RECLAMATION

Managing Water in the West

2016 Glen Canyon Dam Annual Operating Plan

Technical Work Group Meeting
October 21, 2015

U.S. Department of the Interior
Bureau of Reclamation

Colorado River Annual Operating Plan

RECLAMATION

Colorado River Annual Operating Plan

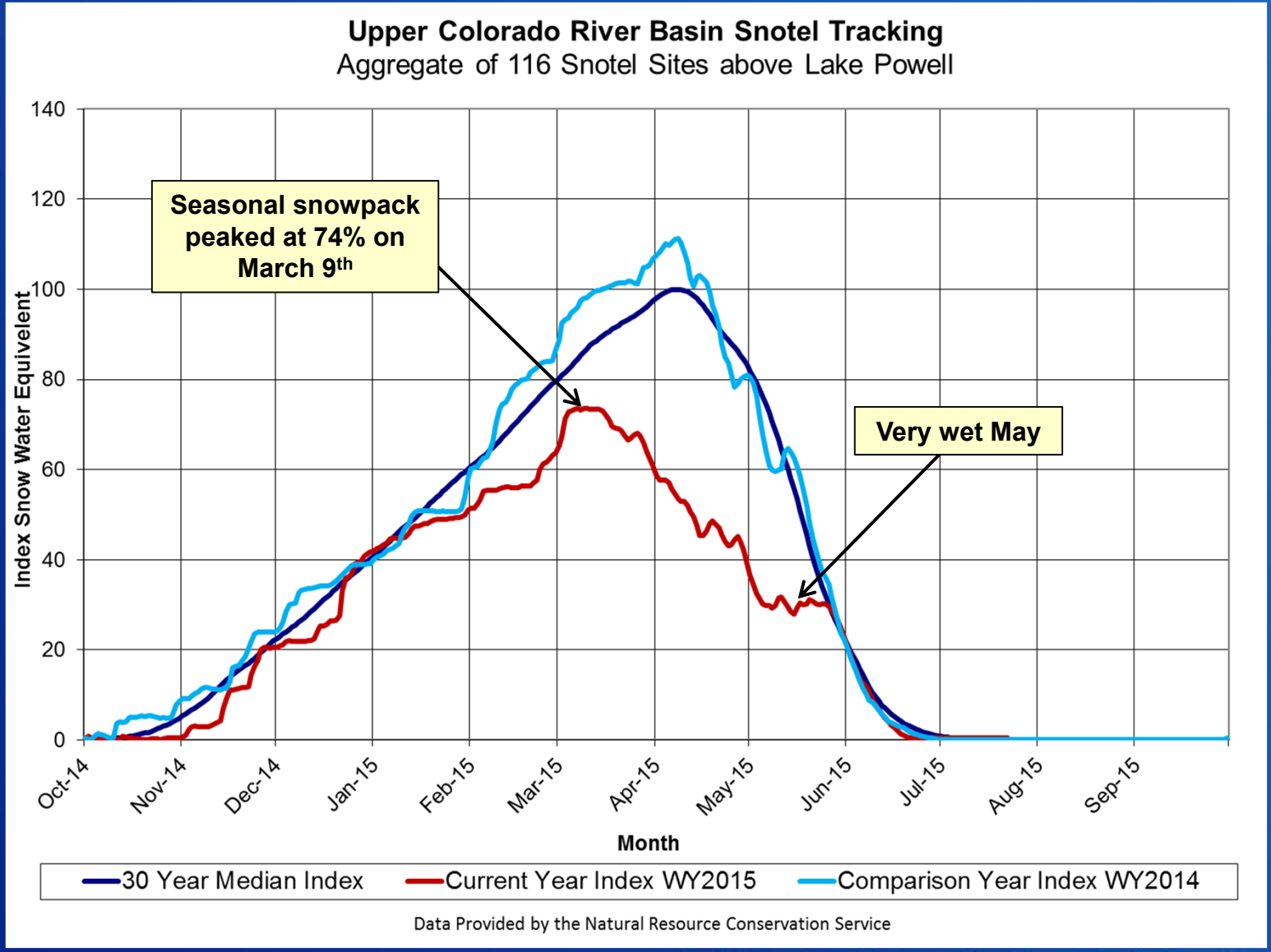
- Report of Colorado River hydrology and reservoir operations for past year and projections for the upcoming year.
- Purpose: Illustrate range of reservoir operations that might be expected in the upcoming water year
- Reflects operational rules, guidelines and decisions that have been put into place for the Colorado River reservoirs.
- AOP document is prepared by Reclamation, in consultation with representatives of the Basin States, Indian Tribes, Upper Colorado River Commission, appropriate Federal agencies, and other Basin stakeholders. Typically three consultation meetings.
- 2016 AOP currently in final stages of development. Expect transmittal to Secretary of Interior in upcoming weeks. http://www.usbr.gov/uc/water/rsvrs/ops/aop/index.html.

