

Glen Canyon Dam Adaptive Management Work Group
Agenda Item Form
September 20, 2017

Agenda Item

Basin Hydrology and 2018 Dam Operations

Purpose of Agenda Item

To increase understanding of water supply, forecasted hydrologic conditions, and projected reservoir conditions and operations for the current and upcoming water years.

Action Requested

Information item only; while we will answer questions, no action is requested.

Presenter

Paul Davidson, Hydraulic Engineer, Bureau of Reclamation, Upper Colorado Region

Previous Action Taken

By the Department of the Interior:

On December 15, 2016, Secretary Jewell signed the Record of Decision for the Glen Canyon Dam Long-Term experimental and Management Plan Final Environmental Impact Statement (LTEMP ROD). Pursuant to the LTEMP ROD, general monthly release volume patterns were phased in between January 1, 2017 and will be fully implemented by September 30, 2017. Beginning October 1, 2017 LTEMP ramp rates and daily fluctuations will be implemented.

Relevant Science

N/A

Summary of Presentation and Background Information

The presentation will cover information pertinent to AMWG members regarding the current water supply and forecasted hydrologic conditions within the Upper Colorado River Basin. Anticipated reservoir conditions and operations at Lake Powell/Glen Canyon Dam for the remainder of WY 2017 and projections for WY 2018 will be discussed. The presentation will also cover the potential range of annual release volumes from Lake Powell in WY 2018 and the corresponding projected monthly release volumes and ramp rates under LTEMP.

The Bureau of Reclamation applies best professional judgment in conducting actual operations and in response to changing conditions throughout the water year. These efforts are undertaken in coordination with the DOI/DOE agencies, the Basin States, AMWG and TWG, to consider changing conditions and adjust projected operations.

