RECLAMATION

Managing Water in the West

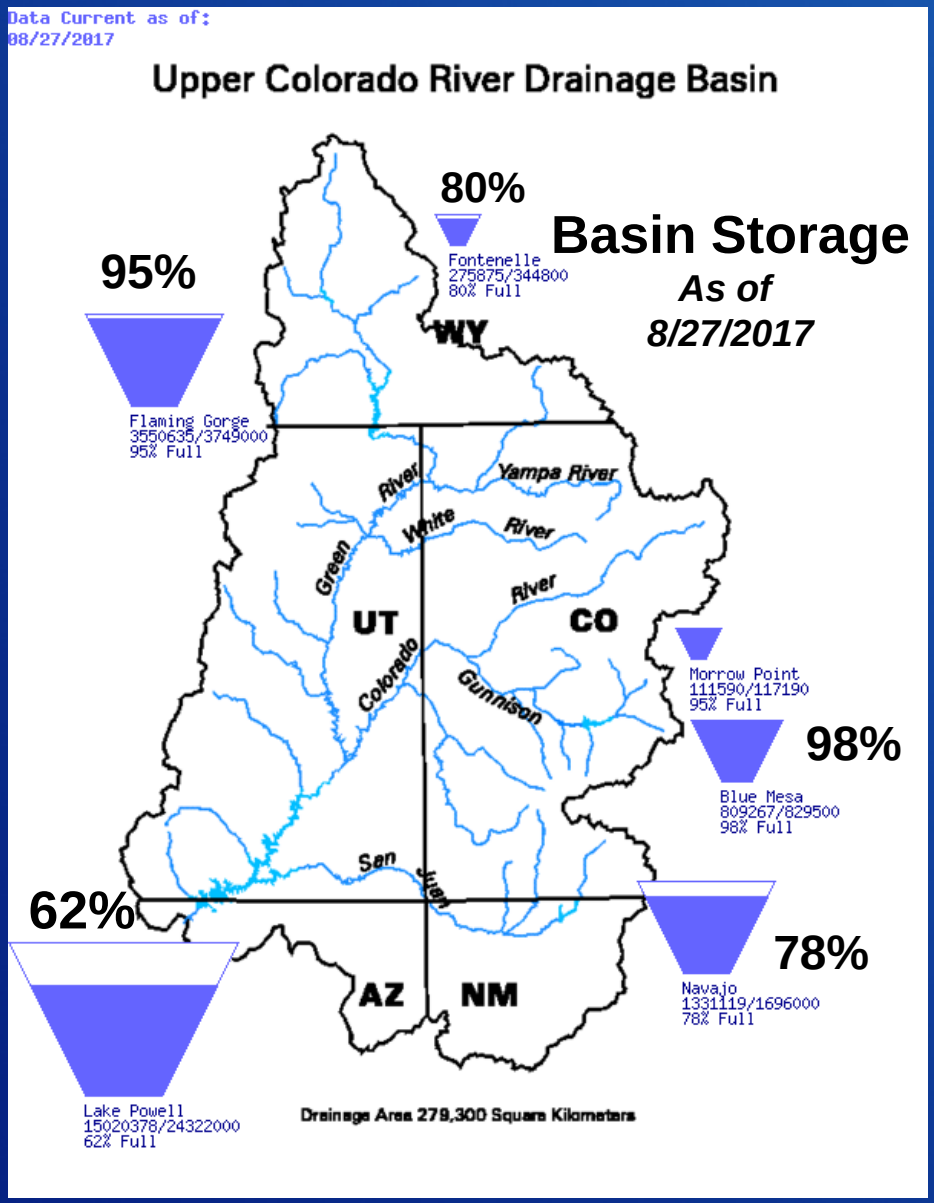
Basin Hydrology, Operations and 2018 Hydrograph