RECLAMATION

Hydrology and Reservoir Operations Water Years 2015 and 2016

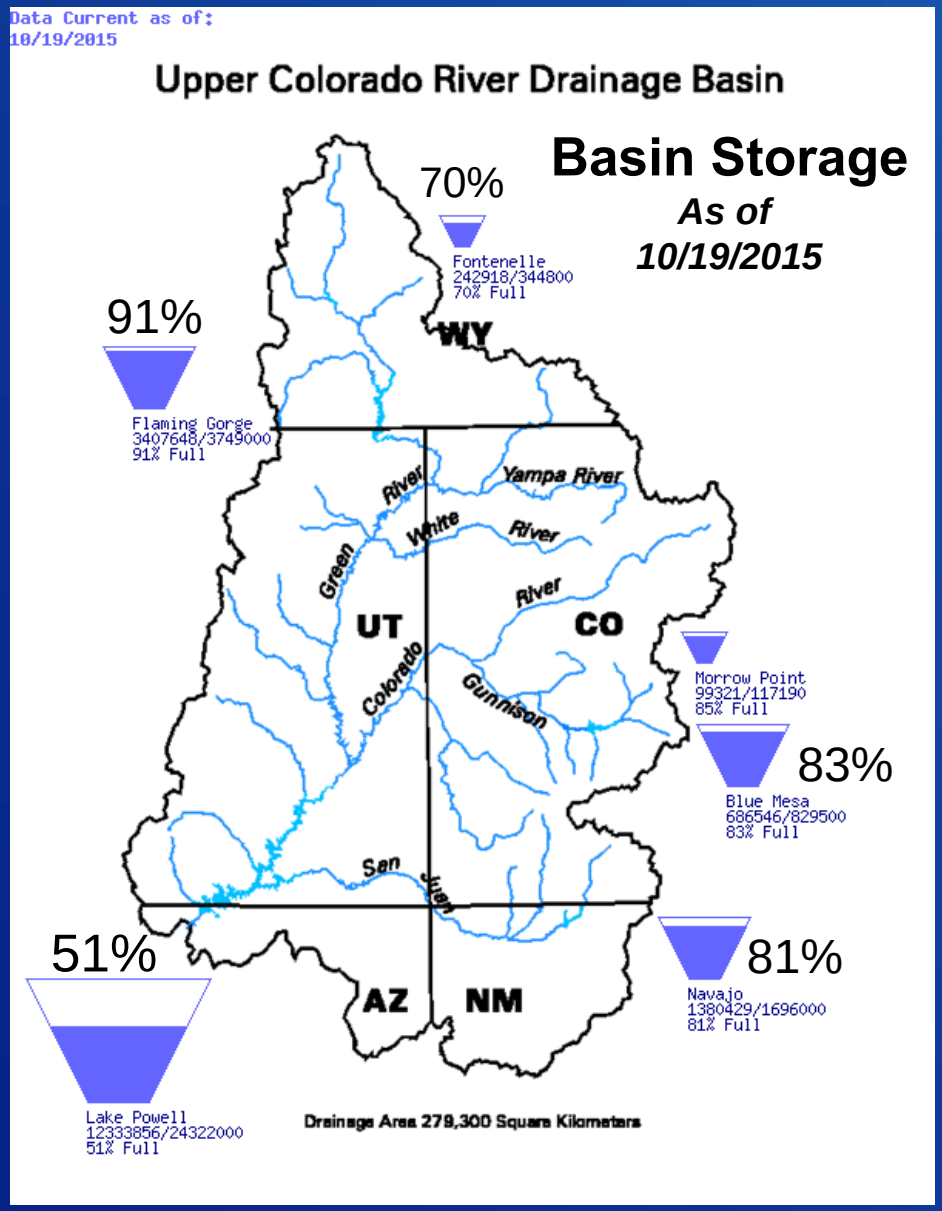
RECLAMATION

Snow Conditions for WY 2015



RECLAMATION

Upper Basin Storage



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

Water Year 2015 Observed Unregulated Inflow

Reservoir	WY 2015 Observed (KAF)	Percent of Average[1]
Fontenelle	1,210	112%
Flaming Gorge	1,560	108%
Blue Mesa	1,040	109%
Navajo	900	84%
Powell	10,170	94%

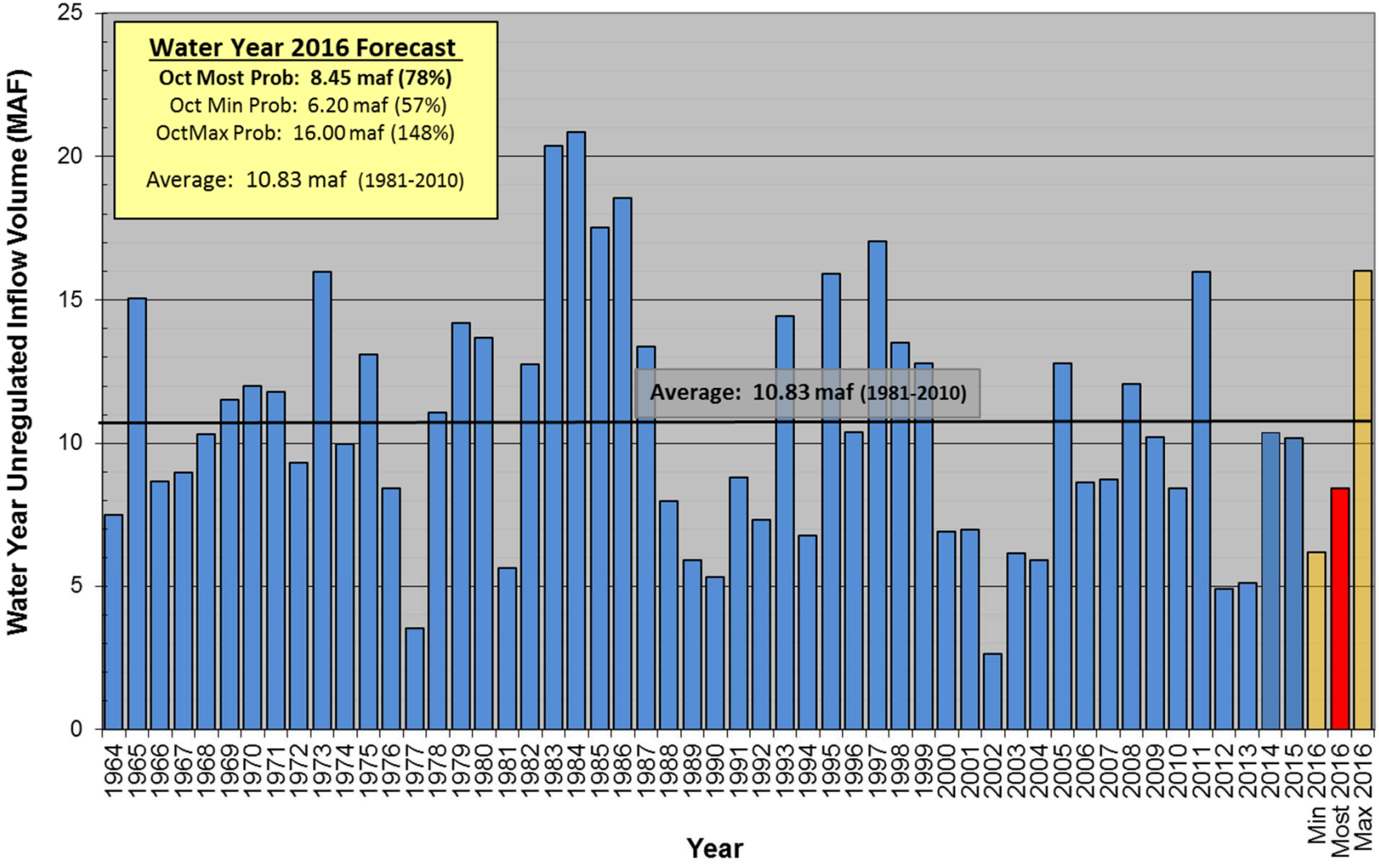
[1] percent of average based on period 1981-2010.

