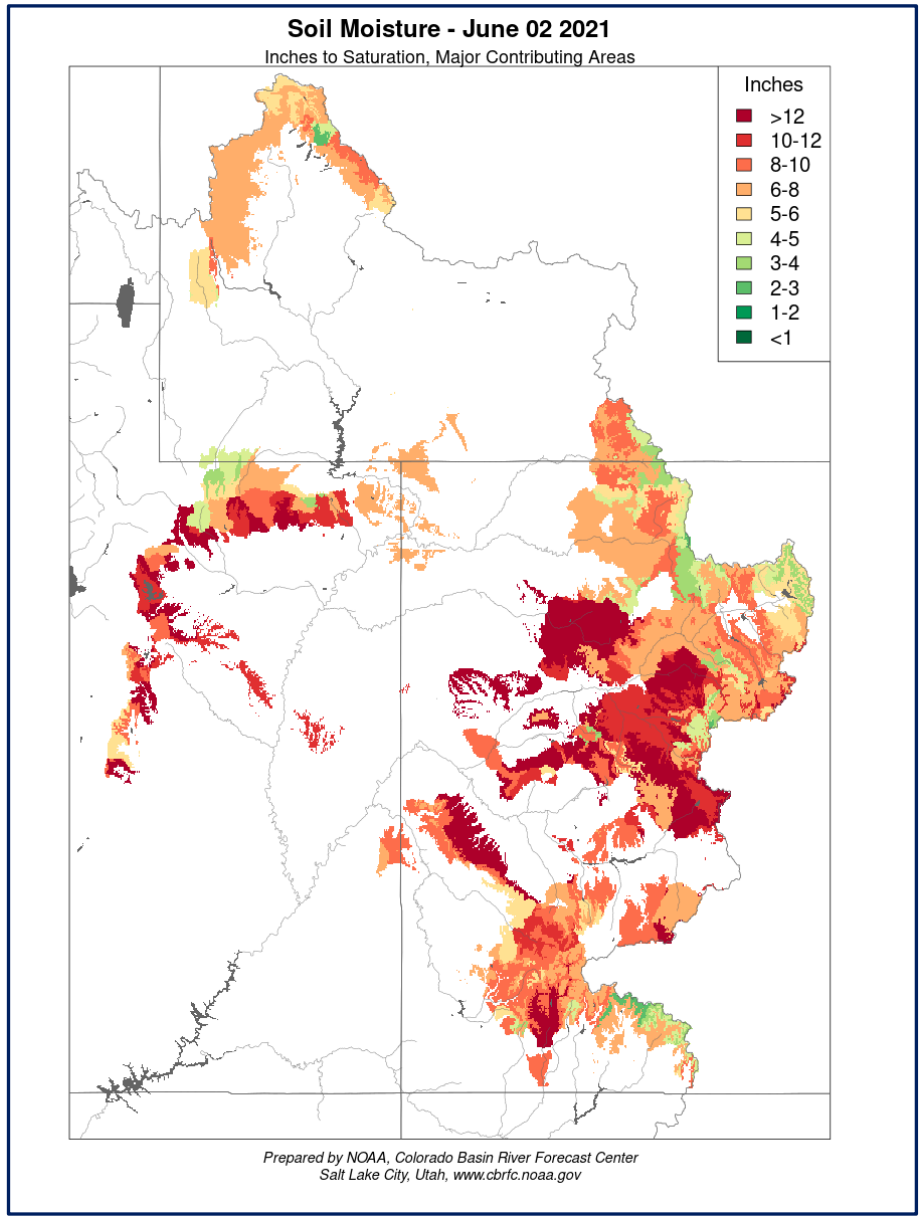
Precipitation: May and Seasonal



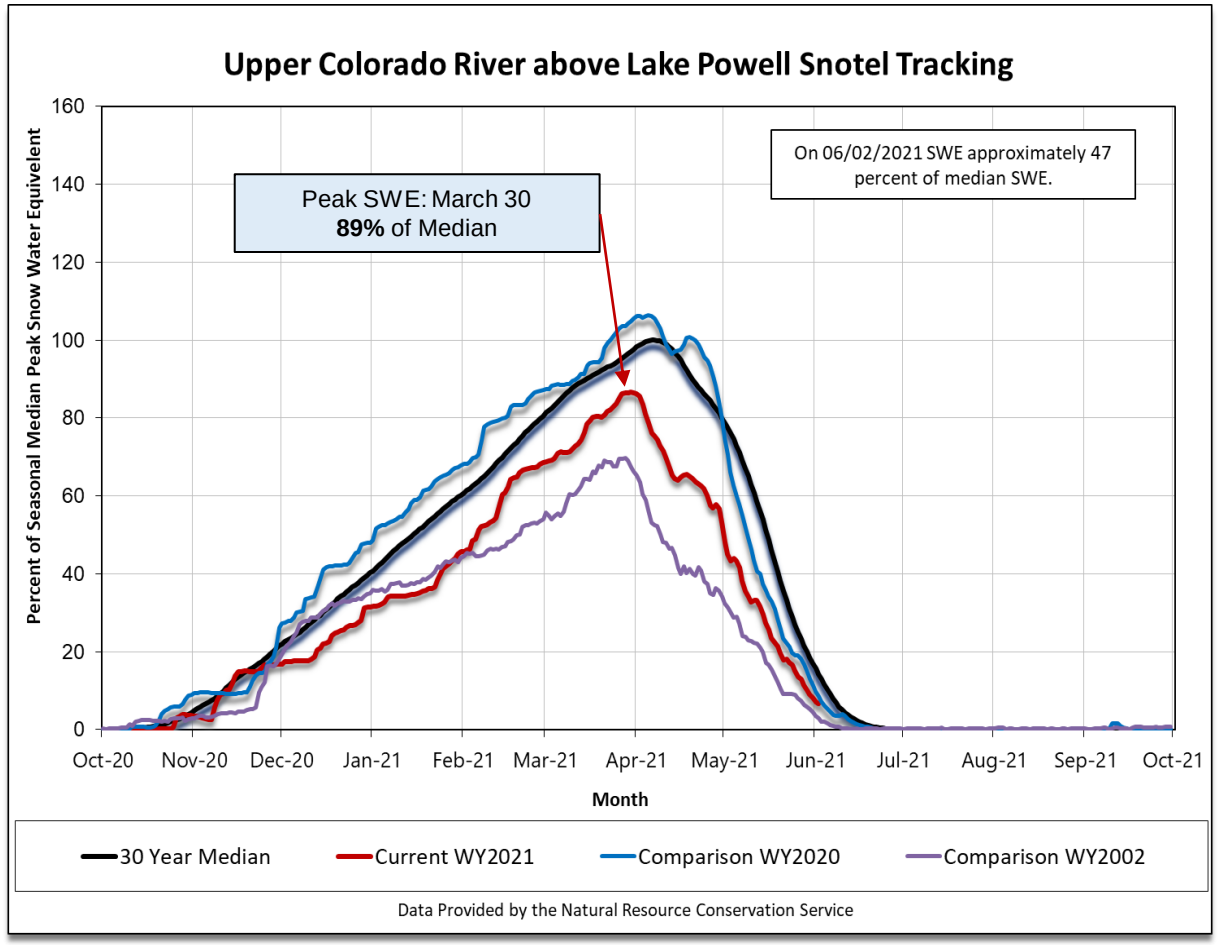


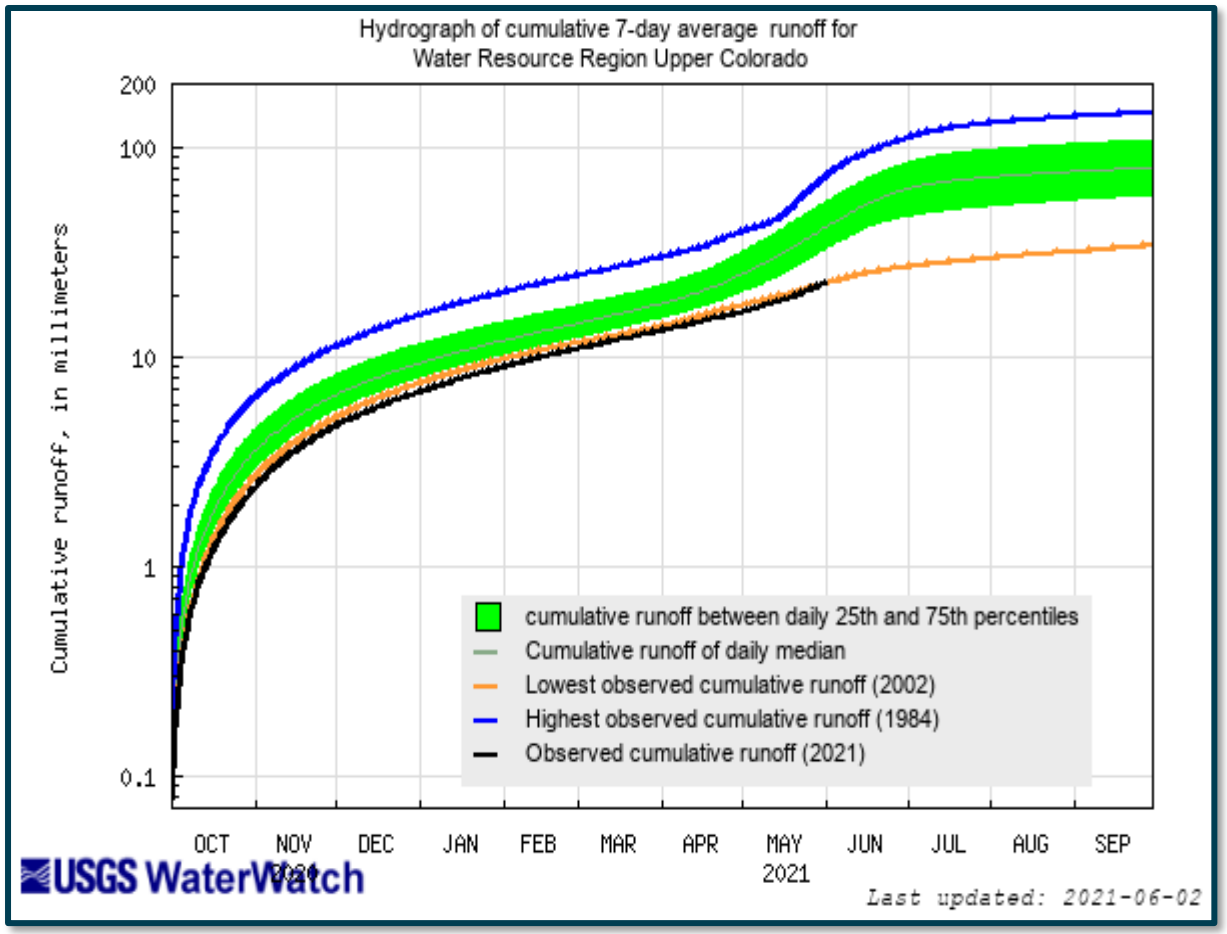
Soil Moisture Comparison: June 2020 and 2021