Glen Canyon Technical Work Group

August 30, 2017

U.S. Department of the Interior
Bureau of Reclamation

Upper Basin Storage



http://www.usbr.gov/uc/water/basin/index.html

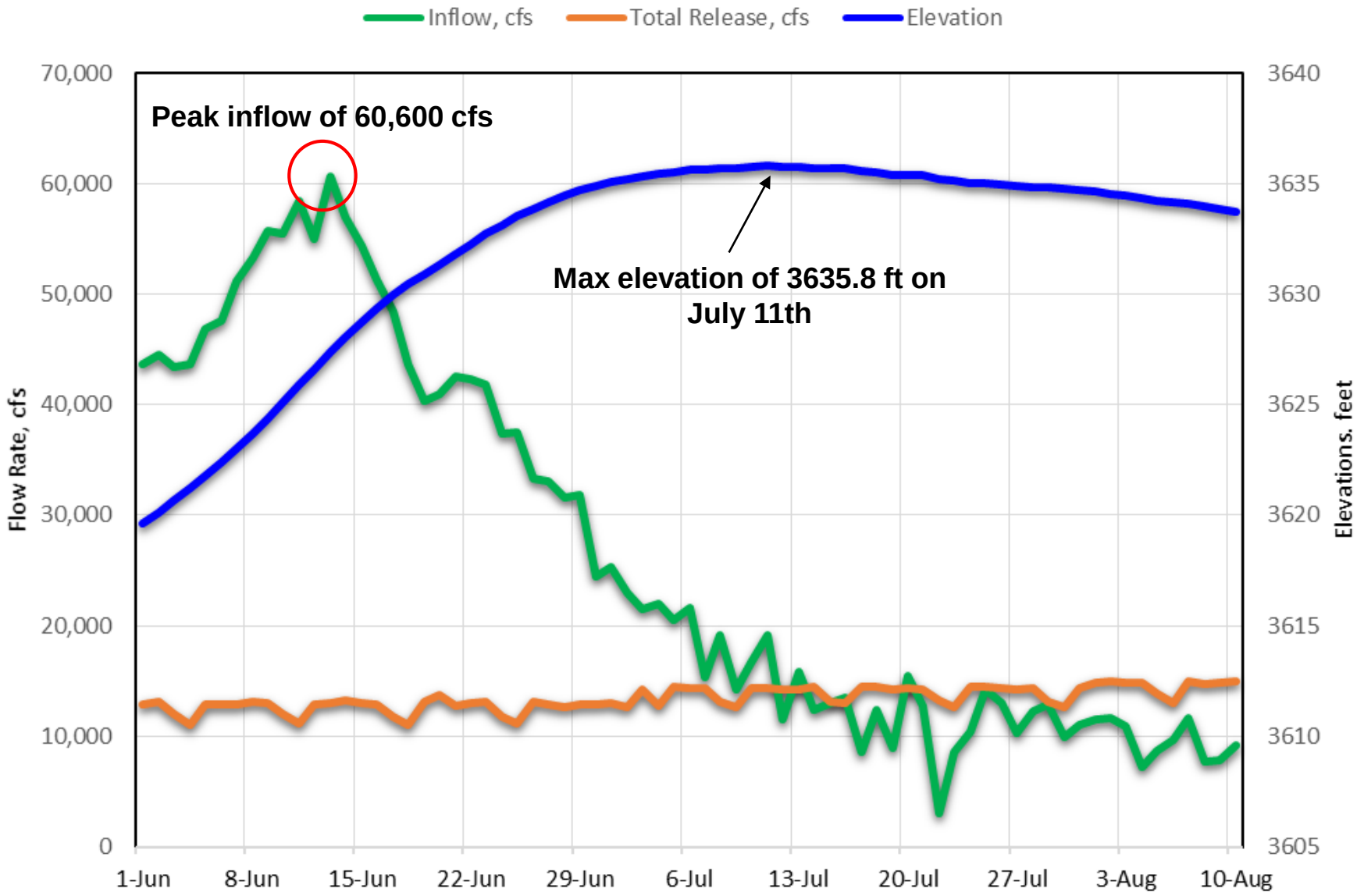
April to July 2017 Observed Inflow

Reservoir	Apr-Jul Observed (KAF)	Percent of Average[1]
Fontenelle	1,719	237%
Flaming Gorge	2,214	226%
Blue Mesa	915	135%
Navajo	775	125%
Powell	8,174	114%

[1] percent of average based on period 1981-2010.