RECLAMATION

Lake Powell Unregulated Inflow

Water Year 2016 Forecast *(issued Oct 1)*

Comparison with History



* Decrease from Sept forecast: 840kaf

RECLAMATION

Lake Powell Operational Tier Determinations (2007 Interim Guidelines)

- August 24-Month Study projection of January 1 elevations establishes the Lake Powell operating Tiers for the upcoming year
- If in Upper Elevation Balancing, April 24-Month Study projection of Sept 30th elevation / storage could shift to Powell operations to balancing or equalization for remainder of water year
- Reservoir operating plans are continually updated throughout the water year as hydrologic and operational conditions change.

RECLAMATION

Lake Powell & Lake Mead Operational Table

Operational Tiers for Water/Calendar Year 2016 determined with the August 2015 24-Month Study

Lake Powell			Lake Mead		
Elevation (feet)	**Operation According to the Interim Guidelines**	**Live Storage (maf)[1]**	**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	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[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)	1,200 (approx.)[2]	**Domestic Surplus or ICS Surplus Condition** Deliver > 7.5 maf	22.9 (approx.)[2]
3,575	**Mid-Elevation Release Tier** Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.5	1,145	**Normal or ICS Surplus Condition** Deliver ≥ 7.5 maf	15.9
3,525	**Lower Elevation Balancing Tier** Balance contents with a min/max release of 7.0 and 9.5 maf	5.9	1,105	**Shortage Condition** Deliver 7.167[4] maf	11.9
3,490		4.0	1,075	**Shortage Condition** Deliver 7.083[5] maf	9.4
3,370		0	1,050	**Shortage Condition** Deliver 7.0[6] maf Further measures may be undertaken[7]	7.5
			1,025		5.8
			1,000		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.

RECLAMATION

Lake Powell Operational Scenarios

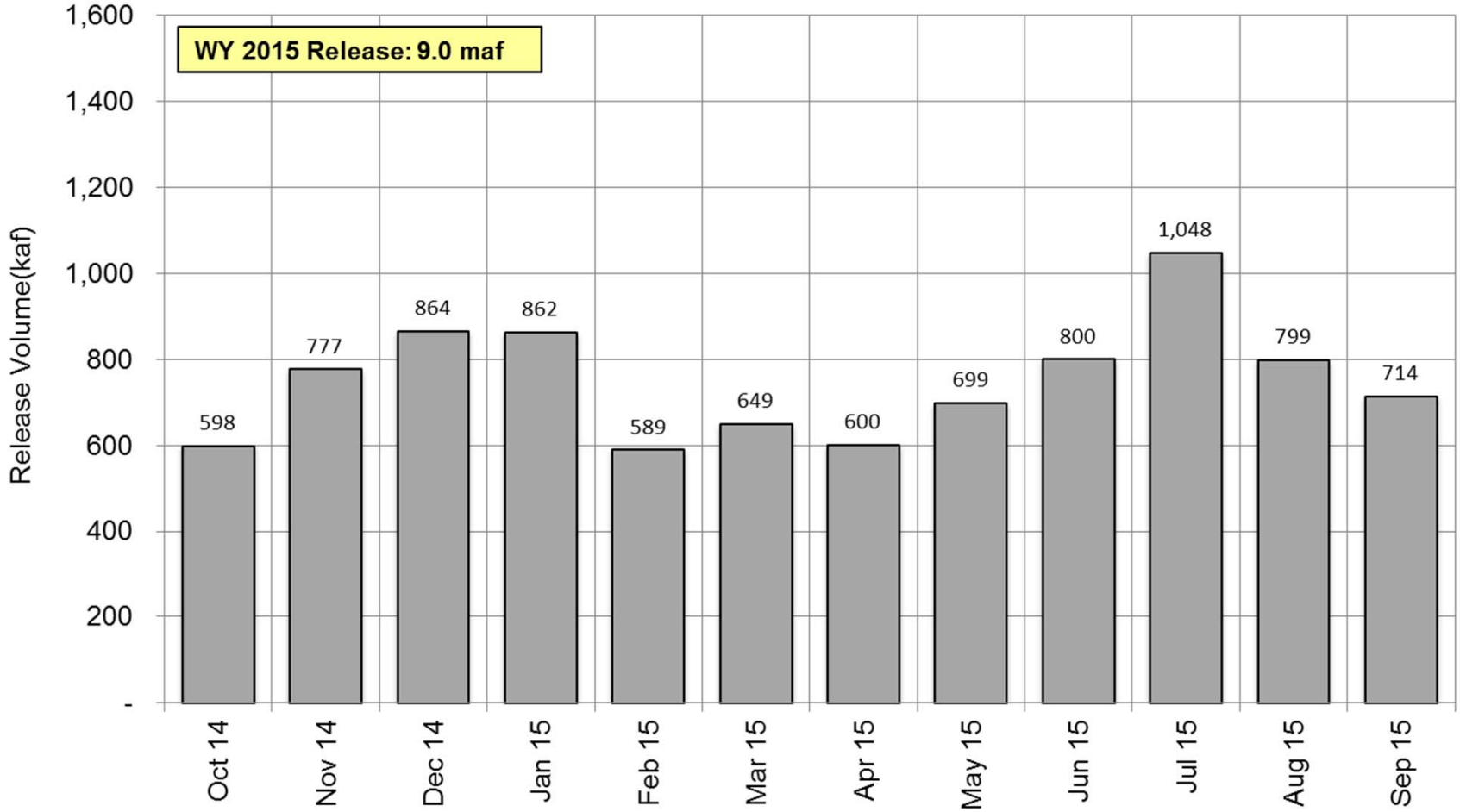
Based on October 2014 24-Month Study Inflow Scenarios