Current SWE and Observed UC Runoff





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

Most Probable May Final Forecast
April-July and WY

April – July 2021
Forecasted Unregulated Inflow
as of May 4, 2021

Reservoir	Unregulated Inflow (kaf)	Difference from April (kaf)	Percent of Average[1]
Fontenelle	380	-50	52
Flaming Gorge	450	-80	46
Blue Mesa	340	-100	50
Navajo	325	-70	44
Powell	1,999	-1,200	28

Water Year 2021
Forecasted Unregulated Inflow
as of May 5, 2021

Reservoir	Unregulated Inflow (kaf)	Difference from April (kaf)	Percent of Average[1]
Fontenelle	630	-61	58
Flaming Gorge	744	-90	51
Blue Mesa	540	-104	57
Navajo	463	-74	43
Powell	3,636	-1,261	34

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

Most Probable May Mid-Month Forecast
April-July and WY

April – July 2021
Forecasted Unregulated Inflow
as of May 17, 2021

Reservoir	Unregulated Inflow (kaf)	Difference from May FF (kaf)	Percent of Average[1]
Fontenelle	345	-35	48
Flaming Gorge	395	-55	40
Blue Mesa	340	No Change	50
Navajo	310	-15	42
Powell	1,850	-150	26

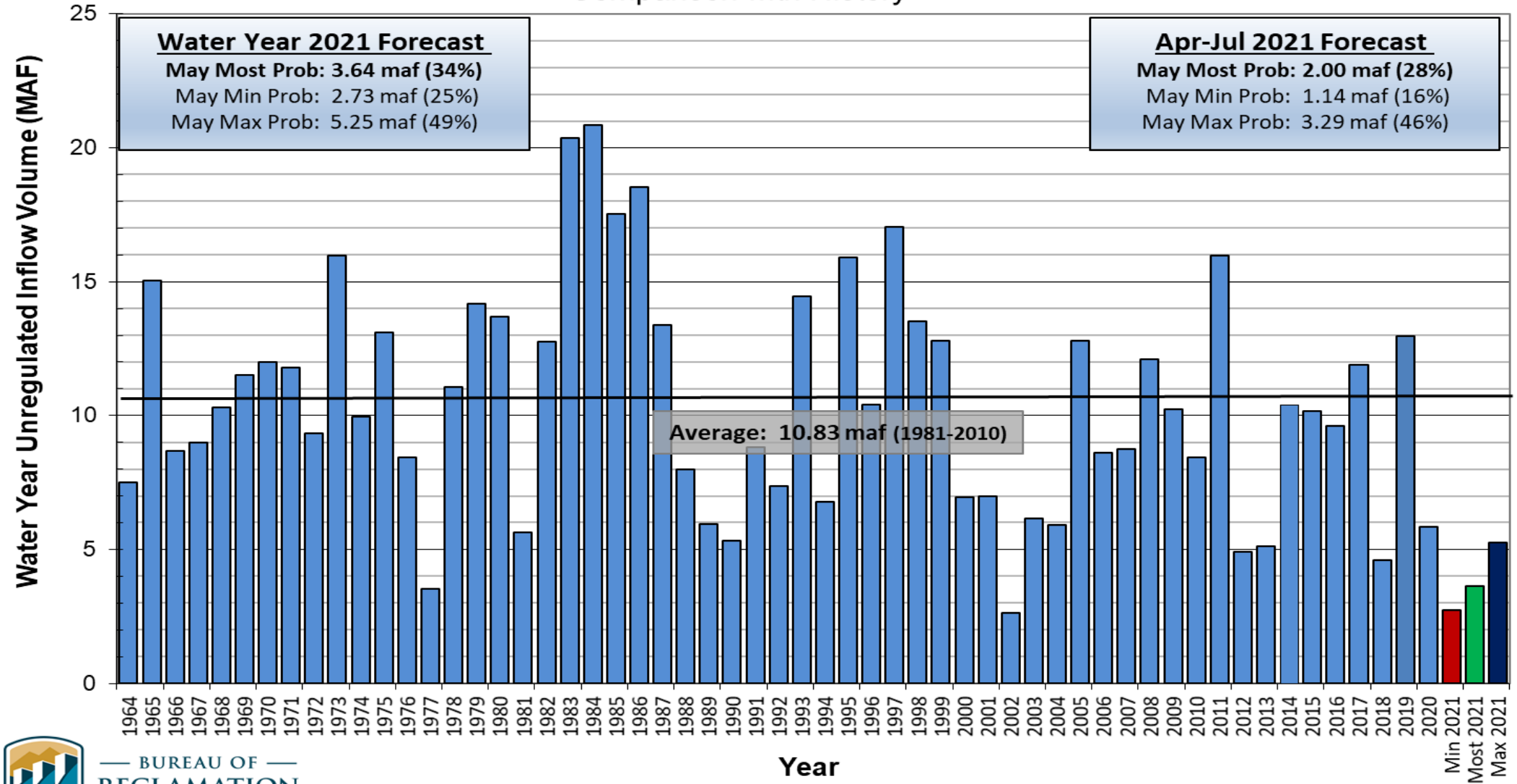
Water Year 2021
Forecasted Unregulated Inflow
as of May 17, 2021

Reservoir	Unregulated Inflow (kaf)	Percent of Average[1]
Fontenelle	595	55
Flaming Gorge	689	48
Blue Mesa	540	57
Navajo	448	41
Powell	3,487	32

Powell April Forecast 4,897 kaf (45%) - a decrease of 1,410 maf

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

Lake Powell Unregulated Inflow
Water Year 2021 Forecast *(issued May 5)*
Comparison with History



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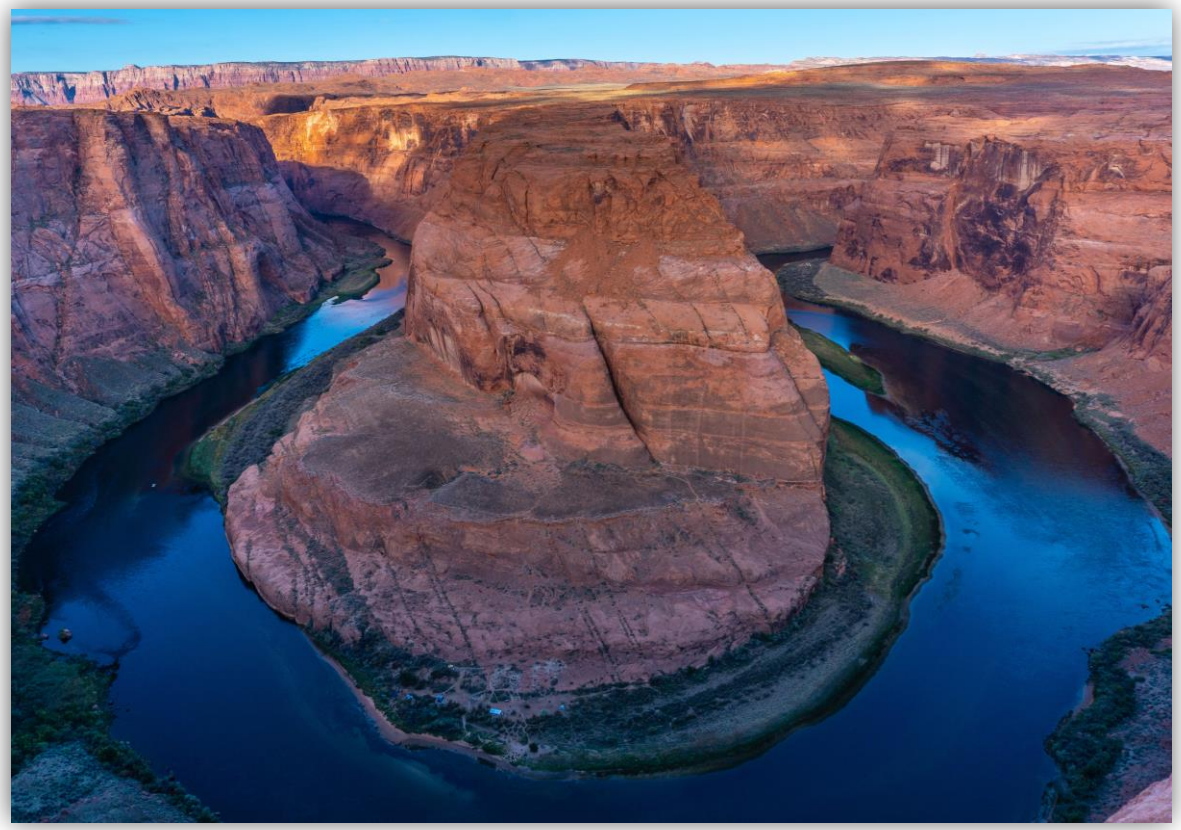
Upper Colorado Basin

Projected Operations for Water Years 2021 and 2022



Drought Response Operations Agreement (DROA)

- Formal notification that the January 2021 Minimum Probable 24 Month Study (24-MS) run projected Powell to fall below 3,525 feet in 2022 was provided pursuant to the DROA.
  - February through May Minimum Probable 24-MS continued to indicate elevations below 3,525 feet in 2022.
  - Operating under enhanced monitoring and coordination under the DROA.
  - Operating with monthly analysis of min/most/max with the parties specified in the DROA.
- The May most probable 24-Month Study elevation projected Lake Powell reaching 3,525.57 feet as early as March 2022.
- The UCRC announced on May 20, 2021, through a press release, that the parties are beginning the process of developing a drought response operations plan in accordance with the DROA.
  - Consultation with the states of Arizona, California, and Nevada will occur prior to finalization of the developed plan.
  - The developed plan will be finalized if Reclamation's April 24-Month Study Most Probable forecast shows Lake Powell falling to a target elevation of 3,525 feet or below within a 12-month period.
  - If the Secretary of Interior determines there is imminent need to protect Lake Powell elevations from dropping below 3,525 feet, she has the discretion to take emergency action after consulting with the Colorado River Basin States.