RECLAMATION

Lake Powell

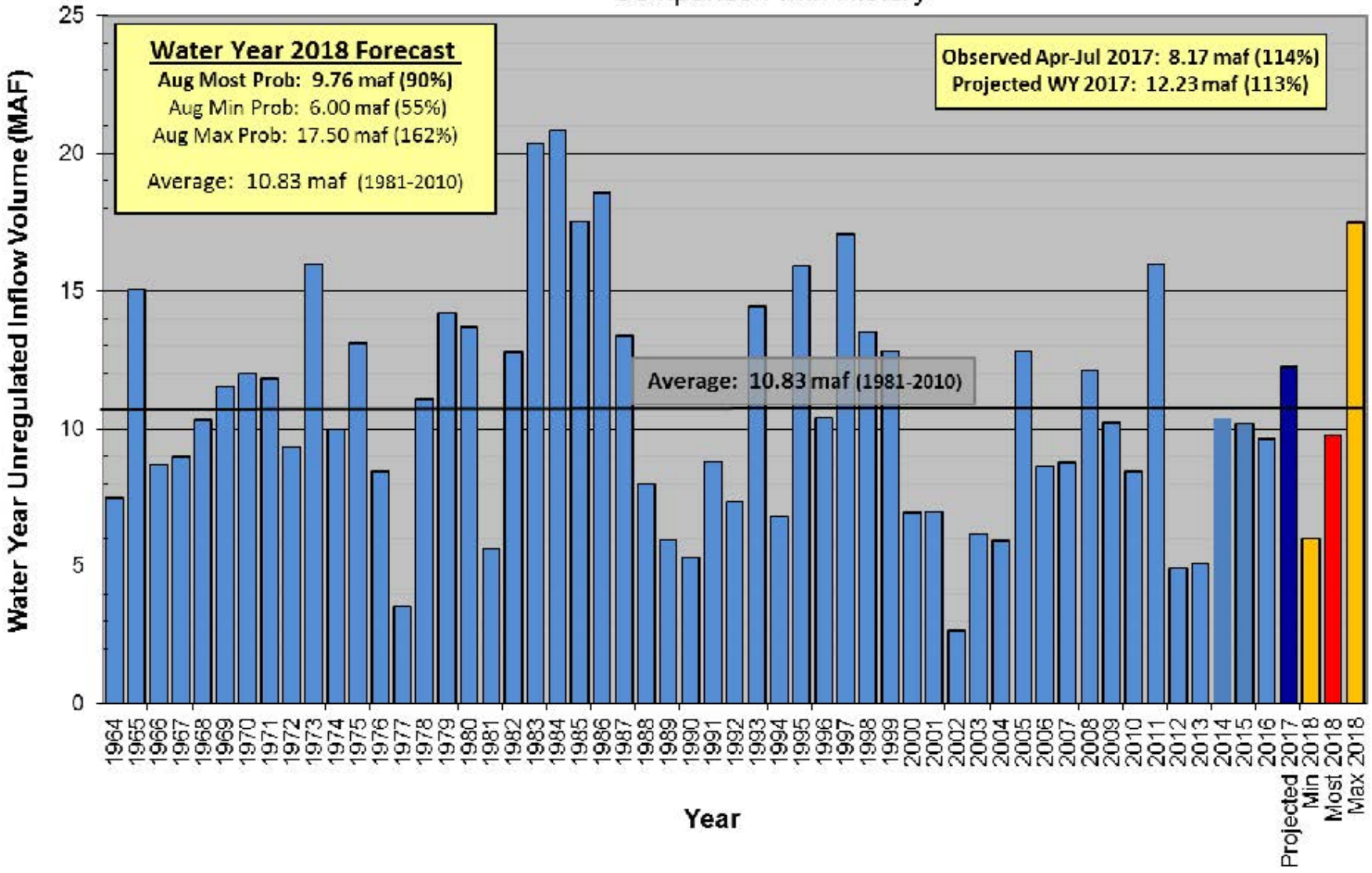


RECLAMATION

Lake Powell Unregulated Inflow

Water Year 2018 Forecast *(Issued August 1)*

Comparison with History

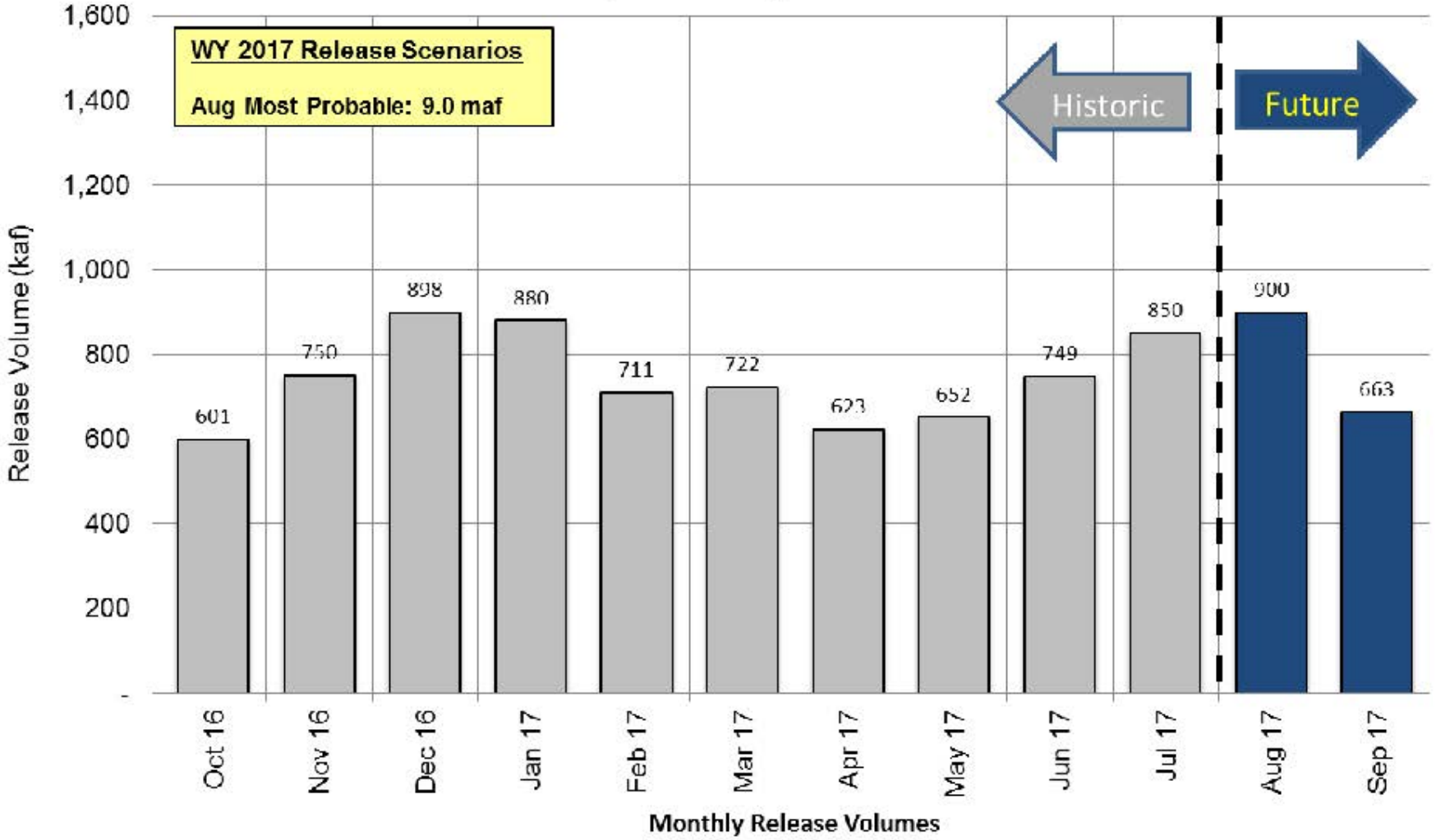


RECLAMATION

Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2017

Updated August 2017



RECLAMATION

Reservoir Operations for Water Year 2018

RECLAMATION

Lake Powell 2018 Operating Tier
Upper Elevation Balancing

- Tier was set in August 2017
  - Start with 8.23 maf release
- Use April 24-Month Study projections of end of water year storage to potentially adjust
  1. Stay with 8.23 maf
  2. Balancing: 8.23 - 9.0 maf
  3. Equalization: > 8.23 maf

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
3,525	**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