Powell Inflow Scenario	WY 2015 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 11.4 maf release

RECLAMATION

Observed Lake Powell Monthly Releases

Water Year 2015

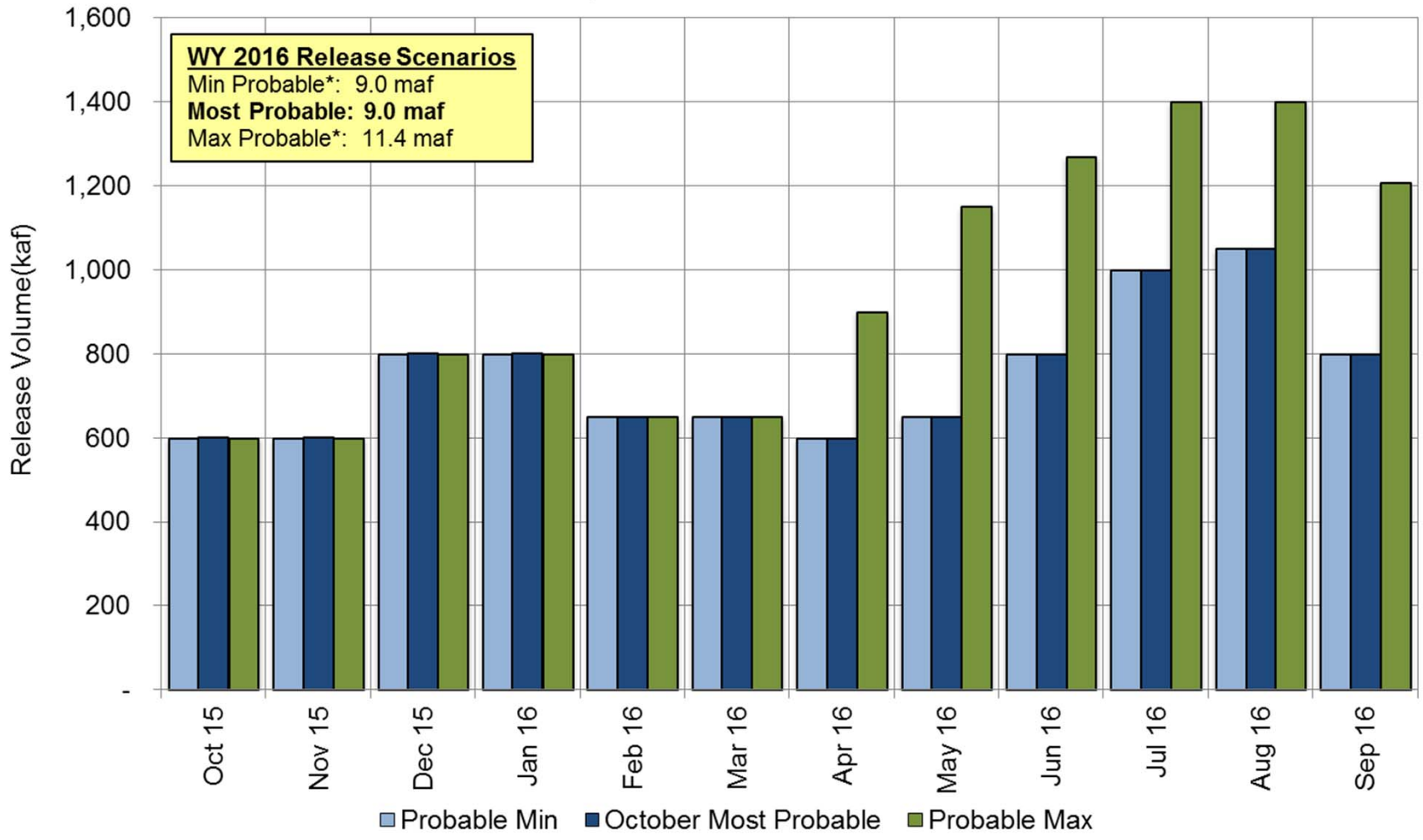


RECLAMATION

Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2016

Updated October 2015



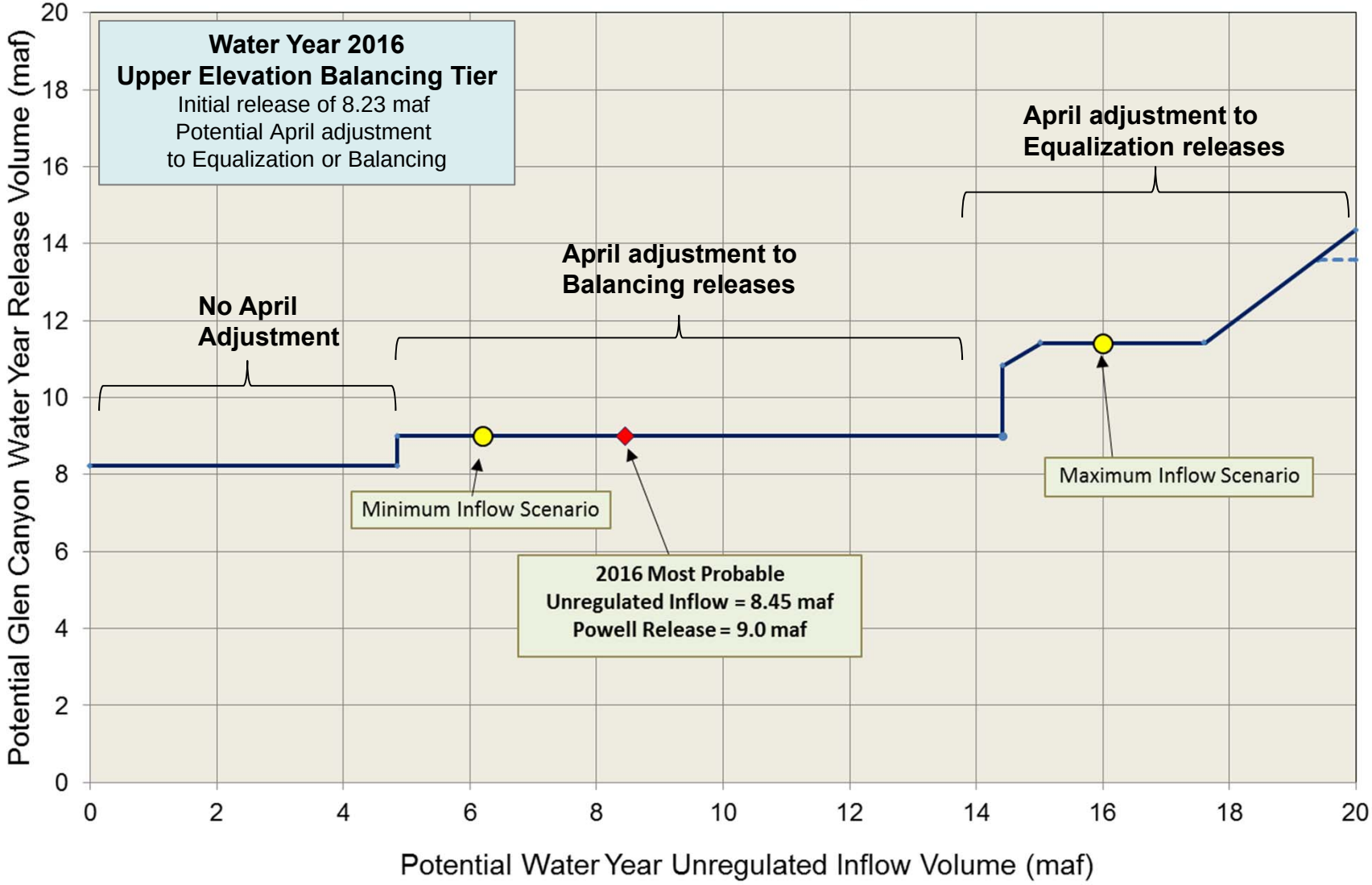