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[1]

Lake Powell

Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf)[1]
3,700	**Equalization Tier** Equalize, avoid spills or release 8.23 maf	24.3
3,636 - 3,666 (2008-2026)	**Upper Elevation Balancing Tier**[3] Release 8.23 maf; 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)
3,591.60 ft Jan 1, 2021 projection		
3,575	**Mid-Elevation Release Tier** Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.5
3,525		5.9
3,490	**Lower Elevation Balancing Tier** Balance contents with a min/max release of 7.0 and 9.5 maf	4.0
3,370		0

Lake Mead

Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf)[1]
1,220	**Flood Control Surplus or Quantified Surplus Condition** Deliver > 7.5 maf	25.9
1,200 (approx.)[2]	**Domestic Surplus or ICS Surplus Condition** Deliver > 7.5 maf	22.9 (approx.)[2]
1,145		15.9
1,105	**Normal or ICS Surplus Condition** Deliver ≥ 7.5 maf	11.9
1,085.28 ft Jan 1, 2021 projection		
1,075	**Shortage Condition** Deliver 7.167[4] maf	9.4
1,050	**Shortage Condition** Deliver 7.083[5] maf	7.5
1,025		5.8
1,000	**Shortage Condition** Deliver 7.0[6] maf Further measures may be undertaken[7]	4.3
895		0

Diagram not to scale

[1] Acronym for million acre-feet

[2] 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.

[3] Subject to April adjustments which may result in a release according to the Equalization Tier

[4] Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

[5] Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

[6] Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

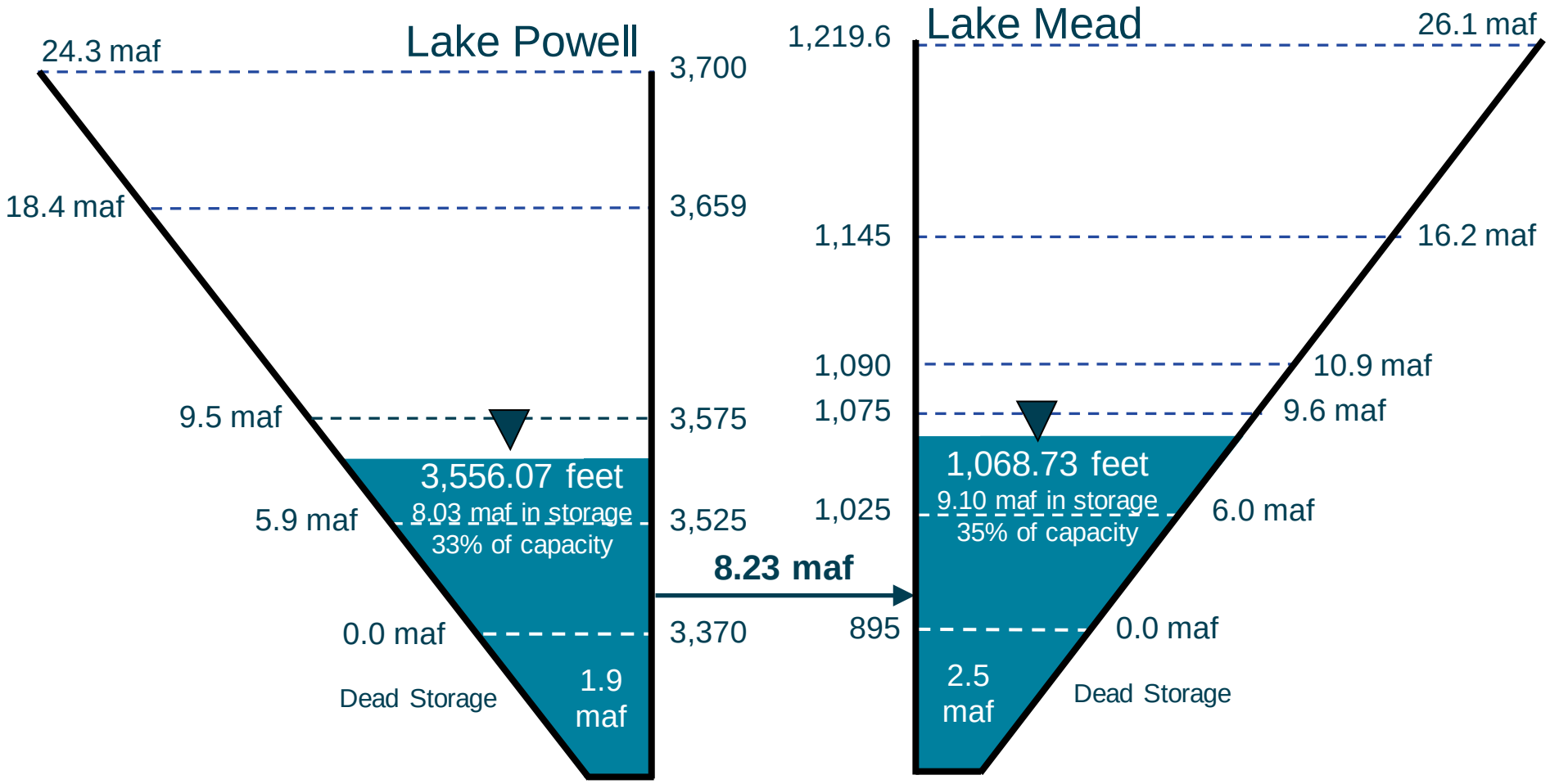
[7] Whenever Lake Mead is below elevation 1,025 feet, the Secretary shall consider whether hydrologic conditions together with anticipated deliveries to the Lower Division States and Mexico is likely to cause the elevation at Lake Mead to fall below 1,000 feet. Such consideration, in consultation with the Basin States, may result in the undertaking of further measures, consistent with applicable Federal law.

[1] Lake Powell and Lake Mead operational tier determinations were based on August 2020 24-Month Study projections and are documented in the 2021 AOP.

End of Water Year 2021 Projections

April 2021 24-Month Study Most Probable Inflow Scenario[1]

Based on a Lake Powell Unregulated Inflow Forecast of 4.90 maf (45% of average)

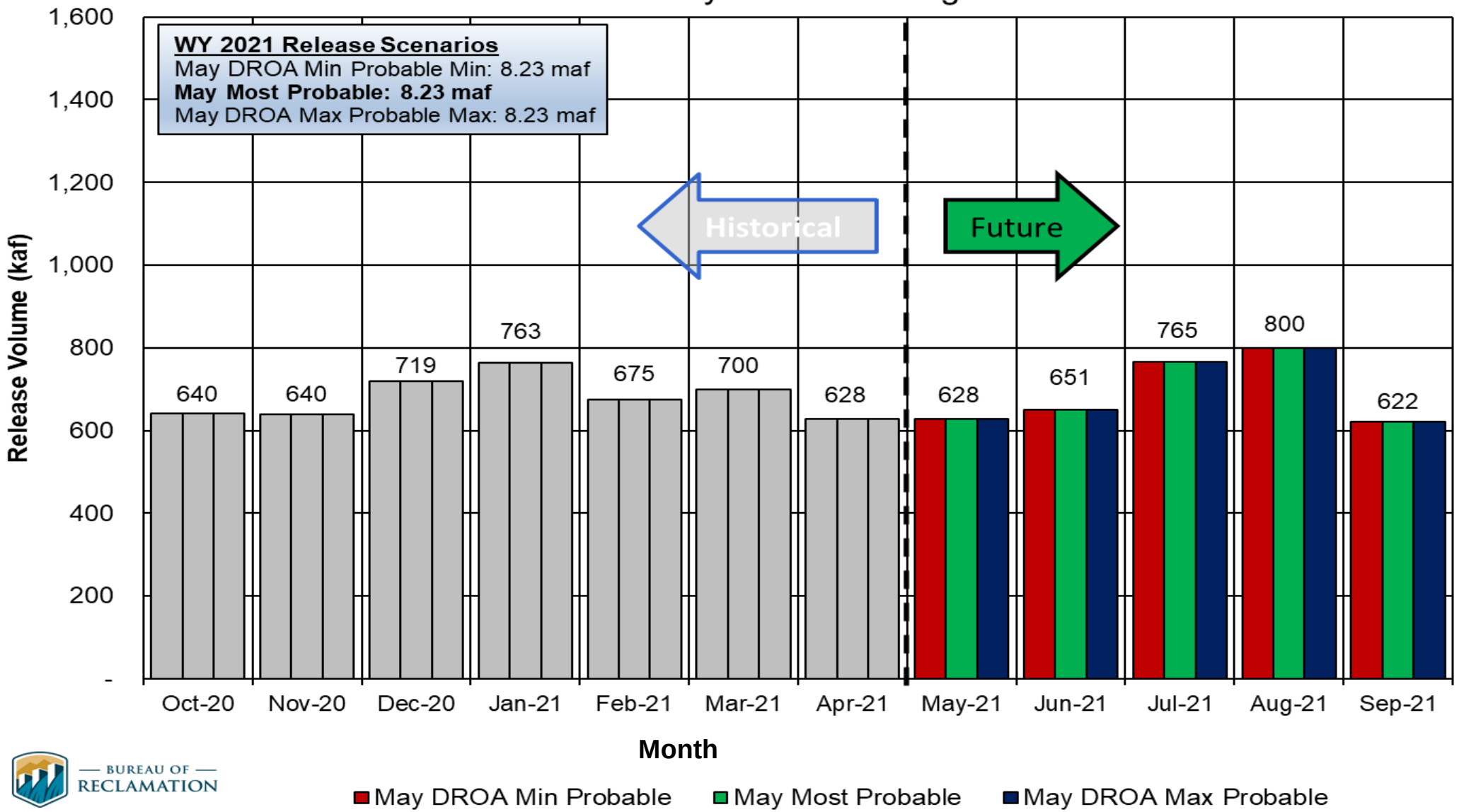


Not to Scale

[1] *WY 2021 unregulated inflow into Lake Powell is based on the CBRFC forecast dated 4/2/21.*

Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2021
Based on May 2021 Modeling



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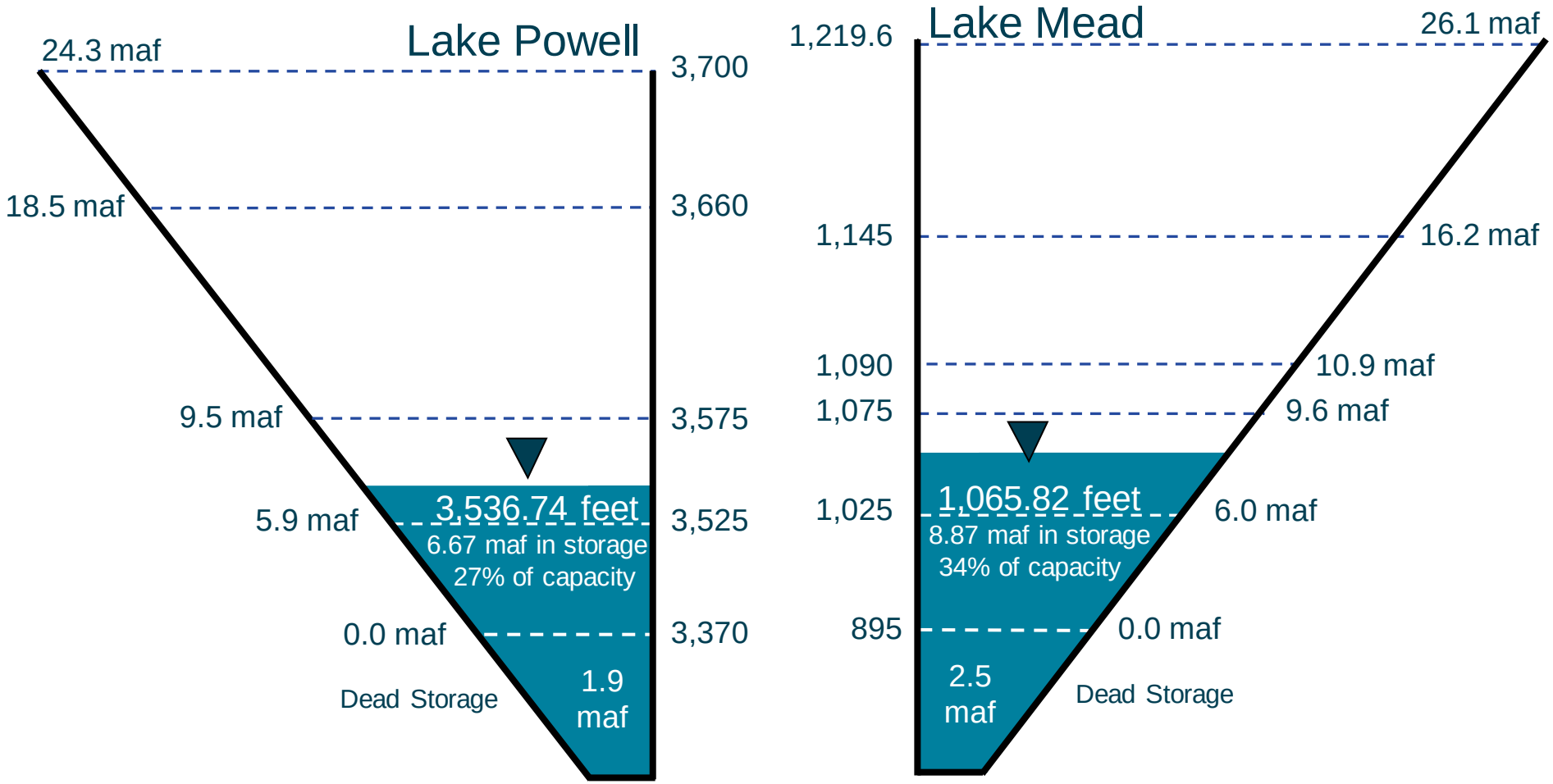
Timing of Operational Decisions

- August 24-Month Study projections of January 1 elevations sets the operating tiers for Lake Powell and Lake Mead

End of Calendar Year 2021 Projections

May 2021 24-Month Study Most Probable Inflow Scenario[1]

Based on a Lake Powell release of 8.23 maf in WY 2021 and 7.48 maf in WY 2022



Not to Scale

[1] *WY 2021 unregulated inflow into Lake Powell is based on the CBRFC forecast dated 5/4/21.*

Lake Powell & Lake Mead Operational Table

Projected Tiers for Water/Calendar Year 2022[1]

Lake Powell

Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf)[1]
3,700	**Equalization Tier** Equalize, avoid spills or release 8.23 maf	24.3
3,636 - 3,666 (2008-2026)	**Upper Elevation Balancing Tier**[3] Release 8.23 maf; 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)
3,575	**Mid-Elevation Release Tier** Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.5
3,536.74 ft *Jan 1, 2022 Projection*		
3,525	**Lower Elevation Balancing Tier** Balance contents with a min/max release of 7.0 and 9.5 maf	5.9
3,490		4.0
3,370		0

Lake Mead

Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf)[1]
1,220	**Flood Control Surplus or Quantified Surplus Condition** Deliver > 7.5 maf	25.9
1,200 (approx.)[2]	**Domestic Surplus or ICS Surplus Condition** Deliver > 7.5 maf	22.9 (approx.)[2]
1,145		15.9
1,105	**Normal or ICS Surplus Condition** Deliver ≥ 7.5 maf	11.9
1,075		9.4
1,065.82 ft *Jan 1, 2022 Projection*	**Shortage Condition** Deliver 7.167[4] maf	
1,050	**Shortage Condition** Deliver 7.083[5] maf	7.5
1,025		5.8
1,000	**Shortage Condition** Deliver 7.0[6] maf Further measures may be undertaken[7]	4.3
895		0

Diagram not to scale

[1] Acronym for million acre-feet

[2] 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.

[3] Subject to April adjustments which may result in a release according to the Equalization Tier

[4] Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

[5] Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

[6] Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

[7] 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.

[1] Lake Powell and Lake Mead operational tier determinations will be based on the August 2021 24-Month Study projections and documented in the draft 2022 AOP.

Lake Powell WY 2022 Operating Tier Scenarios

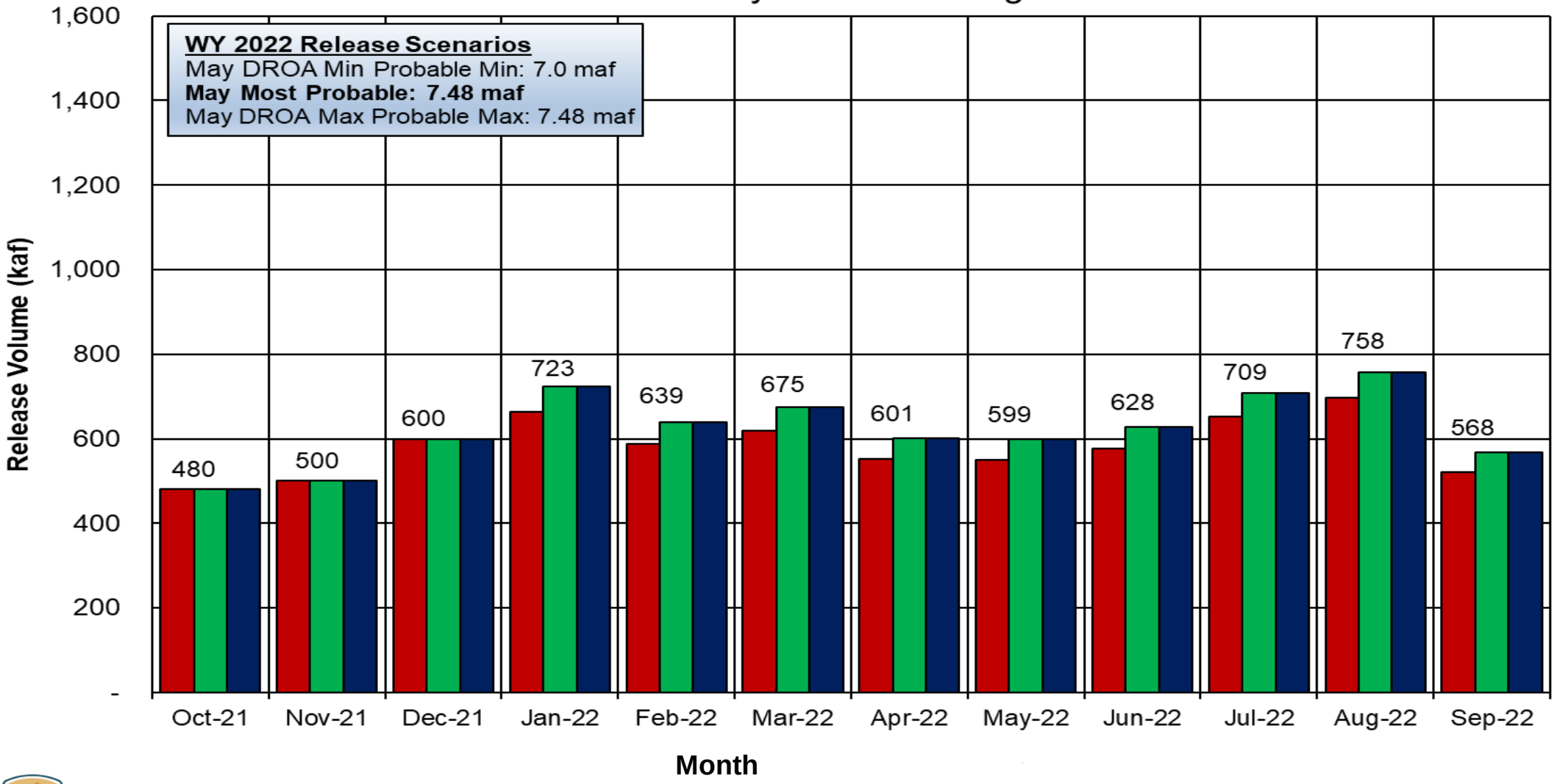
Based on May 2021 24-Month Study Inflow Scenarios

Inflow Scenario	Operating Tier/ Release Volume
May DROA* Minimum Probable	Lower Elevation Balancing 7.00 maf
May Most Probable	Mid-Elevation Release 7.48 maf
May DROA* Maximum Probable	Mid-Elevation Release 7.48 maf

*The Drought Response Operations Agreement (DROA) can be found online at: https://www.usbr.gov/dcp/finaldocs.html.