RECLAMATION

Water Year 2018 Operating Tier

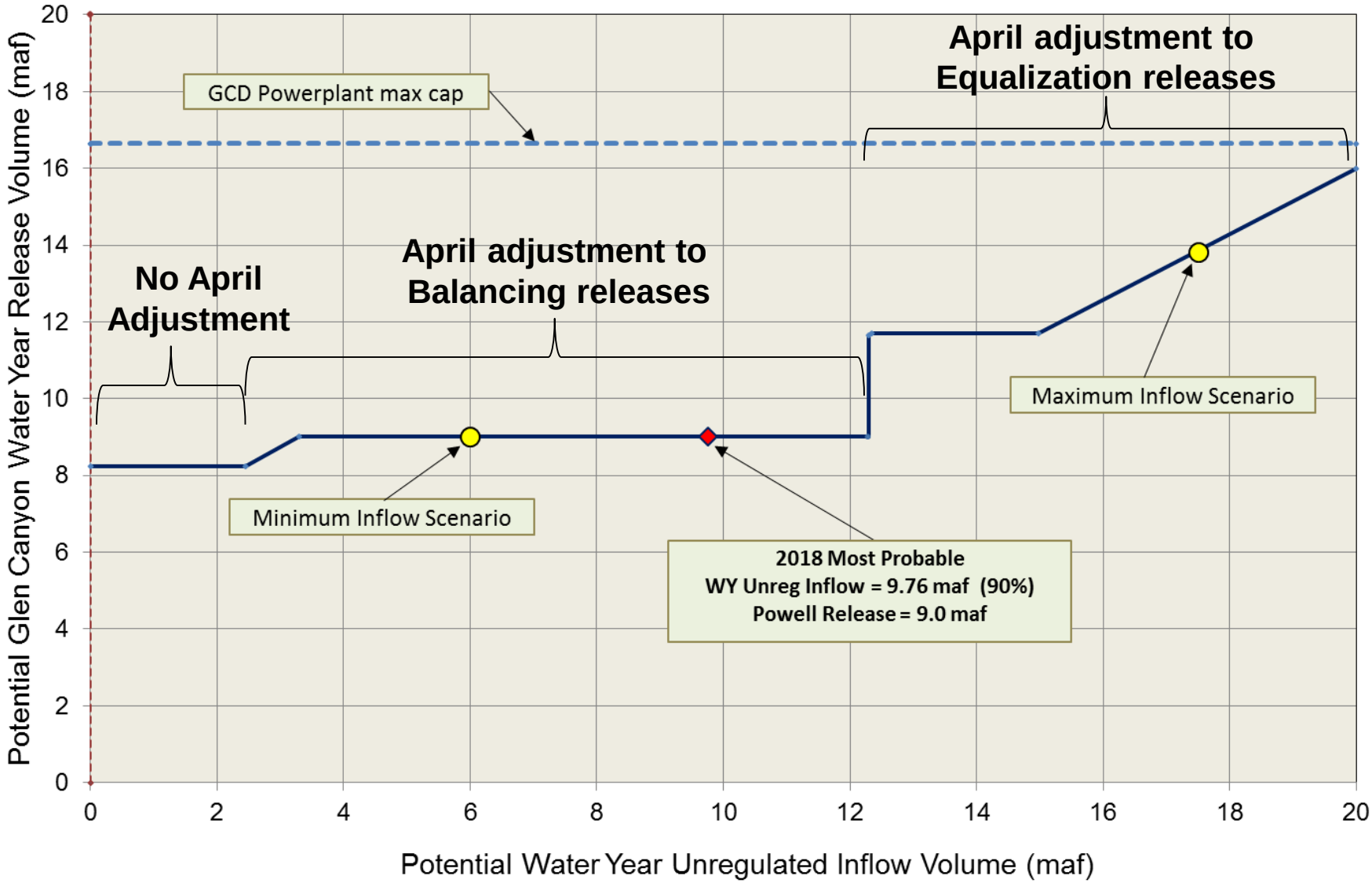
Operating Tier determined with the August 2017 24-Month Study

Powell Inflow Scenario	WY 2018 Release Projection
Probable Minimum	**Upper Elevation Balancing Tier** w/ Projected April shift to Balancing 9.0 maf release
Most Probable	**Upper Elevation Balancing Tier** w/ Projected April shift to Balancing 9.0 maf release
Probable Maximum	**Upper Elevation Balancing Tier** w/ Projected April shift to Equalization 13.8 maf release

RECLAMATION

Potential Lake Powell Release Scenarios

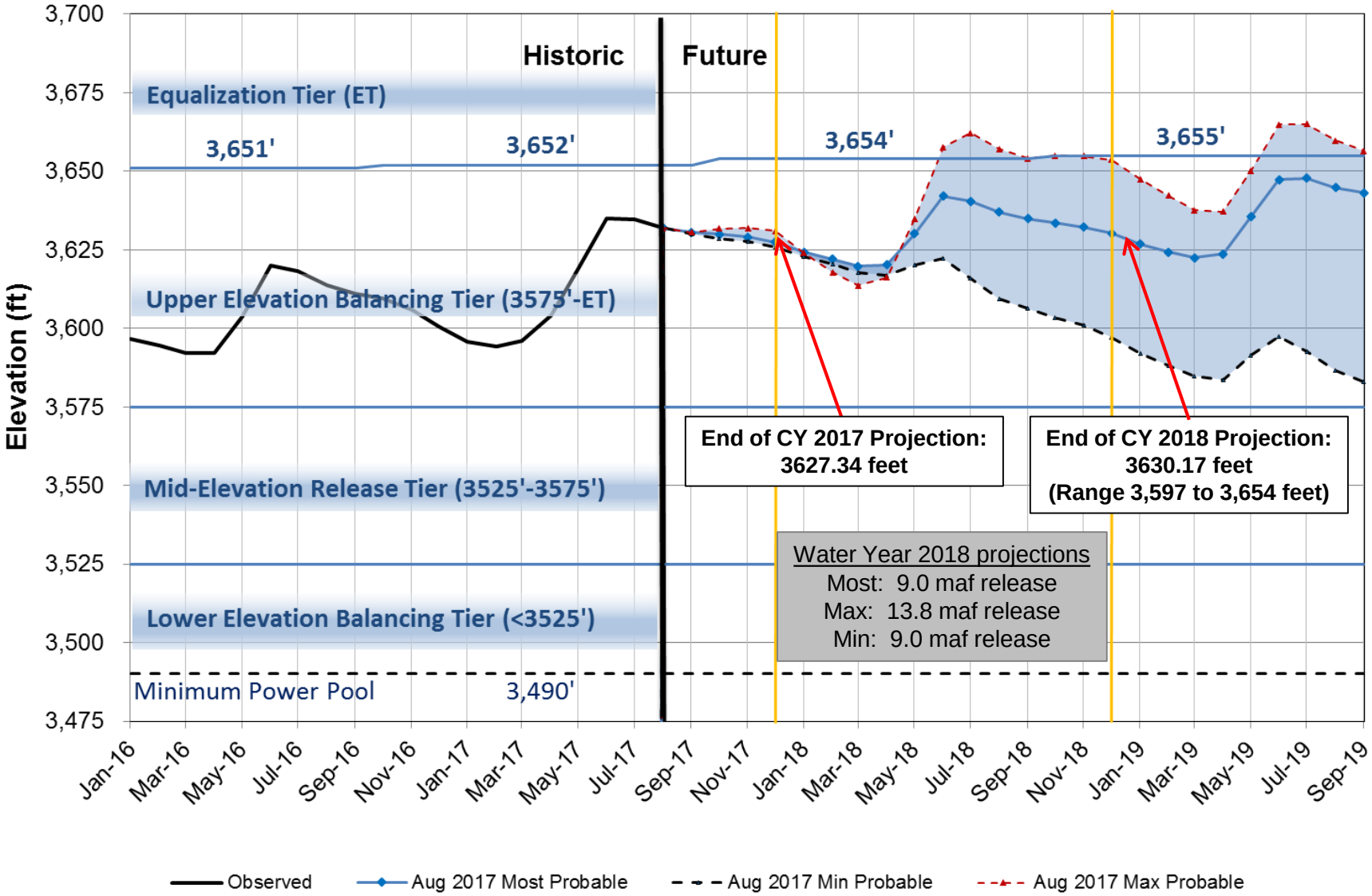
Water Year 2018 Release Volume as a Function of Unregulated Inflow Volume
based on August 2017 24-Month Study Conditions