** Probable min and max annual release volume is based on October probable min and max inflow forecasts*

Monthly distribution will change if 2016 Hydrograph is approved by Secretary

RECLAMATION

Potential Lake Powell Release Scenarios

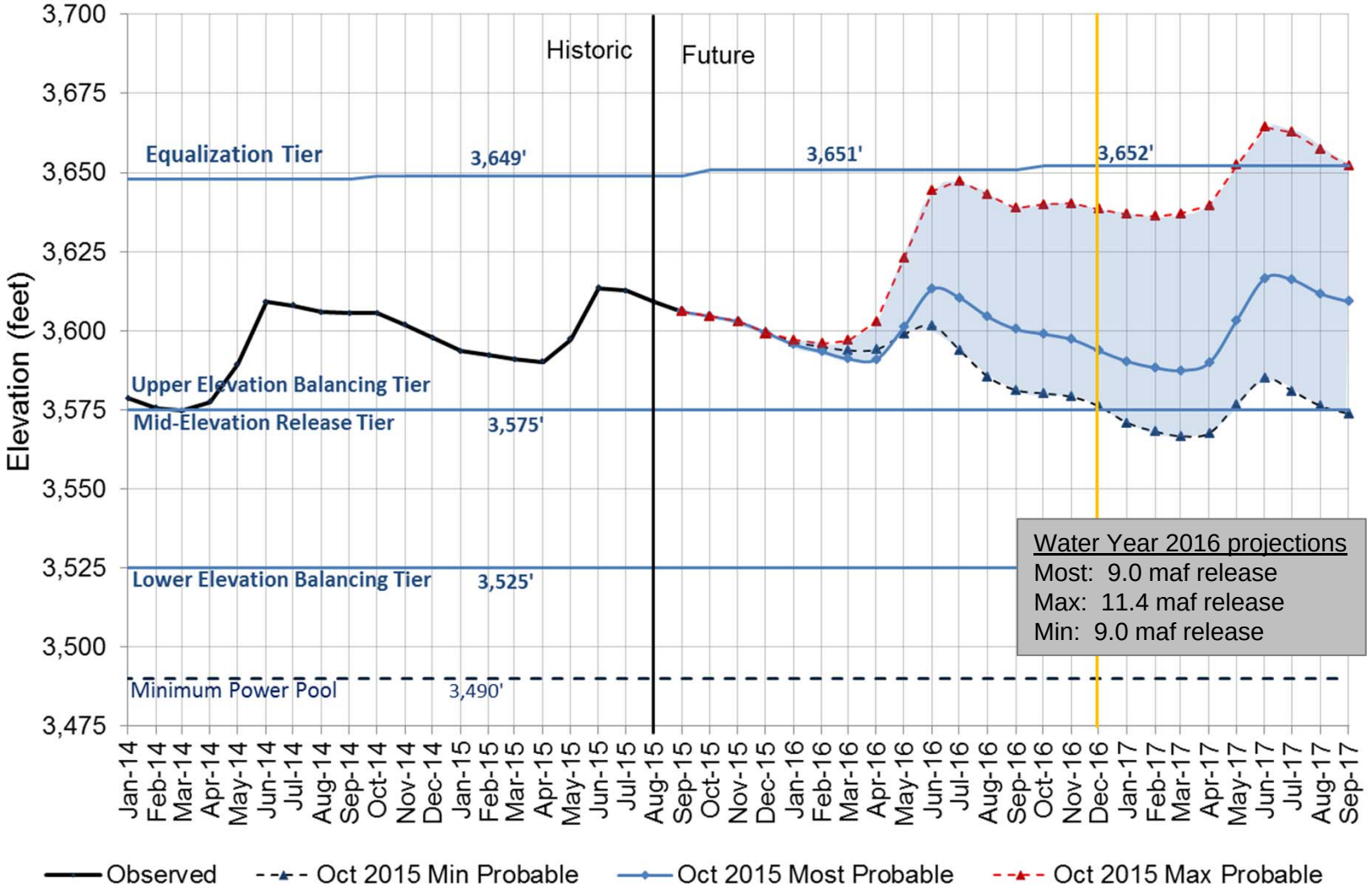
Water Year 2016 Release Volume as a Function of Unregulated Inflow Volume
based on October 2015 24-Month Study Conditions