RECLAMATION

Managing Water in the West

Basin Hydrology, and 2017-2018 Operations

Glen Canyon Technical Work Group
September 20, 2017

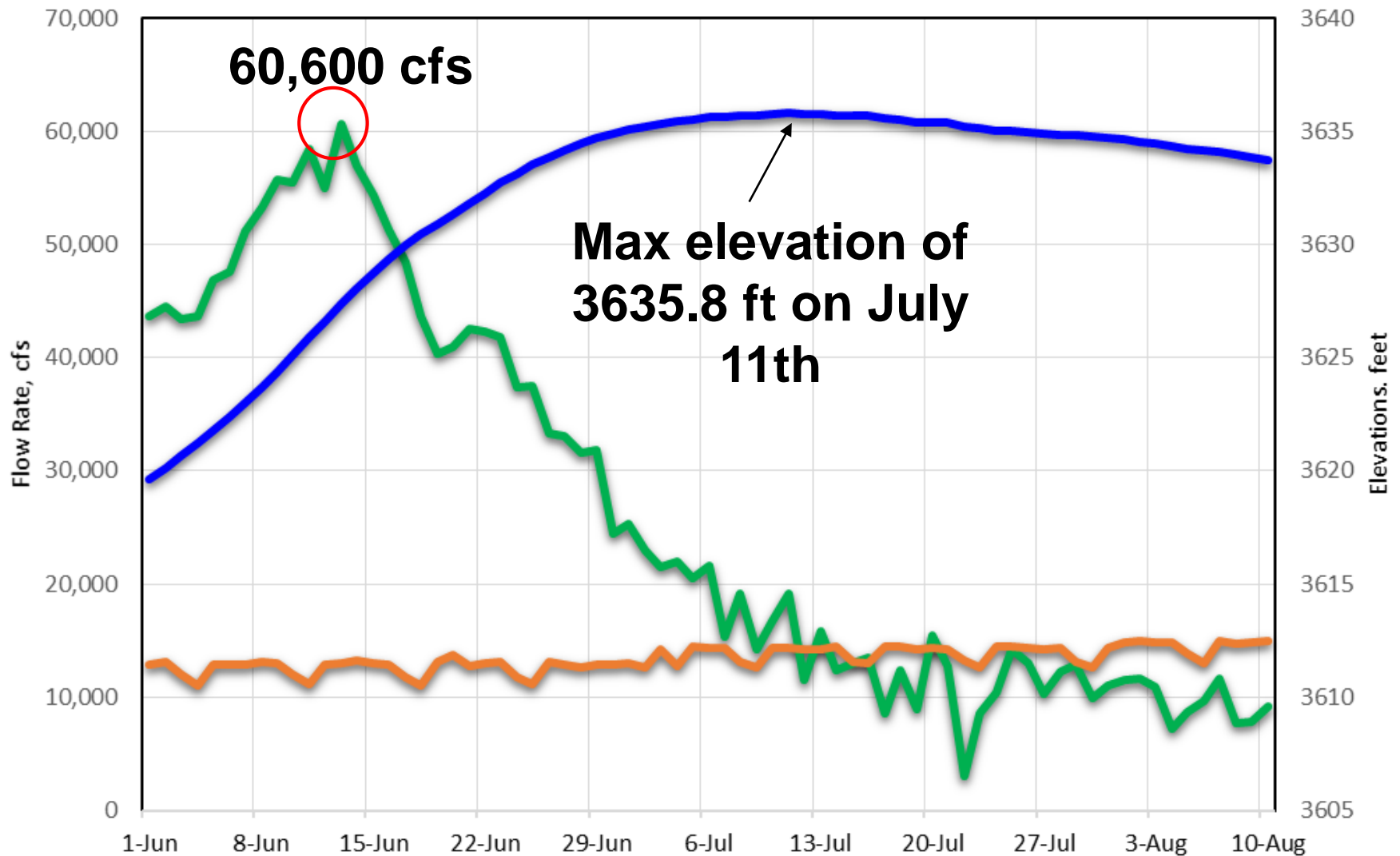


U.S. Department of the Interior
Bureau of Reclamation



Lake Powell

Inflow, cfs Total Release, cfs Elevation

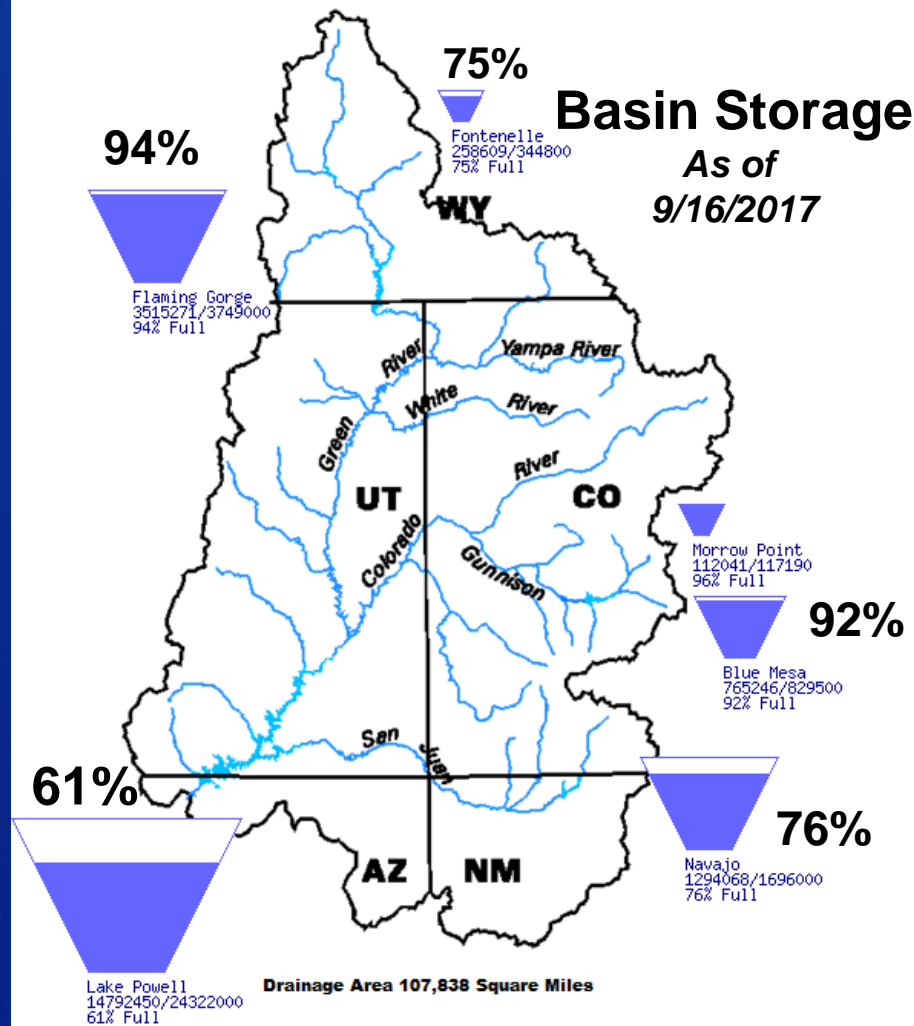


RECLAMATION

Upper Basin Storage

Data Current as of:
09/16/2017

Upper Colorado River Drainage Basin