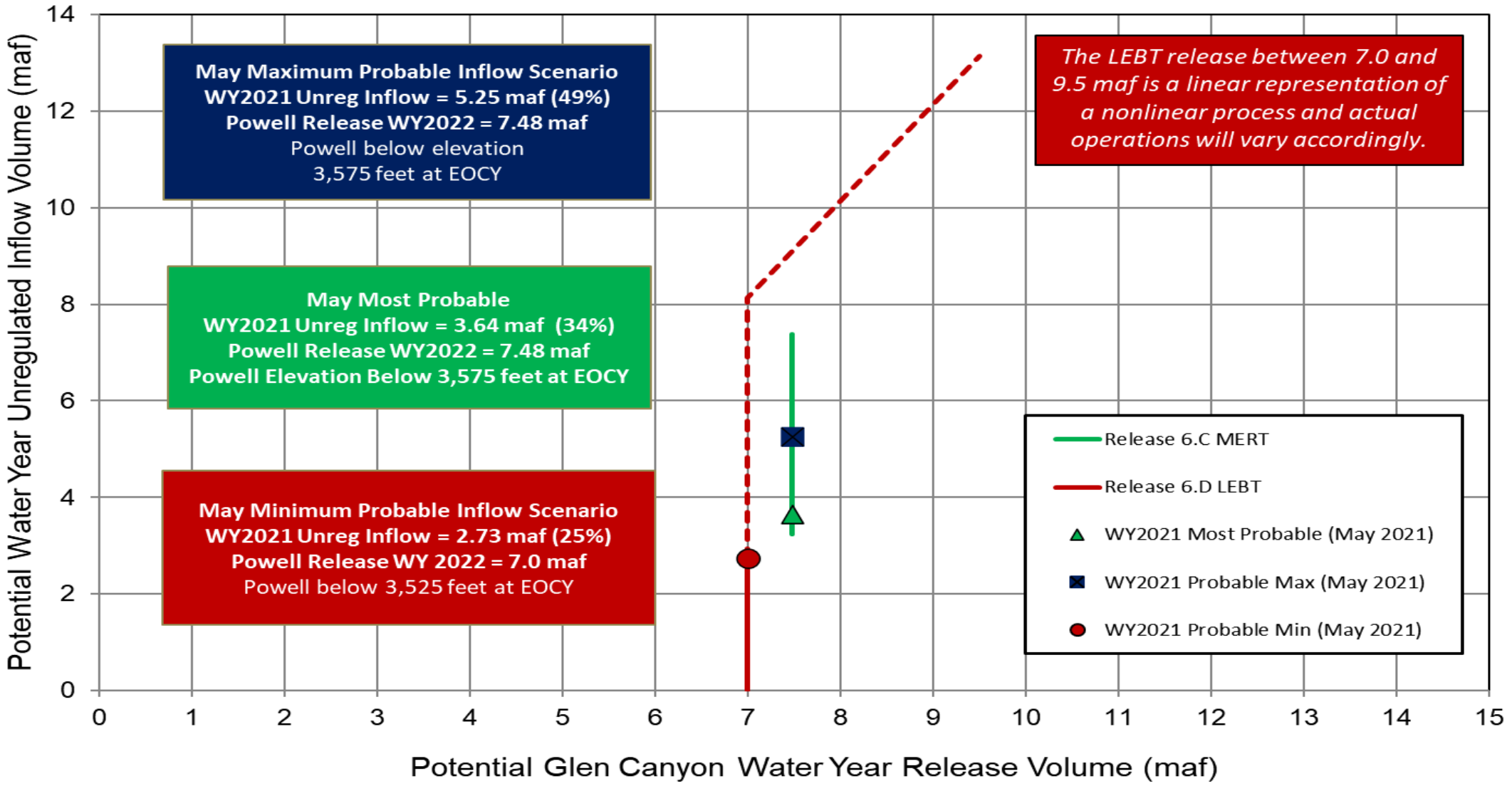
Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2022
Based on May 2021 Modeling



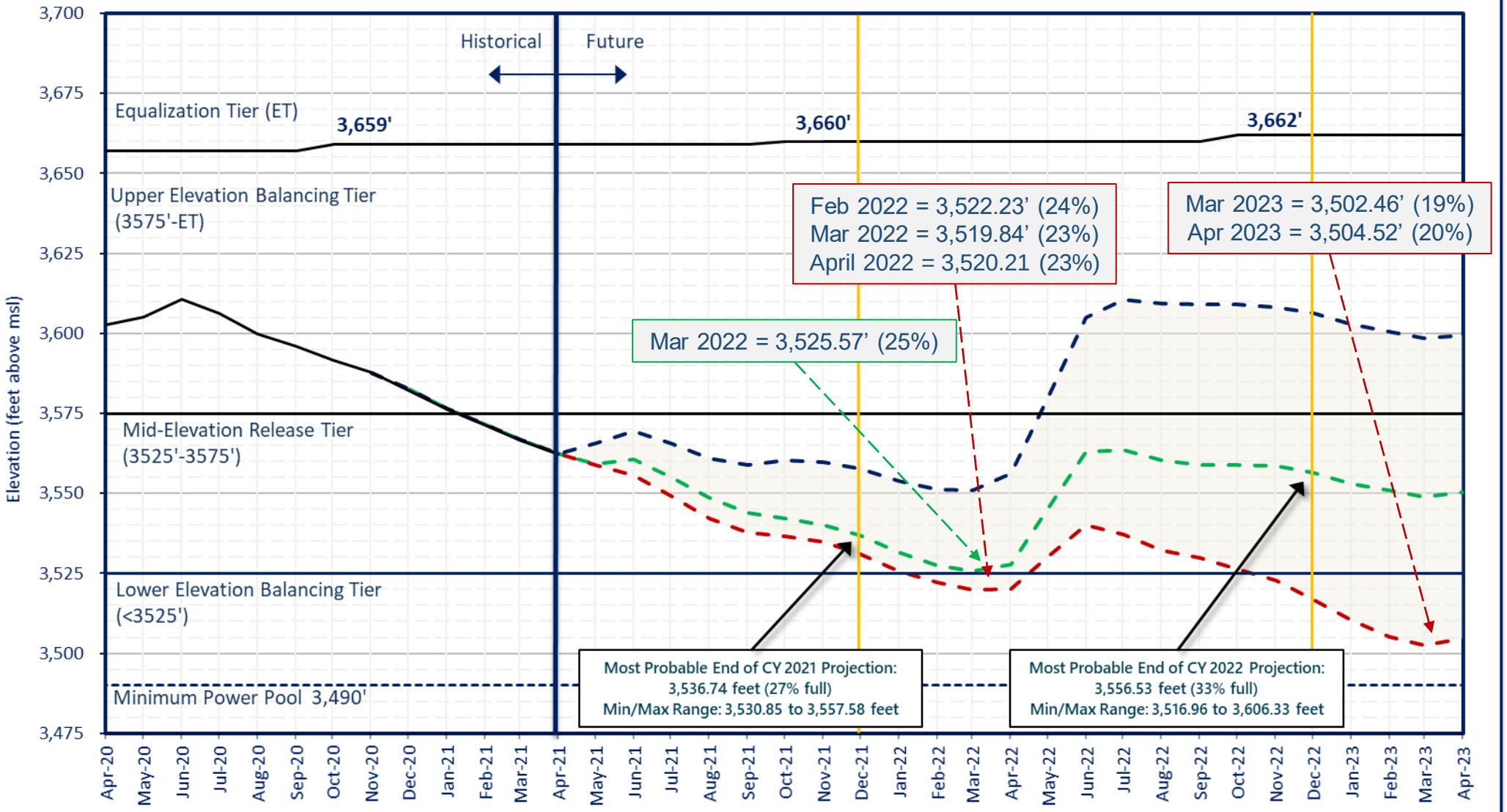
Lake Powell Release Scenarios under Section 6.C and 6.D

Water Year 2022 Release Volume as a Function of Mid Elevation Release Tier and Lower Elevation Balancing Tier based on May 2021 24-Month Study Conditions