RECLAMATION

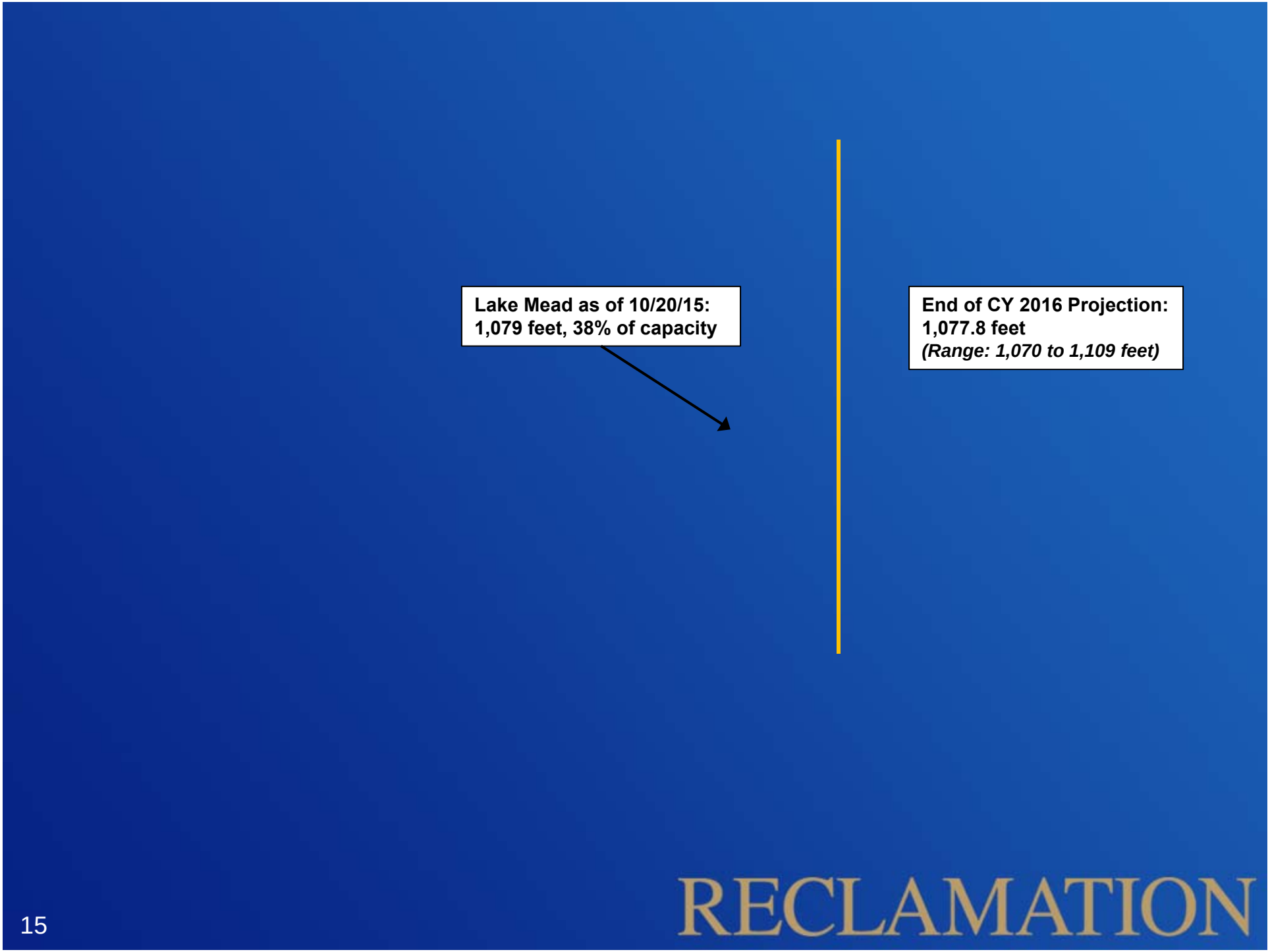
Lake Powell End of Month Elevations

Historic and projected based on October 2015 modeling



Water Year 2016 projections
Most: 9.0 maf release
Max: 11.4 maf release
Min: 9.0 maf release

RECLAMATION



RECLAMATION

RECLAMATION

Percent of Traces with Event or System Condition

Results from August 2015 CRSS[1,2,3] (values in percent)