<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 2017 Operating Tier

Upper Elevation Balancing

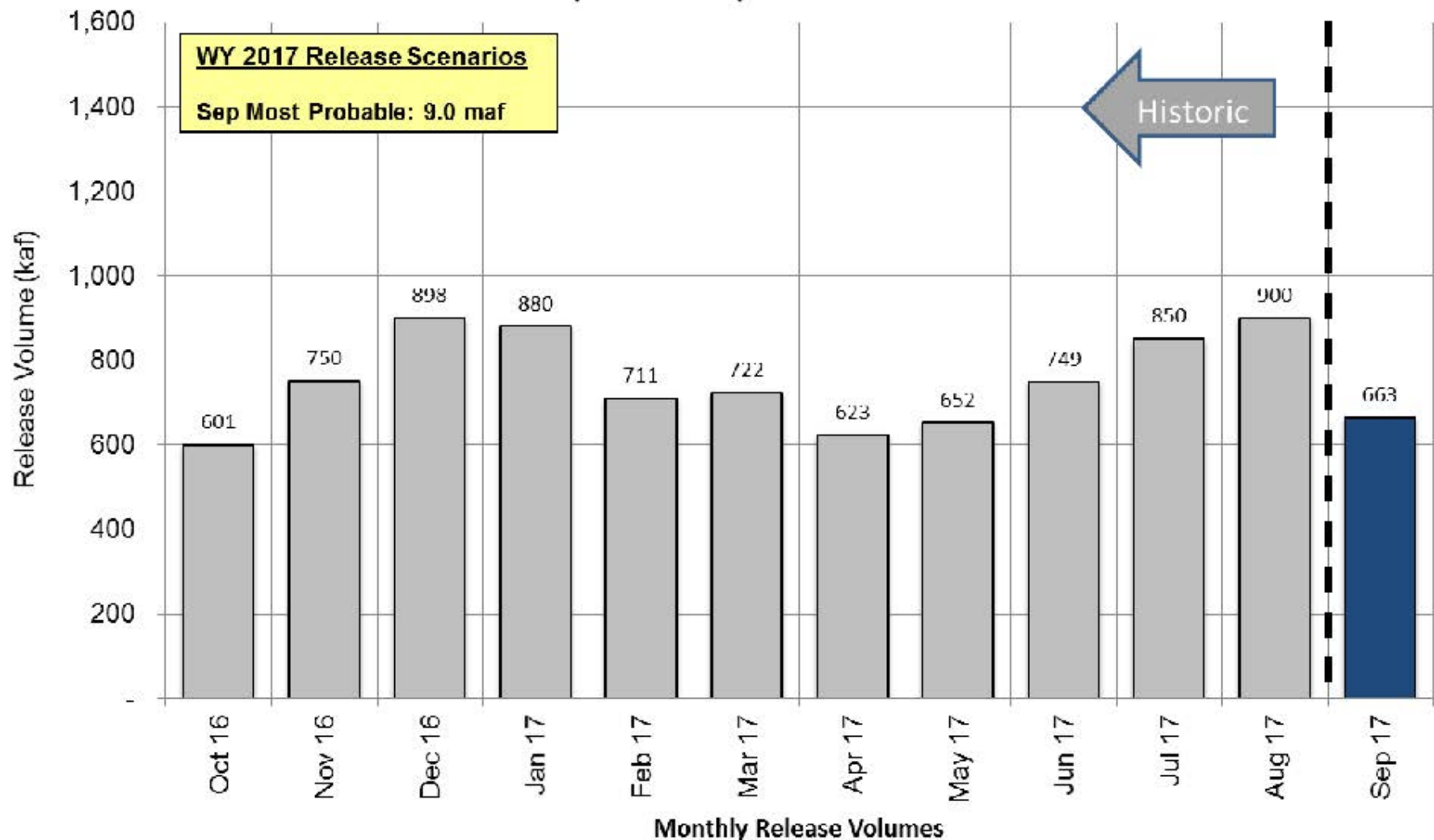
- Tier was set using the August 2016 24-Month Study
- April Adjustment to Balancing
- Goal: Balance contents of Lake Powell and Lake Mead by end of water year
 - Release 8.23 maf - 9.0 maf
 - Currently projecting 9.0 maf release

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)
3,605.8		
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

Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2017

Updated September 2017

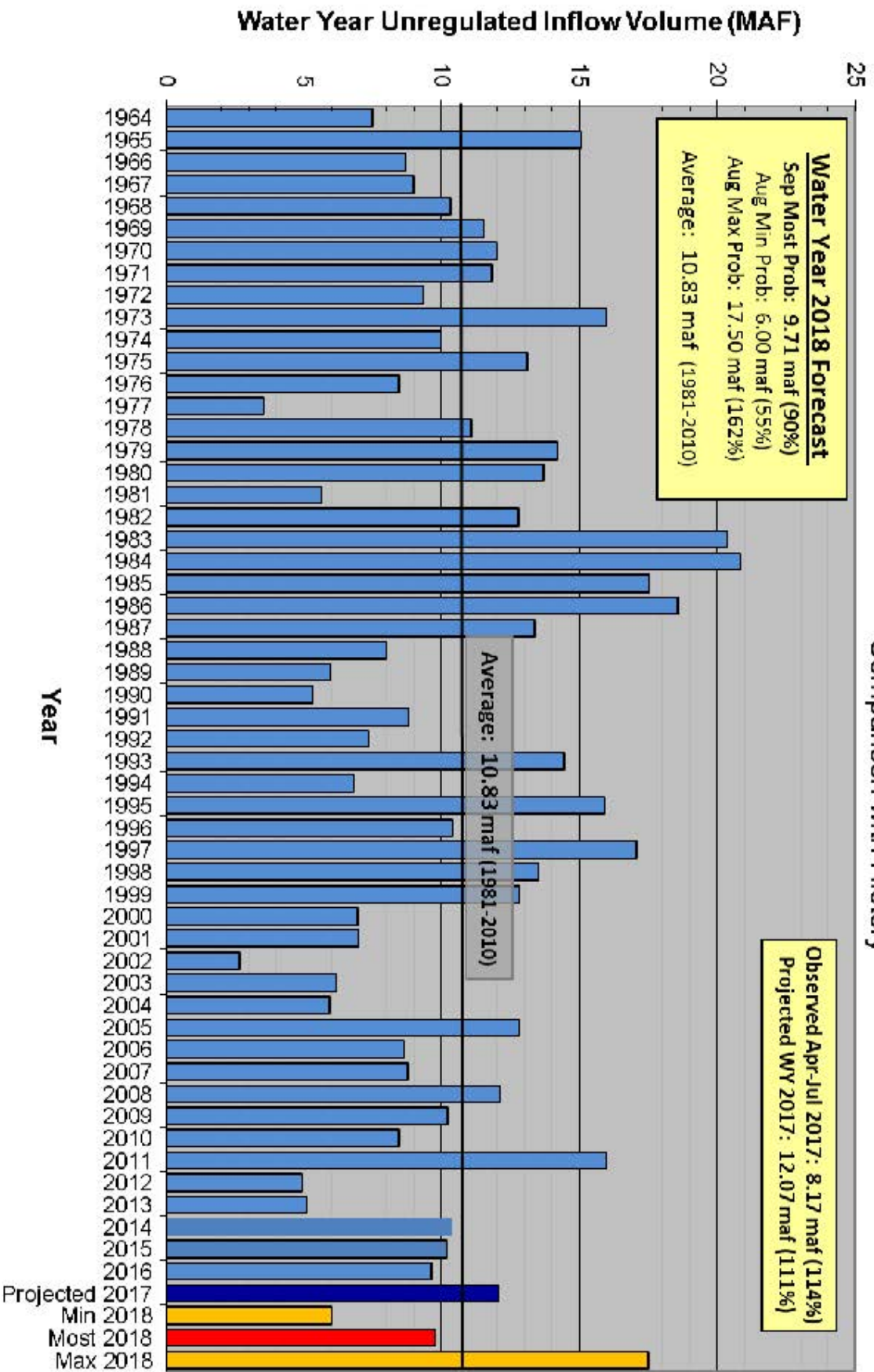


RECLAMATION

Lake Powell Unregulated Inflow

Water Year 2018 Forecast (Issued September 1)

Comparison with History





Water Year 2018 Operations

RECLAMATION

Lake Powell 2018 Operating Tier

Upper Elevation Balancing

- Tier was set using the August 2017 24-Month Study – start with an 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
 – Currently projecting 9.0 maf release

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)
3,627		
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



Water Year 2018 Operating Tier

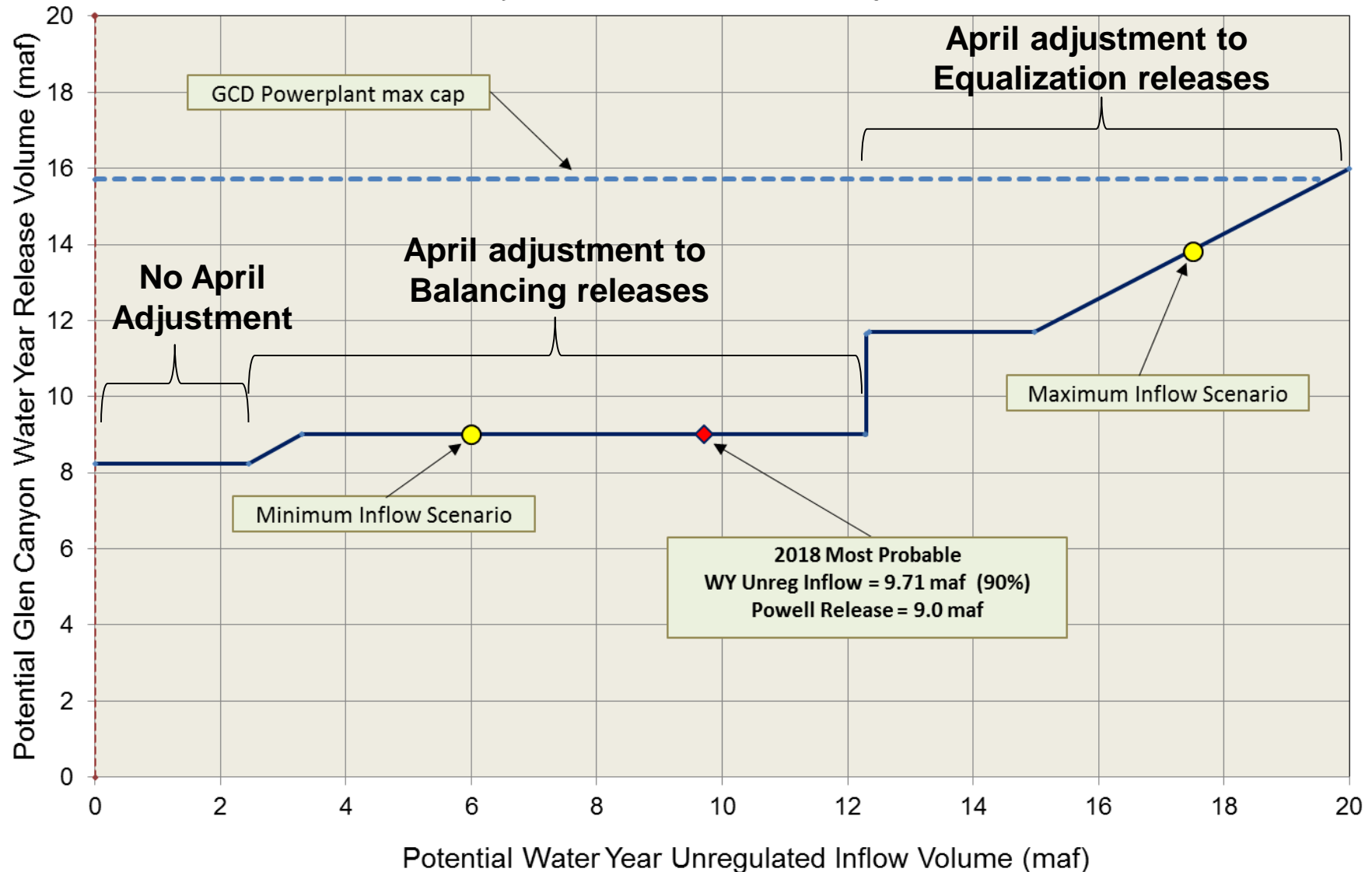
Operating Tier determined with the August 2017 24-Month Study