Lake Powell End of Month Elevations

Projections from the May 2021 24-Month Study Inflow Scenarios



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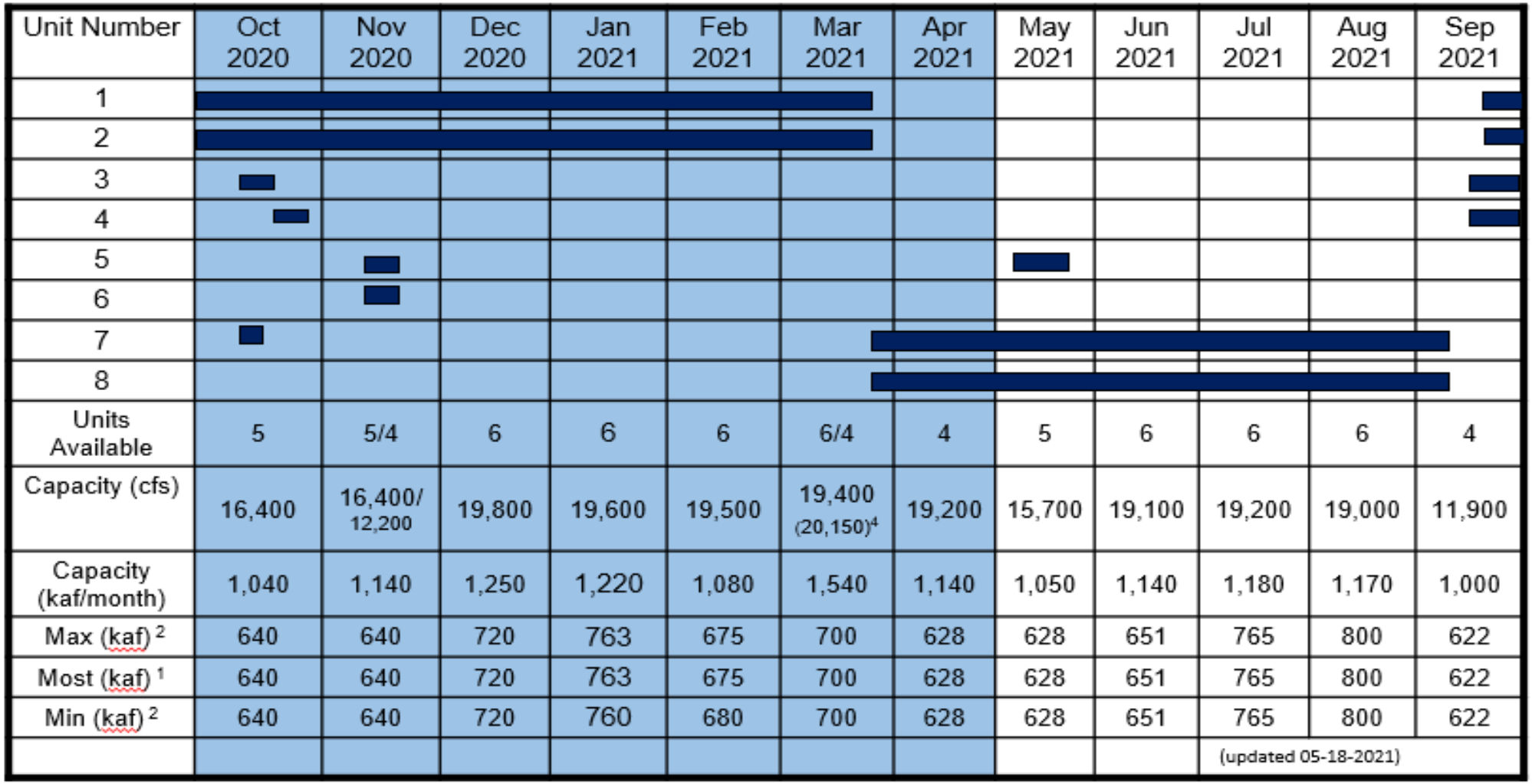
- May 2021 Most Probable - Lake Powell release of 8.23 maf in WY2021 and 7.48 maf in WY2022
- May 2021 DROA* Minimum Probable - Lake Powell release of 8.23 maf in WY2021 and 7.0 maf in WY2022
- May 2021 DROA* Maximum Probable - Lake Powell release of 8.23 maf in WY2021 and 7.48 maf in WY2022
- Historical Elevations

*The Drought Response Operations Agreement (DROA) can be found here: https://www.usbr.gov/dcp/finaldocs.html

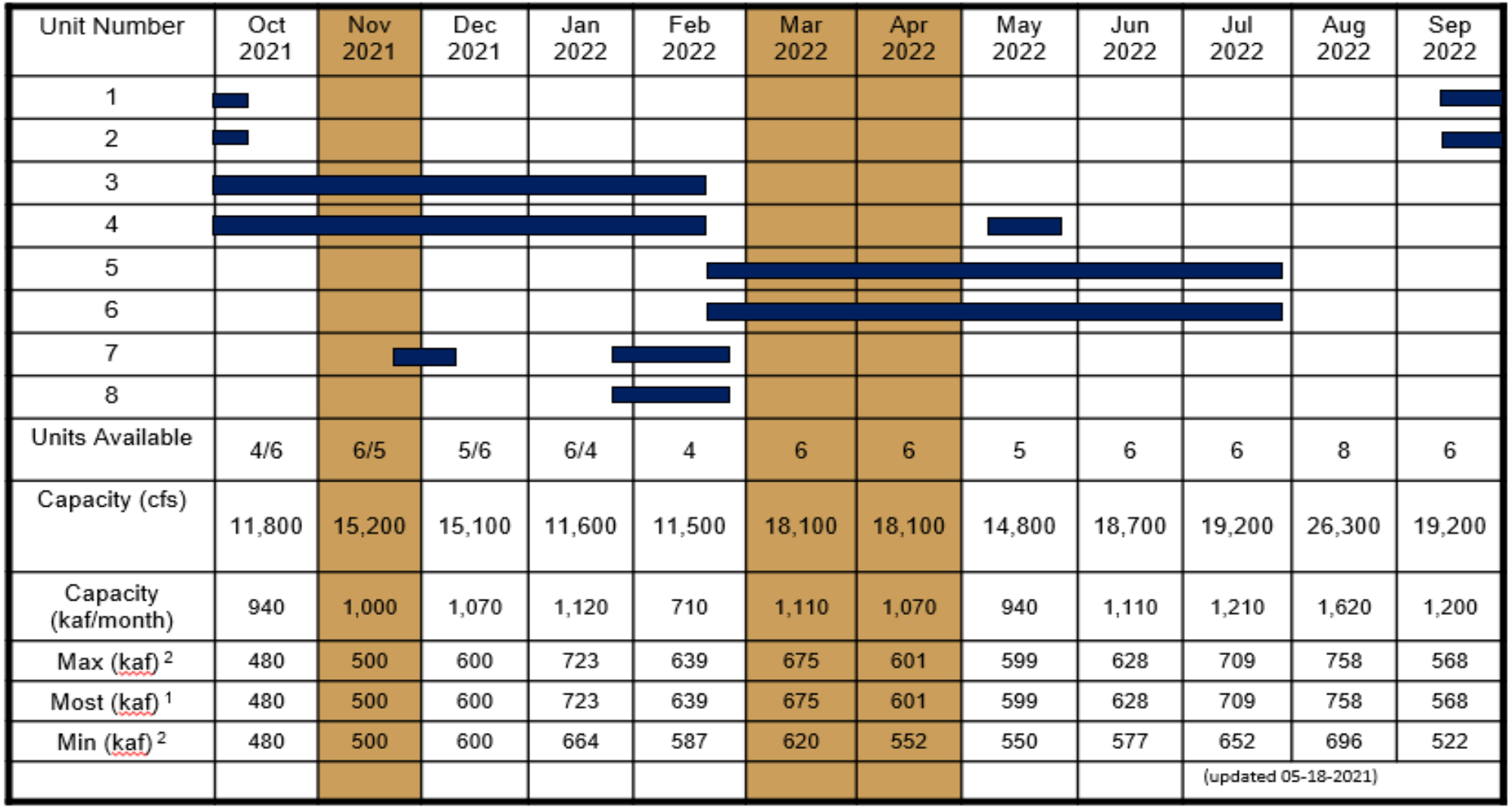
Glen Canyon Dam Power Plant Unit Outage Schedule for 2021



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	6/4	4	5	6	6	6	4	
Capacity (cfs)	16,400	16,400/ 12,200	19,800	19,600	19,500	19,400 (20,150)[4]	19,200	15,700	19,100	19,200	19,000	11,900	MAY MOST[3]
Capacity (kaf/month)	1,040	1,140	1,250	1,220	1,080	1,540	1,140	1,050	1,140	1,180	1,170	1,000	MAY MOST
Max (kaf)[2]	640	640	720	763	675	700	628	628	651	765	800	622	8.23
Most (kaf)[1]	640	640	720	763	675	700	628	628	651	765	800	622	8.23
Min (kaf)[2]	640	640	720	760	680	700	628	628	651	765	800	622	8.23
										(updated 05-18-2021)			

1 Projected release, based on May 2021 Most Probable Inflow Projections and 24-Month Study model runs.
2 Projected release, based on May 2021 DROA Min and Max Probable Inflow Projections and 24-Month Study model runs. The Drought Response Operations Agreement (DROA) can be found here: https://www.usbr.gov/dcp/finaldocs.html.
3 Dependent upon availability to shift contingency reserves, which will increase capacity by 30-40MW (3%) at current efficiency.
4 Increased capacity available from shifting contingency reserves for Spring Disturbance Flow.