RECLAMATION

Lake Powell End of Month Elevations

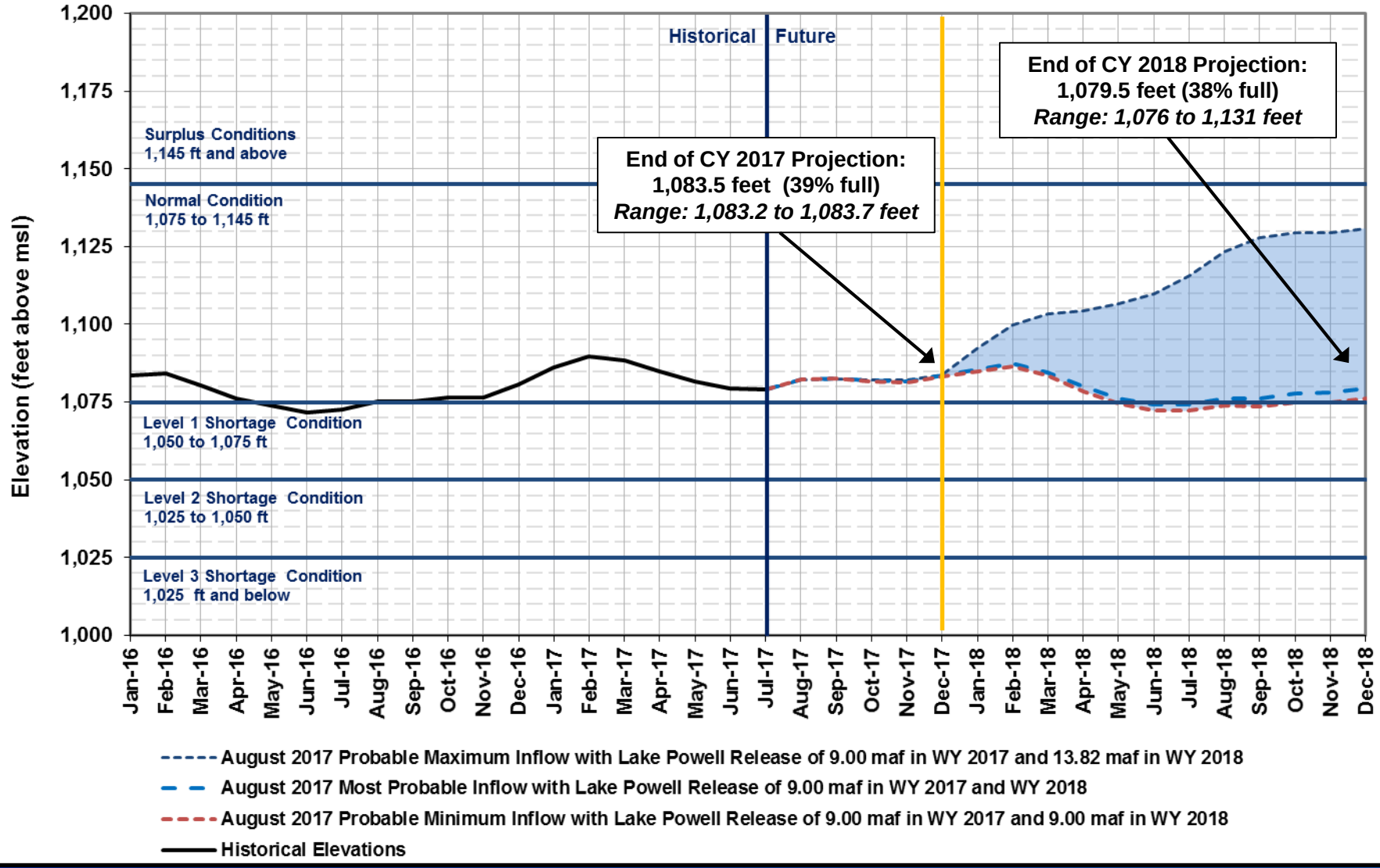
Historic and Projected based on Aug 2017 Modeling