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

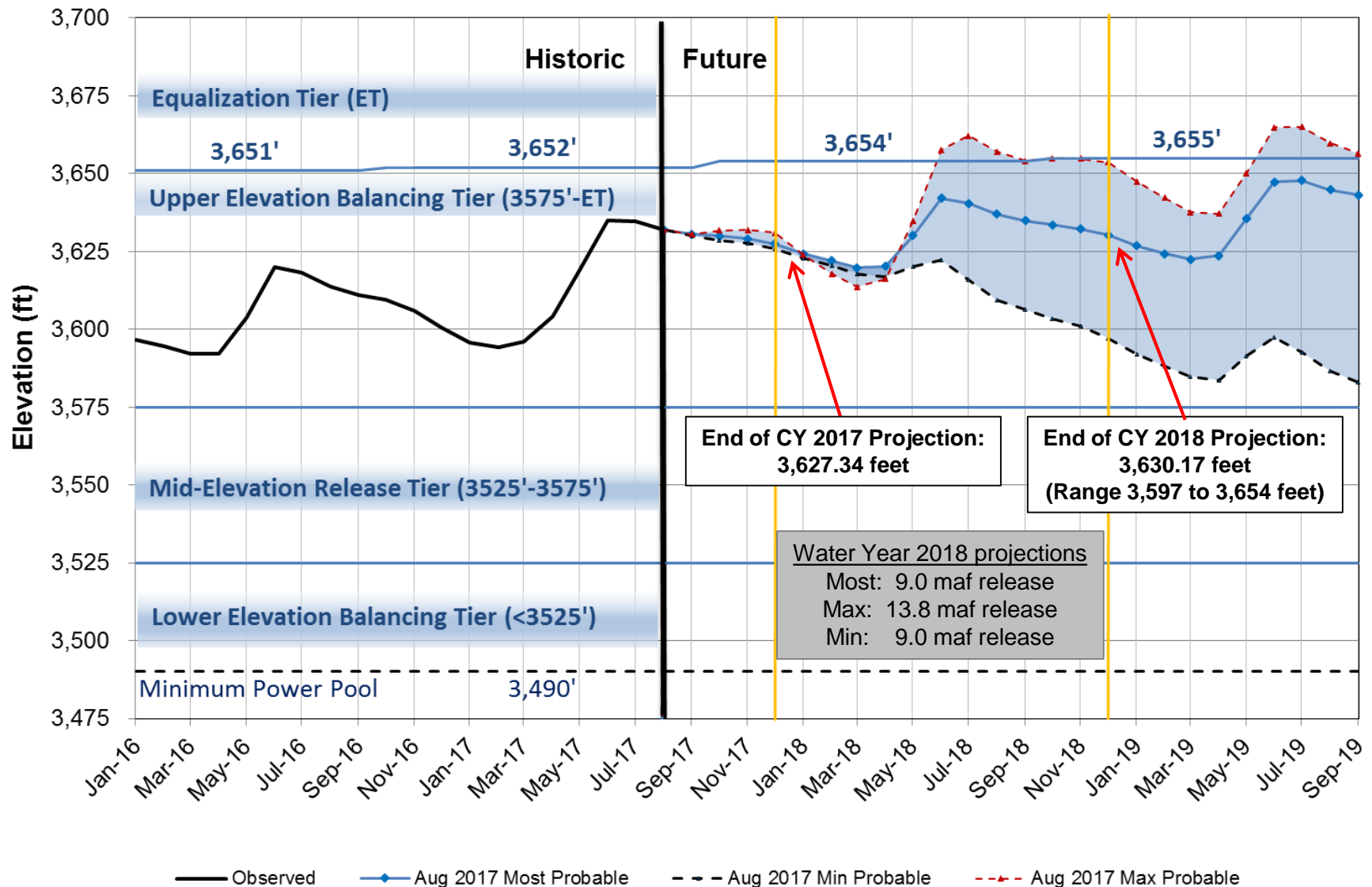
Potential Lake Powell Release Scenarios

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



Lake Powell End of Month Elevations

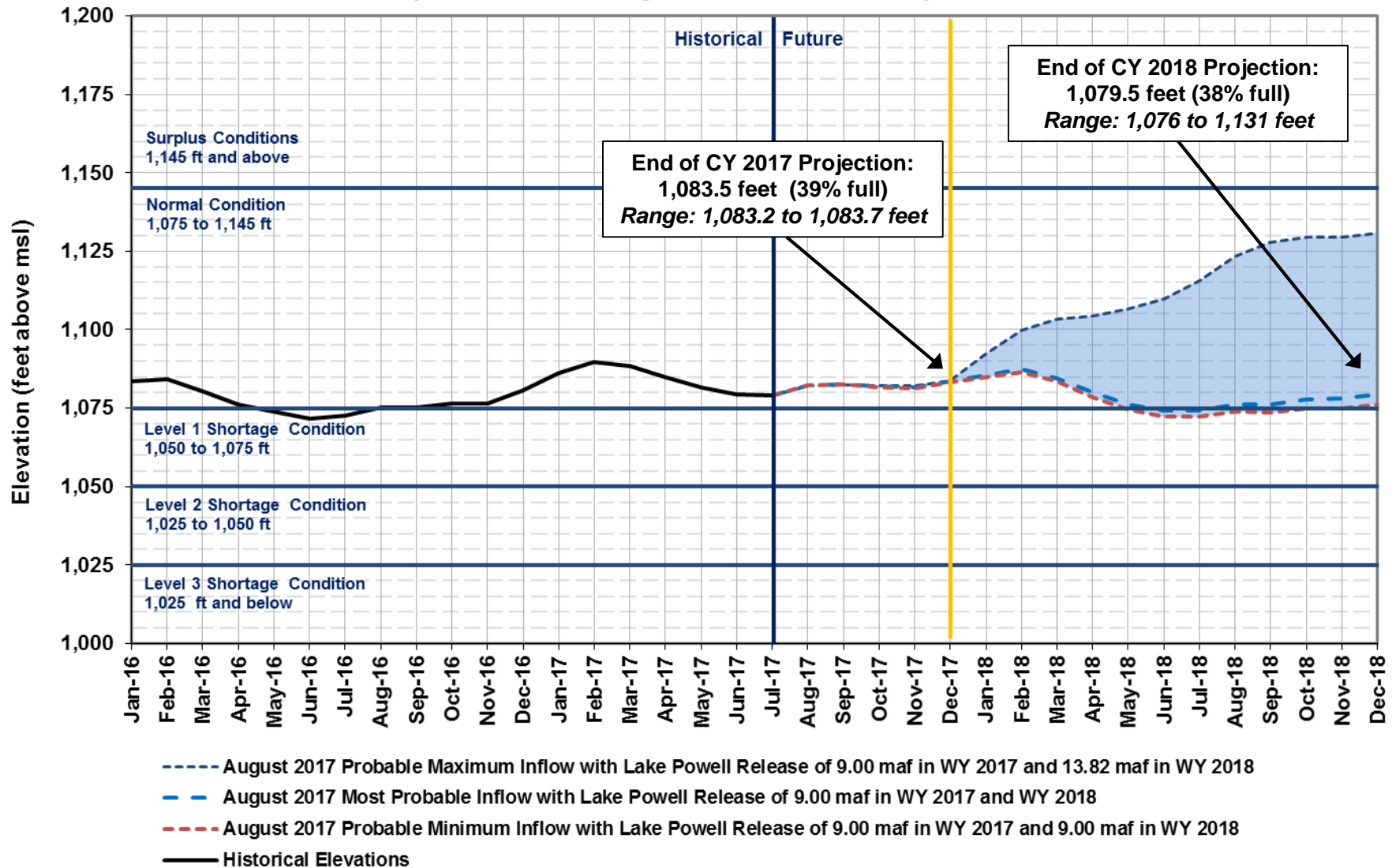
Historic and Projected based on Aug 2017 Modeling





Lake Mead End of Month Elevations

Projections from the August 2017 24-Month Study Inflow Scenarios