Glen Canyon Dam Power Plant Unit Outage Schedule for 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	4/6	6/5	5/6	6/4	4	6	6	5	6	6	8	6	
Capacity (cfs)	11,800	15,200	15,100	11,600	11,500	18,100	18,100	14,800	18,700	19,200	26,300	19,200	MAY MOST[3]
Capacity (kaf/month)	940	1,000	1,070	1,120	710	1,110	1,070	940	1,110	1,210	1,620	1,200	MAY MOST
Max (kaf)[2]	480	500	600	723	639	675	601	599	628	709	758	568	7.48
Most (kaf)[1]	480	500	600	723	639	675	601	599	628	709	758	568	7.48
Min (kaf)[2]	480	500	600	664	587	620	552	550	577	652	696	522	7.0
										(updated 05-18-2021)			

1 Projected release, based on May 2021 Most Probable Inflow Projections and 24-Month Study model runs.

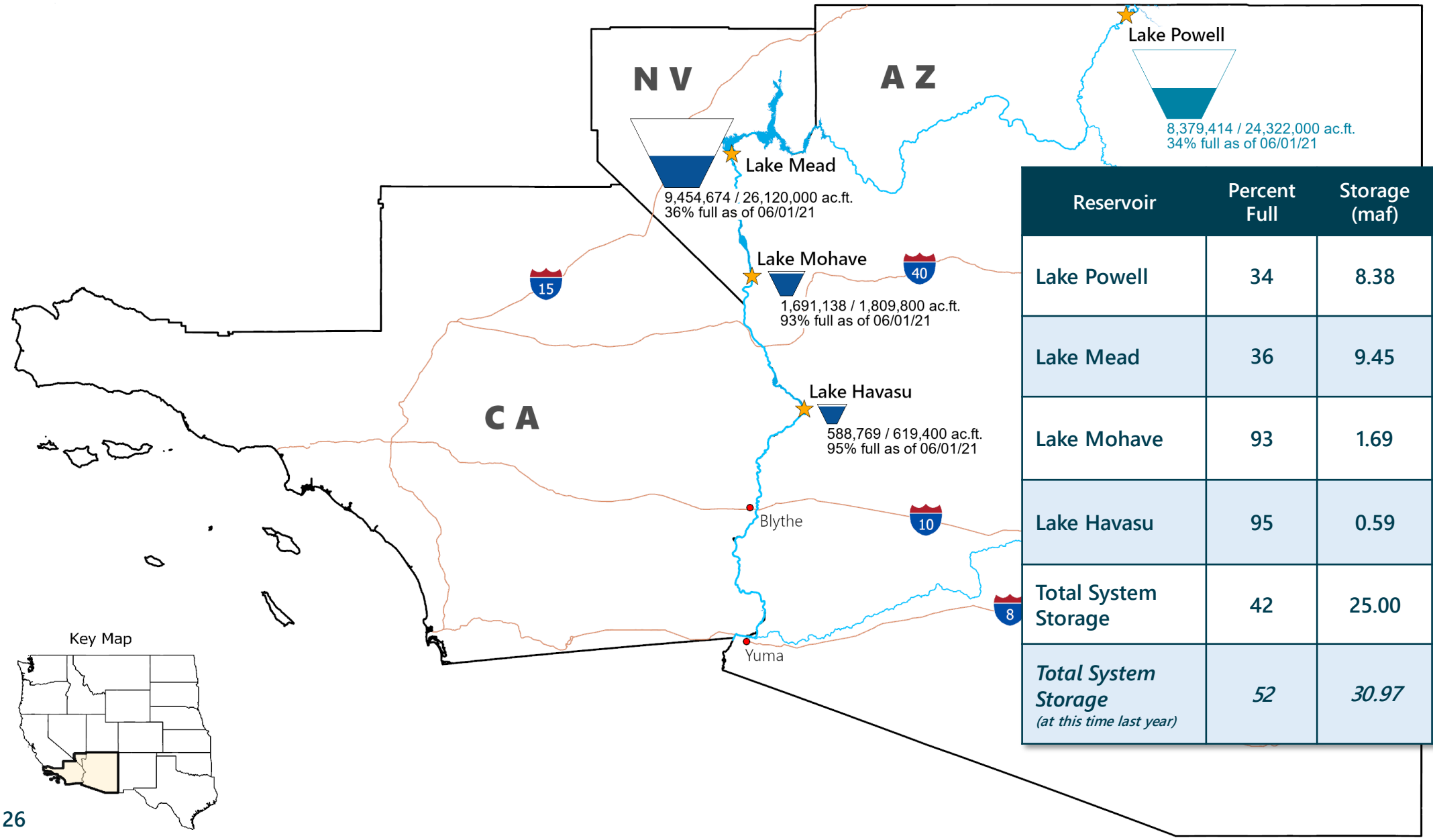
2 Projected release, based on May 2021 DROA Min and Max Probable Inflow Projections and 24-Month Study model runs. The Drought Response Operations Agreement (DROA) can be found here: https://www.usbr.gov/dcp/finaldocs.html.

3 Dependent upon availability to shift contingency reserves, which will increase capacity by 30-40MW (3%) at current efficiency.

Lower Colorado Basin

Calendar Year 2021 Operations Update

Lower Colorado Basin System Conditions (as of June 1, 2021)



Reservoir	Percent Full	Storage (maf)	Elevation (feet)
Lake Powell	34	8.38	3,560.74
Lake Mead	36	9.45	1,073.19
Lake Mohave	93	1.69	642.72
Lake Havasu	95	0.59	448.45
Total System Storage	42	25.00	-
Total System Storage *(at this time last year)*	*52*	*30.97*	-

Lower Basin Side Inflows – WY/CY 2021[1,2]

Intervening Flow from Glen Canyon to Hoover Dam

Month in WY/CY 2021		5-Year Average Intervening Flow (kaf)	Observed Intervening Flow (kaf)	Observed Intervening Flow (% of Average)	Difference From 5-Year Average (kaf)
Observed	October 2020	58	35	60%	-23
	November 2020	71	56	79%	-15
	December 2020	67	59	88%	-8
	January 2021	95	72	75%	-23
	February 2021	97	55	57%	-42
	March 2021	111	33	30%	-78
	April 2021	81	37	46%	-44
	May 2021	50	28	56%	-22
Projected	June 2021	29			
	July 2021	64			
	August 2021	81			
	September 2021	71			
	October 2021	58			
	November 2021	71			
	December 2021	67			
	WY 2021 Totals	876	621	71%	-256
	CY 2021 Totals	876	667	76%	-209

[1] Values were computed with the LC's gain-loss model for the most recent 24-month study.

[2] Percents of average are based on the 5-year mean from 2016-2020.

Lake Powell & Lake Mead Operational Table

Operational Tiers for Water/Calendar Year 2021[1]

Lake Powell

Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf)[1]
3,700	**Equalization Tier** Equalize, avoid spills or release 8.23 maf	24.3
3,636 - 3,666 (2008-2026)	**Upper Elevation Balancing Tier**[3] Release 8.23 maf; 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)
3,591.60 ft Jan 1, 2021 Projection		
3,575	**Mid-Elevation Release Tier** Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.5
3,525		5.9
3,490	**Lower Elevation Balancing Tier** Balance contents with a min/max release of 7.0 and 9.5 maf	4.0
3,370		0

Lake Mead

Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf)[1]
1,220	**Flood Control Surplus or Quantified Surplus Condition** Deliver > 7.5 maf	25.9
1,200 (approx.)[2]	**Domestic Surplus or ICS Surplus Condition** Deliver > 7.5 maf	22.9 (approx.)[2]
1,145		15.9
1,105	**Normal or ICS Surplus Condition** Deliver ≥ 7.5 maf	11.9
1,085.28 ft Jan 1, 2021 Projection		
1,075	**Shortage Condition** Deliver 7.167[4] maf	9.4
1,050	**Shortage Condition** Deliver 7.083[5] maf	7.5
1,025		5.8
1,000	**Shortage Condition** Deliver 7.0[6] maf Further measures may be undertaken[7]	4.3
895		0

Diagram not to scale

[1] Acronym for million acre-feet

[2] 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.

[3] Subject to April adjustments which may result in a release according to the Equalization Tier

[4] Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

[5] Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

[6] Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

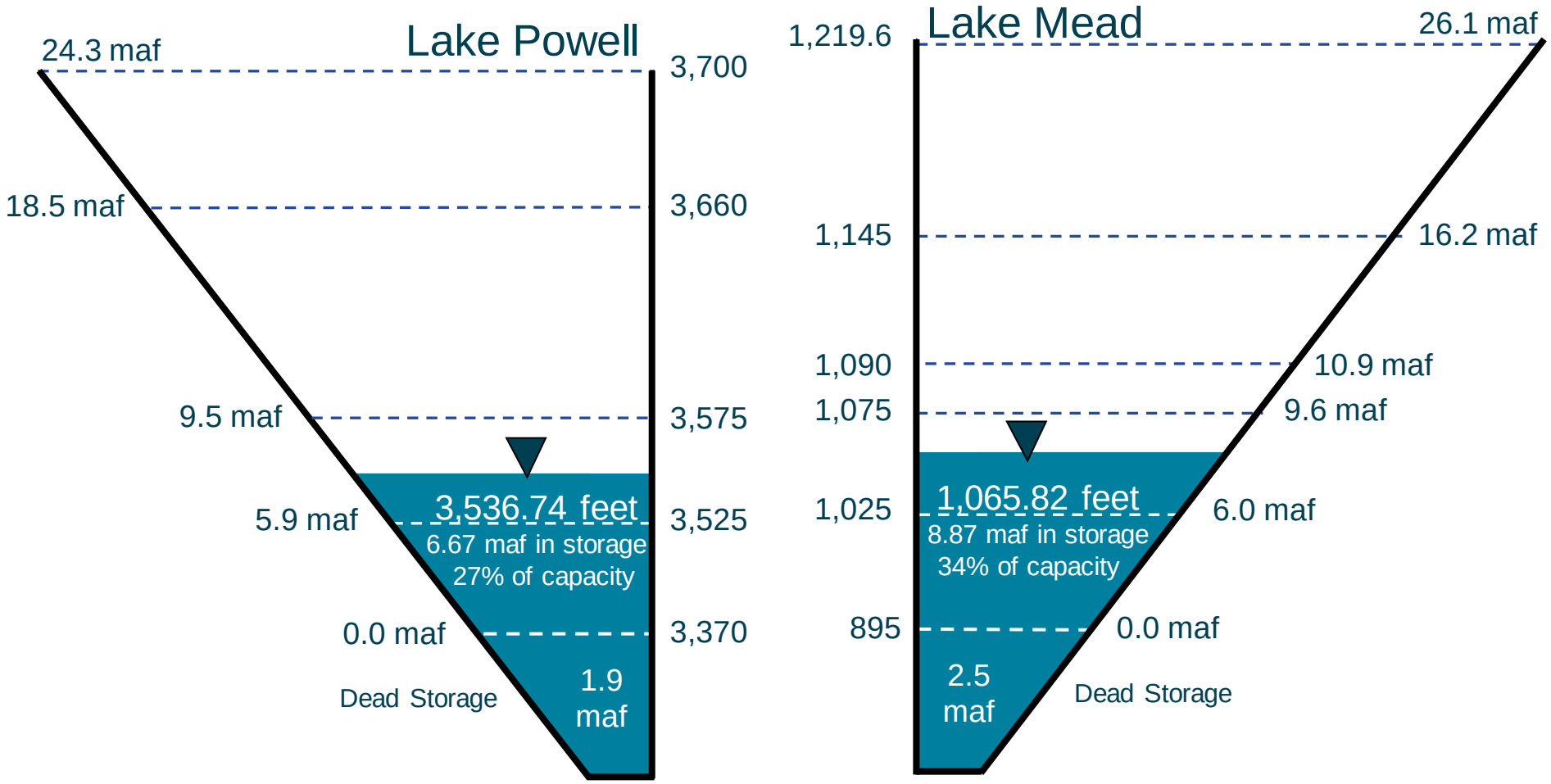
[7] Whenever Lake Mead is below elevation 1,025 feet, the Secretary shall consider whether hydrologic conditions together with anticipated deliveries to the Lower Division States and Mexico is likely to cause the elevation at Lake Mead to fall below 1,000 feet. Such consideration, in consultation with the Basin States, may result in the undertaking of further measures, consistent with applicable Federal law.