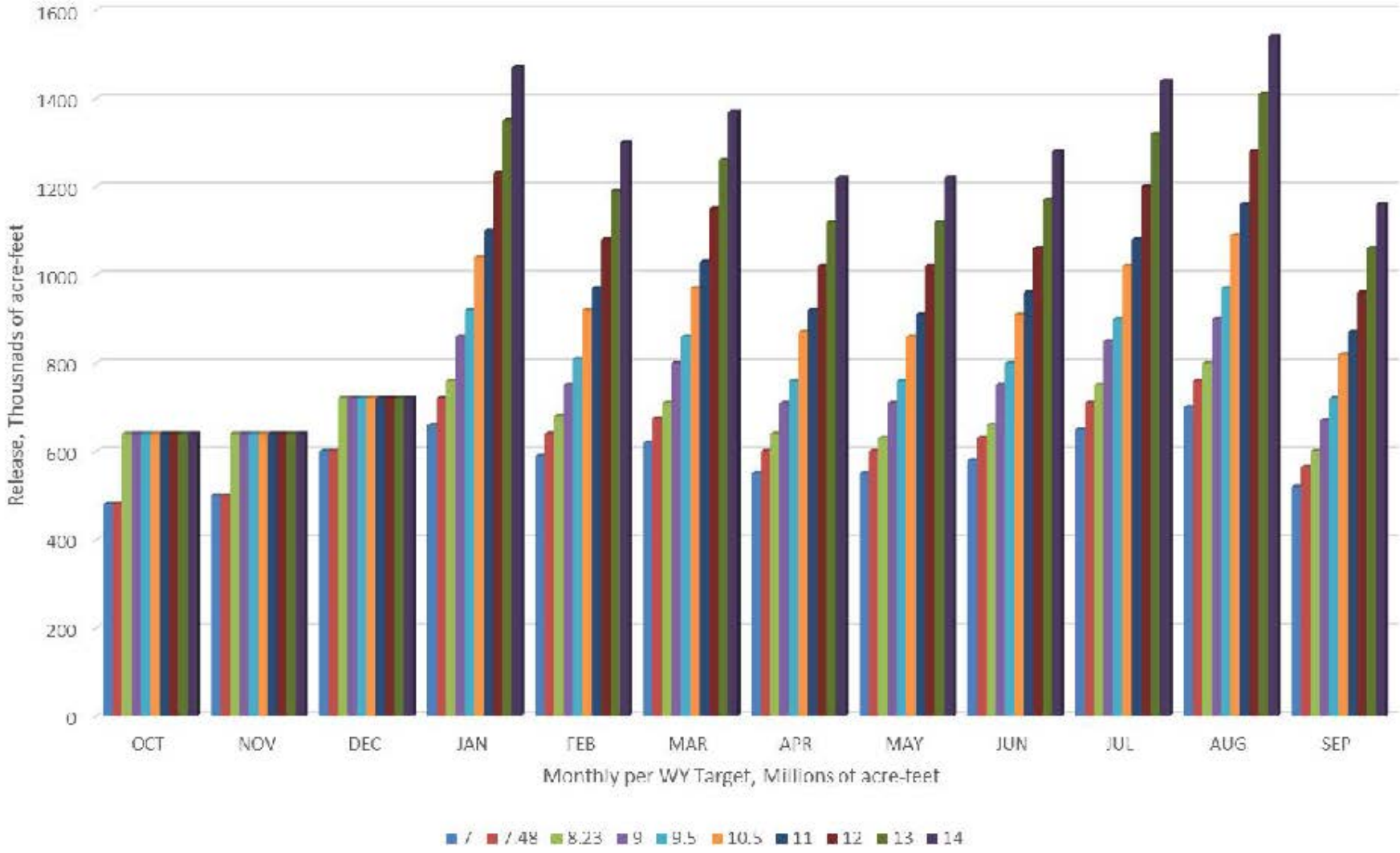
RECLAMATION

Lake Mead End of Month Elevations

Projections from the August 2017 24-Month Study Inflow Scenarios



RECLAMATION



RECLAMATION

LTEMP Monthly Release Volumes 2018

Month	7.00	7.48	8.23	9.00	9.50	10.50	11.00	12.00	13.00	14.00
OCT	480	480	640	640	640	640	640	640	640	640
NOV	500	500	640	640	640	640	640	640	640	640
DEC	600	600	720	720	720	720	720	720	720	720
JAN	660	720	760	860	920	1040	1100	1230	1350	1470
FEB	590	640	680	750	810	920	970	1080	1190	1300
MAR	620	675	710	800	860	970	1030	1150	1260	1370
APR	550	600	640	710	760	870	920	1020	1120	1220
MAY	550	600	630	710	760	860	910	1020	1120	1220
JUN	580	630	660	750	800	910	960	1060	1170	1280
JUL	650	710	750	850	900	1020	1080	1200	1320	1440
AUG	700	760	800	900	970	1090	1160	1280	1410	1540
SEP	520	565	600	670	720	820	870	960	1060	1160