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 – 1 st level (Mead ≤ 1,075 and ≥ 1,050)	0	15	40	35	33
	Shortage – 2 nd level (Mead < 1,050 and ≥ 1,025)	0	0	2	10	15
	Shortage – 3 rd 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.

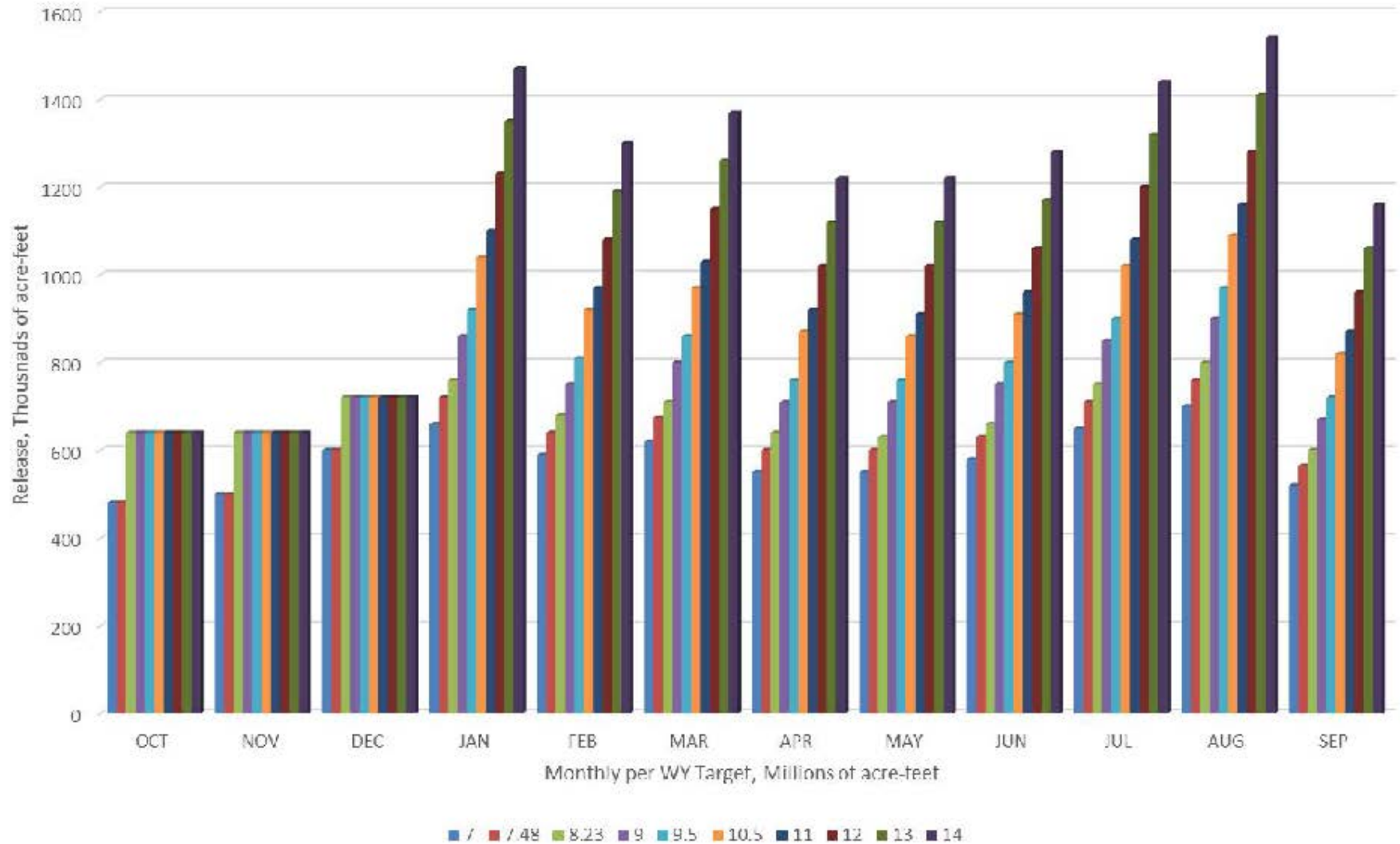
³ Percentages shown may not sum to 100% due to rounding to the nearest percent.