[1] Lake Powell and Lake Mead operational tier determinations were based on August 2020 24-Month Study projections and are documented in the 2021 AOP.

End of Calendar Year 2021 Projections

May 2021 24-Month Study Most Probable Inflow Scenario[1]

Based on a Lake Powell release of 8.23 maf in WY 2021 and 7.48 maf in WY 2022



Not to Scale

[1] *WY 2021 unregulated inflow into Lake Powell is based on the CBRFC forecast dated 5/4/21.*

2007 Interim Guidelines, Minute 323, Lower Basin Drought Contingency Plan, and Binational Water Scarcity Contingency Plan

Total Volumes (kaf)

Lake Mead Elevation (feet msl)	2007 Interim Guidelines Shortages		Minute 323 Delivery Reductions	Total Combined Reductions	DCP Water Savings Contributions			Binational Water Scarcity Contingency Plan Savings	Combined Volumes by Country *US: (2007 Interim Guidelines Shortages + DCP Contributions)* *Mexico: (Minute 323 Delivery Reductions + Binational Water Scarcity Contingency Plan Savings)*					Total Combined Volumes
	AZ	NV	Mexico	***Lower Basin States + Mexico***	AZ	NV	CA	Mexico	*AZ Total*	*NV Total*	*CA Total*	*Lower Basin States Total*	*Mexico Total*	***Lower Basin States + Mexico***
1,090 - 1,075	0	0	0	***0***	192	8	0	41	192	8	0	*200*	*41*	***241***
1,075 – 1,050	320	13	50	***383***	192	8	0	30	512	21	0	*533*	*80*	***613***
1,050 - 1,045	400	17	70	***487***	192	8	0	34	592	25	0	*617*	*104*	***721***
1,045 - 1,040	400	17	70	***487***	240	10	200	76	640	27	200	*867*	*146*	***1,013***
1,040 - 1,035	400	17	70	***487***	240	10	250	84	640	27	250	*917*	*154*	***1,071***
1,035 - 1,030	400	17	70	***487***	240	10	300	92	640	27	300	*967*	*162*	***1,129***
1,030 - 1,025	400	17	70	***487***	240	10	350	101	640	27	350	*1,017*	*171*	***1,188***
<1,025	480	20	125	***625***	240	10	350	150	720	30	350	*1,100*	*275*	***1,375***

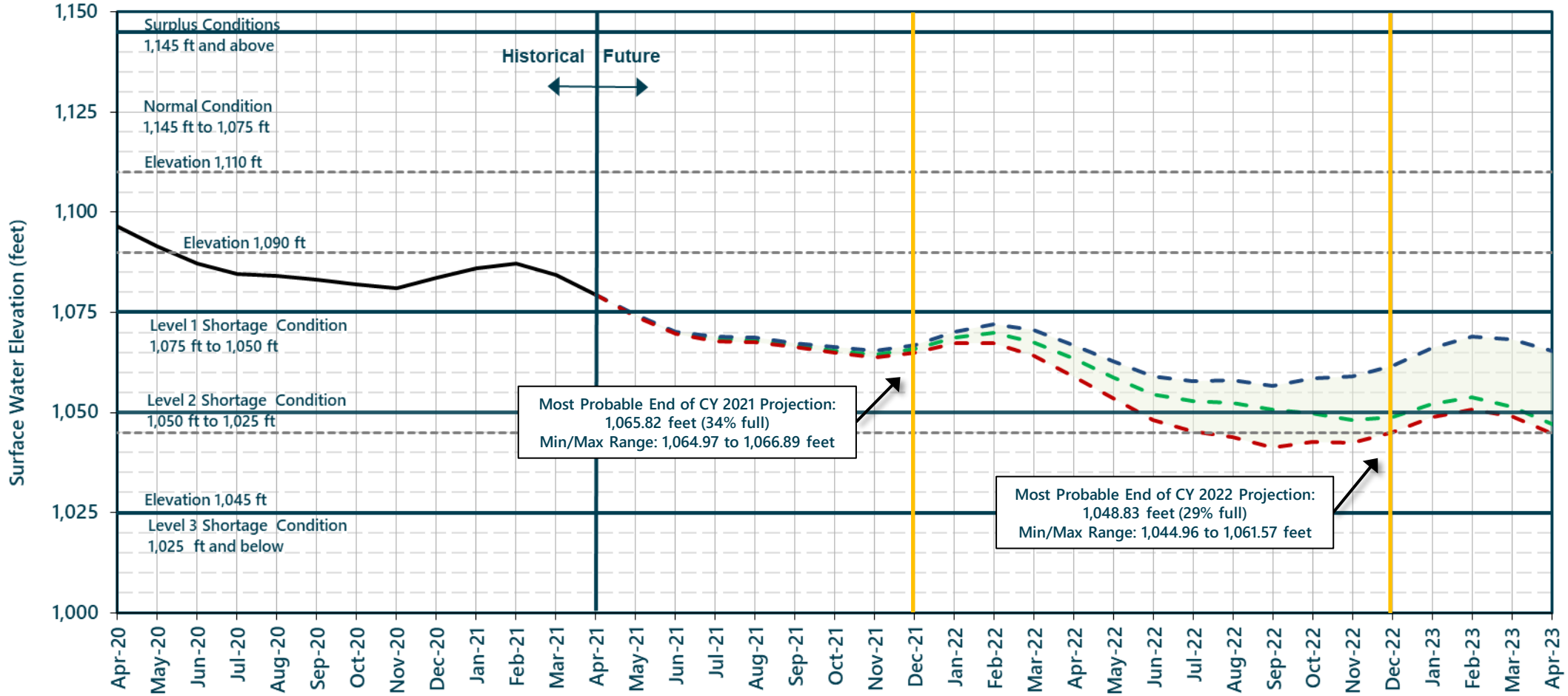
Projected **2022 Reductions + Contributions**

Projected **2022 Reductions + Contributions**

The Secretary of the Interior will take affirmative actions to implement programs designed to create or conserve 100,000 acre-ft per year or more of Colorado River System water to contribute to conservation of water supplies in Lake Mead and other Colorado River reservoirs in the lower basin. All actions taken by the United States shall be subject to applicable law, including availability of appropriations.

Lake Mead End of Month Elevations

Projections from the May 2021 24-Month Study Inflow Scenarios



Historical Elevations

May 2021 Most Probable Inflow with a Lake Powell release of 8.23 maf in WY 2021 and 7.48 maf in WY 2022

May 2021 DROA* Maximum Probable Inflow with a Lake Powell release of 8.23 maf in WY 2021 and 7.48 maf in WY 2022

May 2021 DROA* Minimum Probable Inflow with a Lake Powell release of 8.23 maf in WY 2021 and 7.00 maf in WY 2022

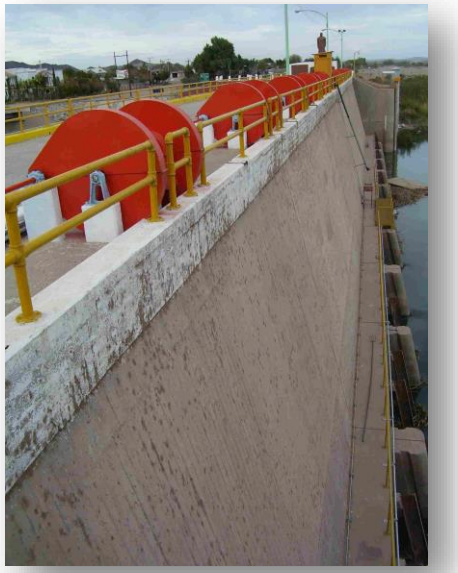
*The Drought Response Operations Agreement (DROA) can be found online at: https://www.usbr.gov/dcp/finaldocs.html.

Additional Operational Data
Provisional 2021 Year-to-Date Totals

- Mexico Excess Flows
  - ➢16,859 af (through 6/1)

- Brock Reservoir Total Storage
  - ➢50,186 af (through 5/27)

- Senator Wash Total Storage
  - ➢32,174 af (through 5/27)



YAO Operations Update

- Pumped drainage return flows from the Wellton-Mohawk Irrigation and Drainage District
  - Flow at station 0+00 on the Main Outlet Drain from January through April 2021 was 33,366 ac-ft at 2,689 ppm
- Provisional drainage flows to the Colorado River
  - From the South Gila Drainage Wells January through March 2021 was 1,356 ac-ft at 1,535 ppm
  - From the Yuma Mesa Conduit January through March 2021 was 5,900 ac-ft at 1,209 ppm

2022 Colorado River Annual Operating Plan

Colorado River Management Work Group

First Consultation

June 3, 2021

BUREAU OF RECLAMATION