MIN & MOST

MAX

RECLAMATION

2018 Hydrograph

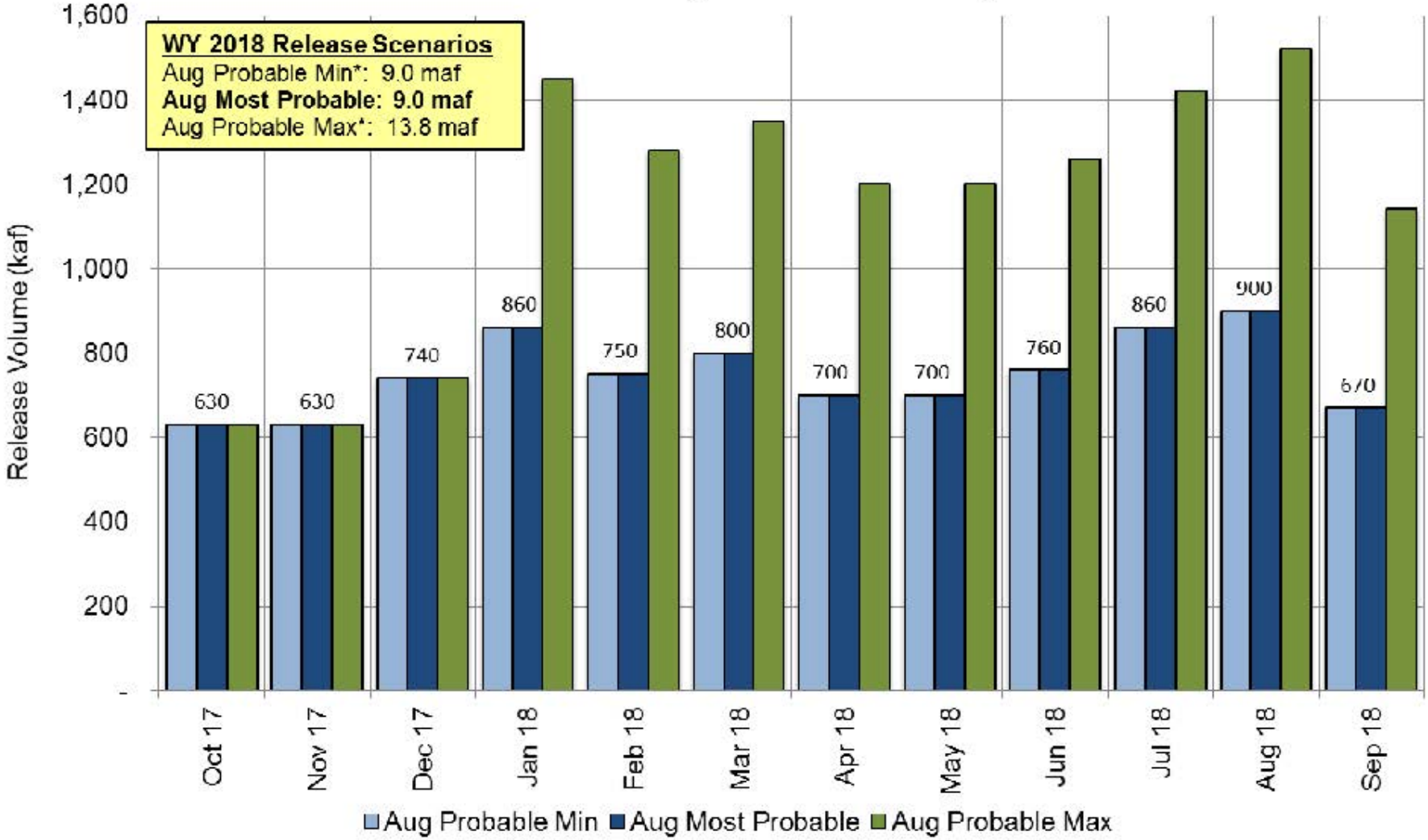
Month	LTEMP Release Volume, (kaf)	Operational Considerations Release Volume, (kaf)*	LTEMP Daily Fluctuations (cfs)**
OCT	640	630	5,700
NOV	640	630	5,700
DEC	720	740	6,700
JAN	860	860	7,700
FEB	750	750	6,800
MAR	800	800	7,200
APR	710	700	6,300
MAY	710	700	6,300
JUN	750	760	7,600
JUL	850	860	8,000
AUG	900	900	8,000
SEP	670	670	6,000

- *Modifications of monthly volumes reached between Reclamation and WAPA
- **LTEMP Daily fluctuations determined by, 9 x monthly vol (Sep – May), and 10 x monthly vol (Jun – Aug)
- LTEMP Down ramp rates, 2,500 cfs/hr (all months)
- Up-ramp rates, 4,000 cfs/hr (all months)

RECLAMATION

Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2018
Based on August 2017 modeling



** Probable Min and Max annual release volume is based on August Min and Max inflow forecasts*

RECLAMATION

Glen Canyon Power Plant Planned Unit Outage Schedule for Water Year 2018

Unit Number	Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018	Aug 2018	Sep 2018	
Units Available	5	5	7	5	5	5	5	6/8	8	8	8	7	
Capacity (cfs)	**17,200**	**17,200**	**17,200**	**17,200**	**17,200**	**17,200**	**17,200**	**21,600**	**28,700**	**28.700**	**30,300**	**24,800**	
Capacity (kaf/month)	1,270	1,140	1,410	1,240	1,120	1,060	1,010	1,610	1,710	1,760	1,760	1,560	
Max (kaf) [1]	630	630	740	1,450	1,280	1,350	1,200	1,200	1,260	1,420	1,520	1,141	**13.80**
Most (kaf) [2]	630	630	740	860	750	800	700	700	760	860	900	670	**9.0**
Min (kaf) [1]	630	630	740	860	750	800	700	700	760	860	900	670	**9.0**

1 **Projected release, based on Aug 2017 Min and Max Probable Inflow Projections and 24-Month Study model runs**