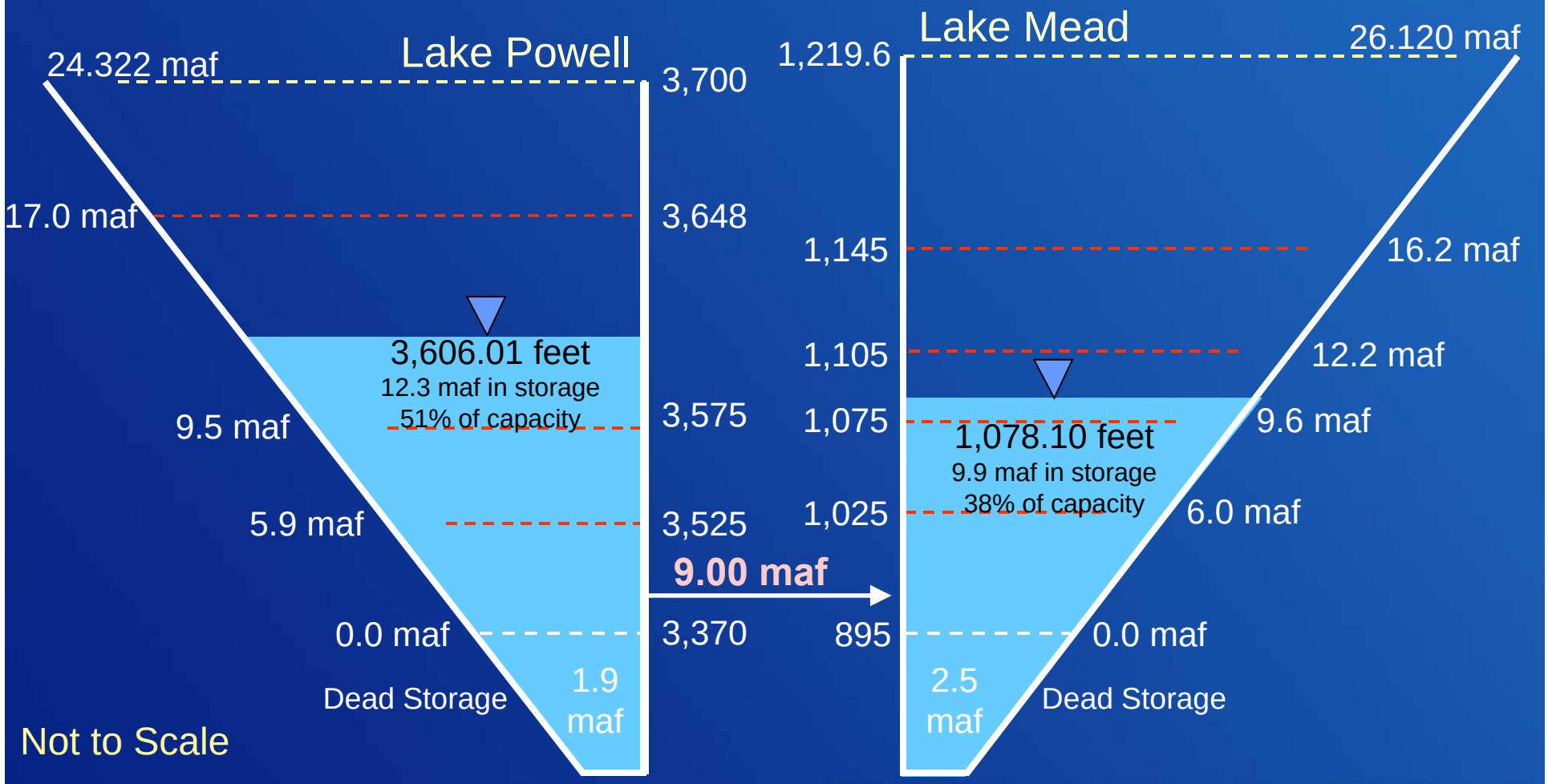
	Event or System Condition	2016	2017	2018	2019	2020
Upper Basin – Lake Powell	**Equalization Tier**	**8**	**24**	**23**	**27**	**29**
	Equalization annual release > 8.23 maf	8	23	23	27	28
	Equalization annual release = 8.23 maf	0	0	0	0	1
	Upper Elevation Balancing Tier	**92**	**52**	**55**	**54**	**47**
	Upper Elevation Balancing annual release > 8.23 maf	82	39	43	42	36
	Upper Elevation Balancing annual release 8.23 maf	10	13	11	10	11
	Upper Elevation Balancing annual release < 8.23 maf	0	0	1	2	0
	Mid-Elevation Release Tier	**0**	**24**	**19**	**10**	**17**
	Mid-Elevation Release – annual release 8.23 maf	0	0	0	1	1
	Mid-Elevation Release – annual release 7.48 maf	0	24	19	9	16
	Lower Elevation Balancing Tier	**0**	**0**	**3**	**9**	**7**
Lower Basin – Lake Mead	**Shortage Condition any amount (Mead ≤ 1,075 ft)**	**0**	**18**	**52**	**65**	**59**
	Shortage – 1st level (Mead ≤ 1,075 and ≥ 1,050)	0	18	42	47	35
	Shortage – 2nd level (Mead < 1,050 and ≥ 1,025)	0	0	10	14	18
	Shortage – 3rd level (Mead < 1,025)	0	0	0	4	7
	Surplus Condition any amount (Mead ≥ 1,145 ft)	**0**	**0**	**6**	**7**	**15**
	Surplus – Flood Control	0	0	0	2	2
	Normal or ICS Surplus Condition	**100**	**82**	**42**	**28**	**26**

[1] Reservoir initial conditions based on December 31, 2015 conditions using projections from the most probable August 2015 24 Month Study.
[2] Results are based on 107 hydrologic inflow sequences based on resampling of the observed natural flow record from 1906 2012.
[3] Percentages shown may not be representative of the full range of future possibilities that could occur with different modeling assumptions.