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

RECLAMATION



LTEMP Monthly Release Volumes



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)**	LTEMP hourly Ramp Rates (cfs), (down/up)
OCT	640	630	5,700	2,500/4,000
NOV	640	630	5,700	2,500/4,000
DEC	720	740	6,700	2,500/4,000
JAN	860	860	7,700	2,500/4,000
FEB	750	750	6,800	2,500/4,000
MAR	800	800	7,200	2,500/4,000
APR	710	700	6,300	2,500/4,000
MAY	710	700	6,300	2,500/4,000
JUN	750	760	7,600	2,500/4,000
JUL	850	860	8,000	2,500/4,000
AUG	900	900	8,000	2,500/4,000
SEP	670	670	6,000	2,500/4,000

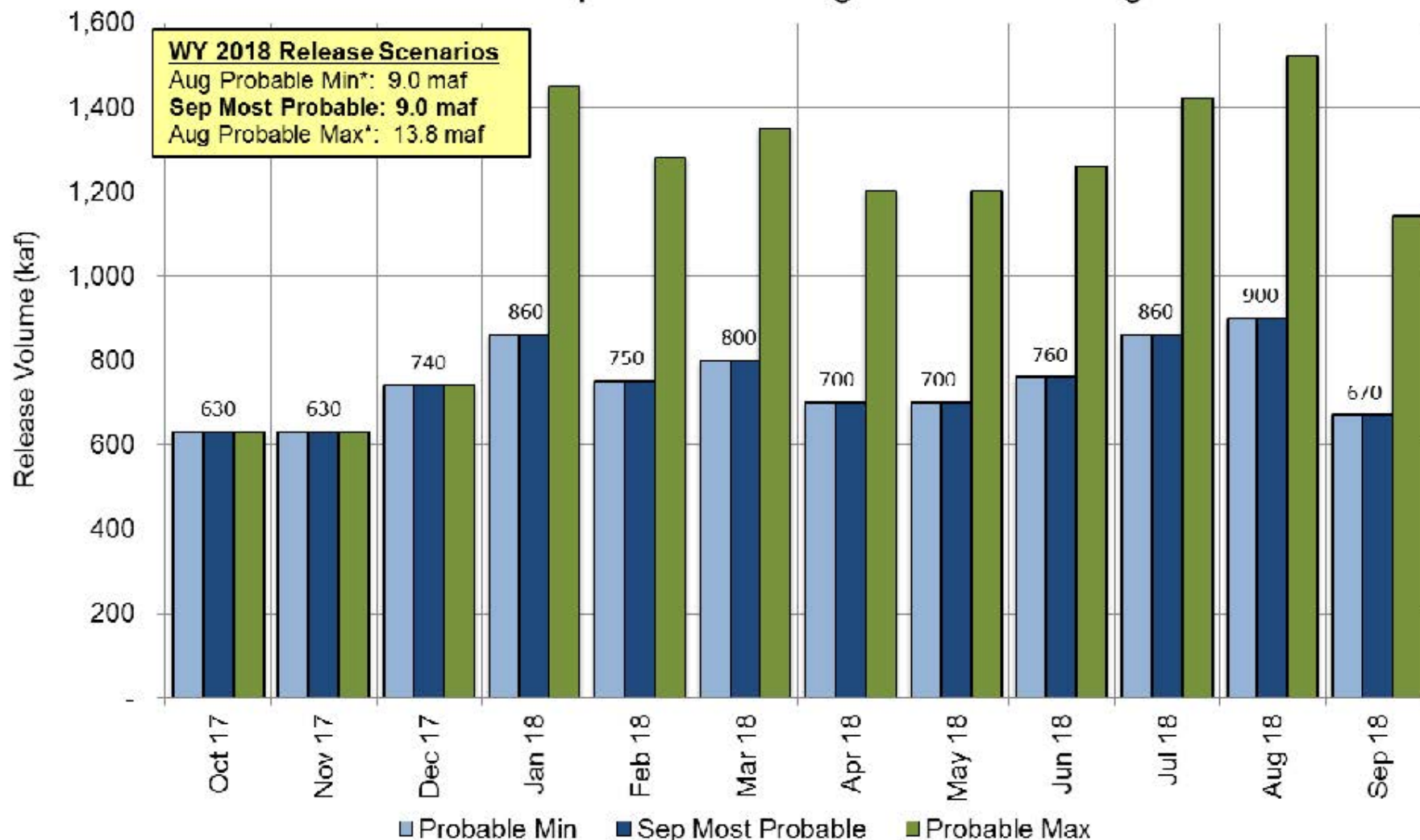
- *Modifications of monthly volumes reached between BOR and WAPA
- **LTEMP Daily fluctuations determined by, 9 x monthly vol (Sep – May), and 10 x monthly vol (Jun – Aug)