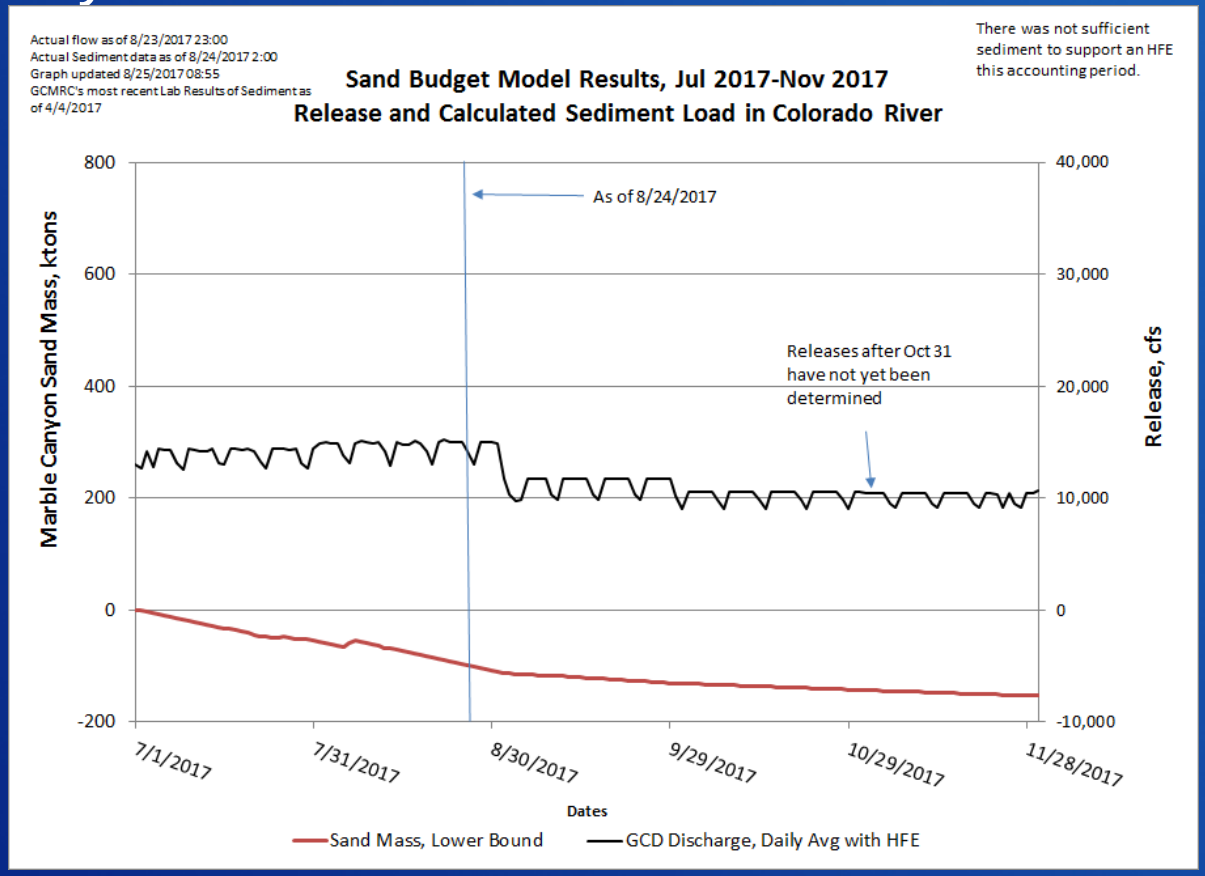
2 **Projected release, based on Aug 2017 Most Probable Inflow Projections and 24-Month Study model runs**

(updated 8-14-2017)

RECLAMATION

Sand Budget Model Results

- As of 8-24-2017, not enough sediment input to trigger a fall 2017 HFE
- Still early in the season



RECLAMATION

Percent of Traces with Event or System Condition

Results from August 2017 CRSS[1,2,3,4] (values in percent)

	Event or System Condition	2018	2019	2020	2021	2022
Upper Basin – Lake Powell	**Equalization Tier**	**20**	**29**	**27**	**29**	**31**
	Equalization – annual release > 8.23 maf	*20*	*29*	*27*	*28*	*30*
	Equalization – annual release = 8.23 maf	*0*	*0*	*0*	*1*	*1*
	Upper Elevation Balancing Tier	**80**	**68**	**55**	**52**	**52**
	Upper Elevation Balancing – annual release > 8.23 maf	*75*	*52*	*41*	*35*	*37*
	Upper Elevation Balancing – annual release = 8.23 maf	*5*	*15*	*15*	*17*	*14*
	Upper Elevation Balancing – annual release < 8.23 maf	*0*	*1*	*0*	*0*	*1*
	Mid-Elevation Release Tier	**0**	**3**	**17**	**15**	**12**
	Mid-Elevation Release – annual release = 8.23 maf	*0*	*0*	*0*	*0*	*2*
	Mid-Elevation Release – annual release = 7.48 maf	*0*	*3*	*17*	*15*	*10*
	Lower Elevation Balancing Tier	**0**	**0**	**0**	**4**	**5**
Lower Basin – Lake Mead	**Shortage Condition – any amount (Mead ≤ 1,075 ft)**	**0**	**15**	**42**	**45**	**52**
	Shortage – 1st level (Mead ≤ 1,075 and ≥ 1,050)	*0*	*15*	*40*	*35*	*33*
	Shortage – 2nd level (Mead < 1,050 and ≥ 1,025)	*0*	*0*	*2*	*10*	*15*
	Shortage – 3rd level (Mead < 1,025)	*0*	*0*	*0*	*1*	*5*
	Surplus Condition – any amount (Mead ≥ 1,145 ft)	**0**	**0**	**7**	**12**	**17**
	Surplus – Flood Control	*0*	*0*	*1*	*2*	*3*
	Normal or ICS Surplus Condition	**100**	**85**	**51**	**43**	**31**

[1] Reservoir initial conditions based on results from the August 2017 most-probable 24-Month Study.

[2] Percentages computed from 110 hydrologic inflow sequences based on resampling of the observed natural flow record from 1906-2015 for a total of 110 traces analyzed.

[3] Percentages shown may not sum to 100% due to rounding to the nearest percent.

[4] Percentages shown may not be representative of the full range of future possibilities that could occur with different modeling assumptions.

Questions?

Paul Davidson
801-524-3642
PDavidson@usbr.gov

Hydraulic Engineer, Glen Canyon
Reclamation, Upper Colorado Region
Resource Management Division
Water Resources Group

RECLAMATION