RECLAMATION

Projected Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2018

Based on September and 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
1												
2												
3												
4												
5												
6												
7												
8												
Units Available	6	4	5	4	5	5	5	6/8	8	8	8	7
Capacity (cfs)	20,800	13,100	13,100	13,200	16,800	16,800	13,300	21,000	28,300	28,300	28,300	24,500
Capacity (kaf/month)	1,280	960	1,150	990	1,020	1,030	990	1,590	1,680	1,740	1,740	1,540
Max (kaf) ¹	630	630	740	1,450	1,280	1,350	1,200	1,200	1,260	1,420	1,520	1,141
Most (kaf) ²	630	630	740	860	750	800	700	700	760	860	900	670
Min (kaf) ¹	630	630	740	860	750	800	700	700	760	860	900	670

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

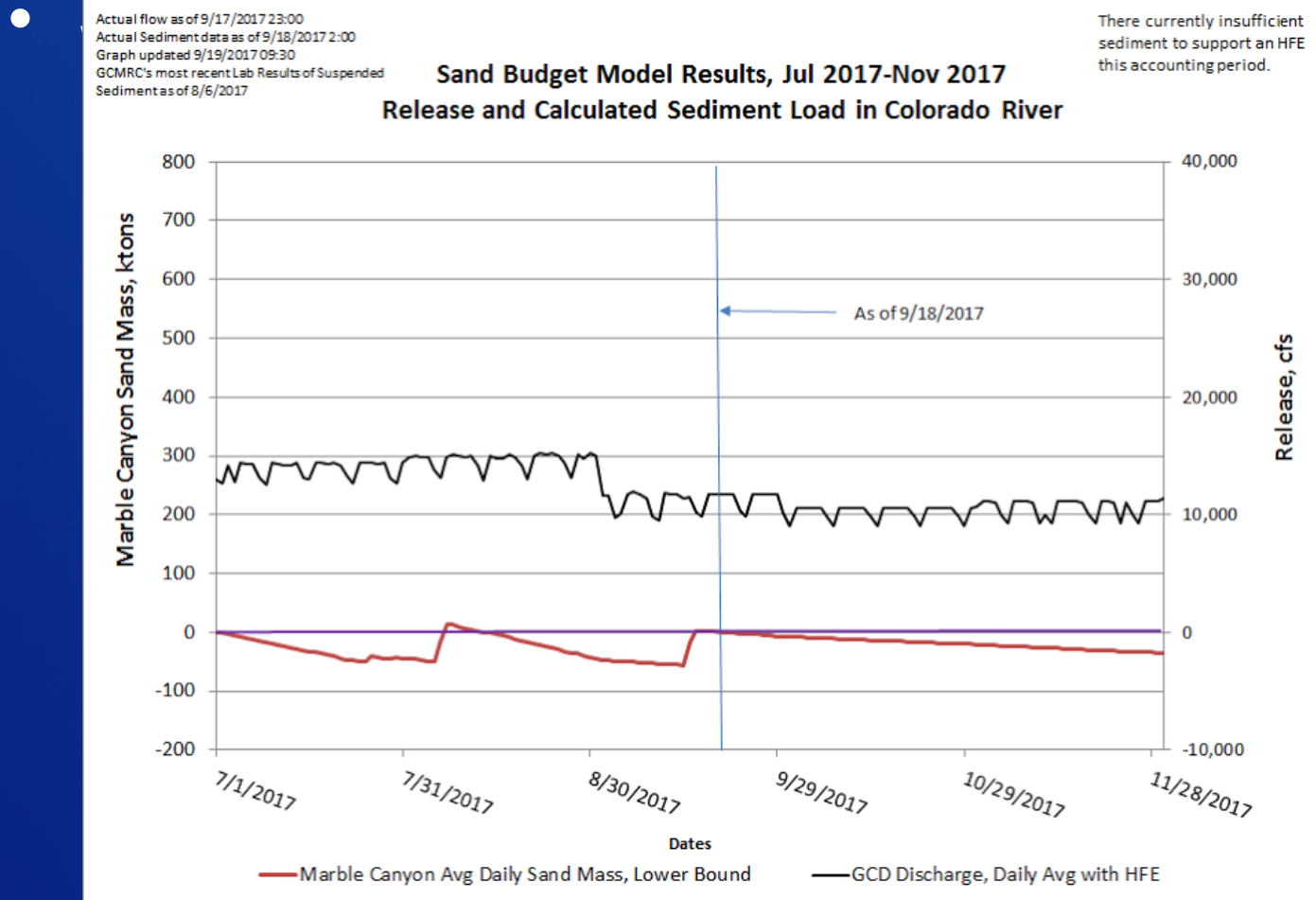
² Projected release, based on Sep 2017 Most Probable Inflow Projections and 24-Month Study model runs

(updated 9-8-2017)

RECLAMATION

Sand Budget Model Results

- As of 9-18-2017, not enough sediment input to trigger a fall 2017 HFE



RECLAMATION

Questions?

Paul Davidson

801-524-3642

PDavidson@usbr.gov

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

RECLAMATION