RECLAMATION

End of Water Year 2015 Conditions

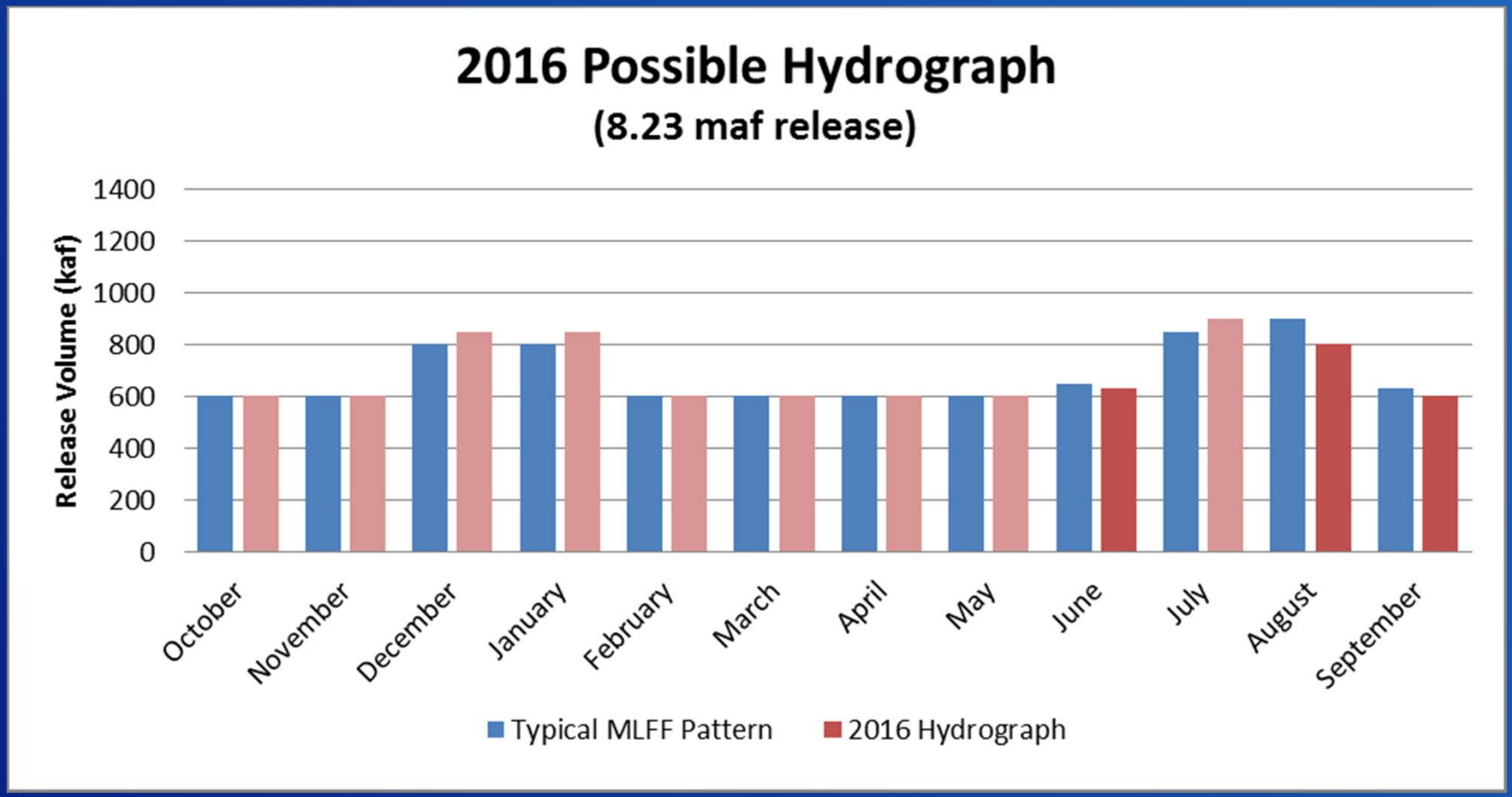
Observed Unregulated Inflow into Powell[1] = 10.17 maf (94% of average)



[1] Percent of average inflow is based on the 30-year period of record from 1981-2010 .

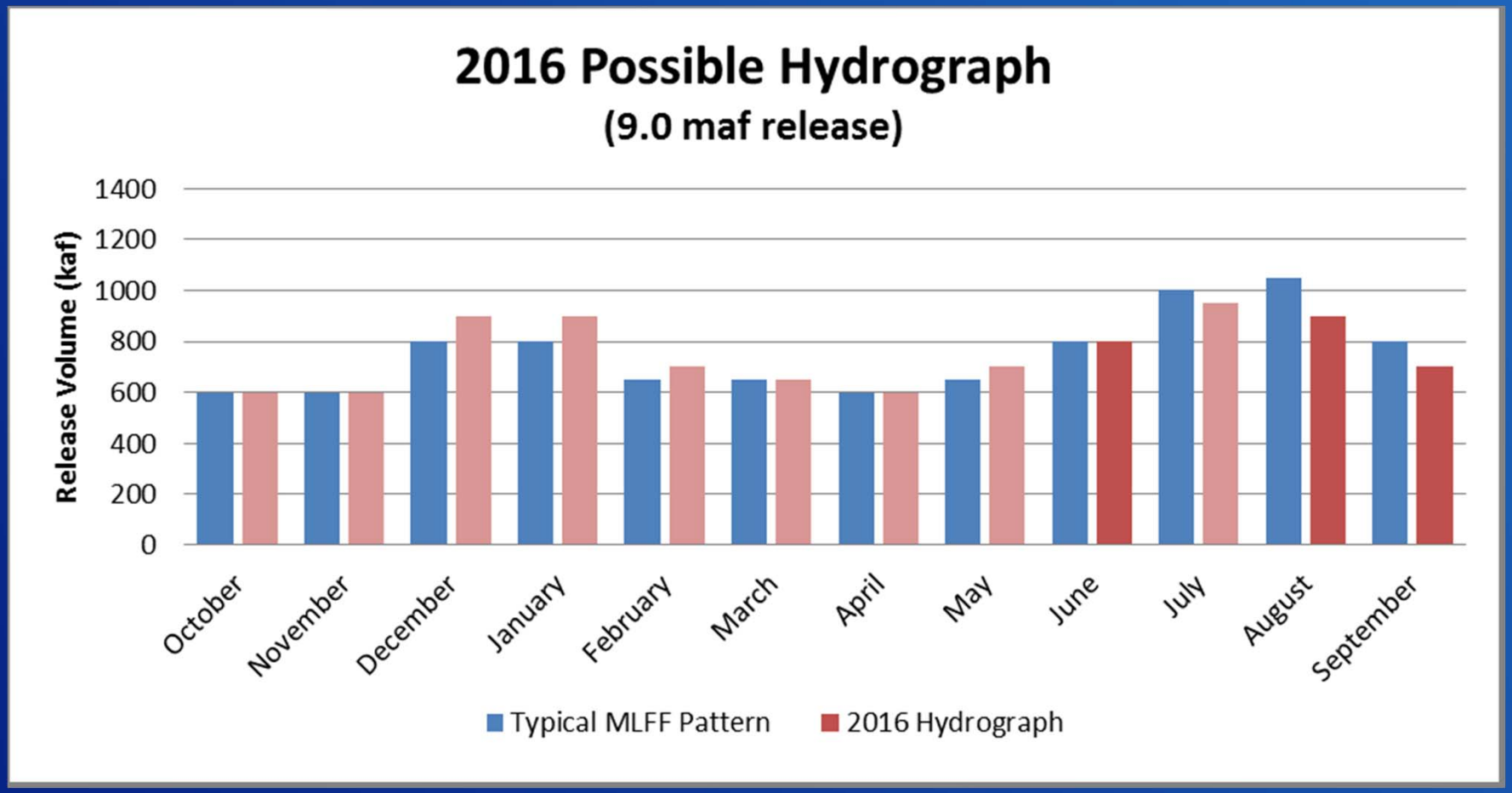
RECLAMATION

2016 Possible Hydrograph
8.23 maf release scenario



RECLAMATION

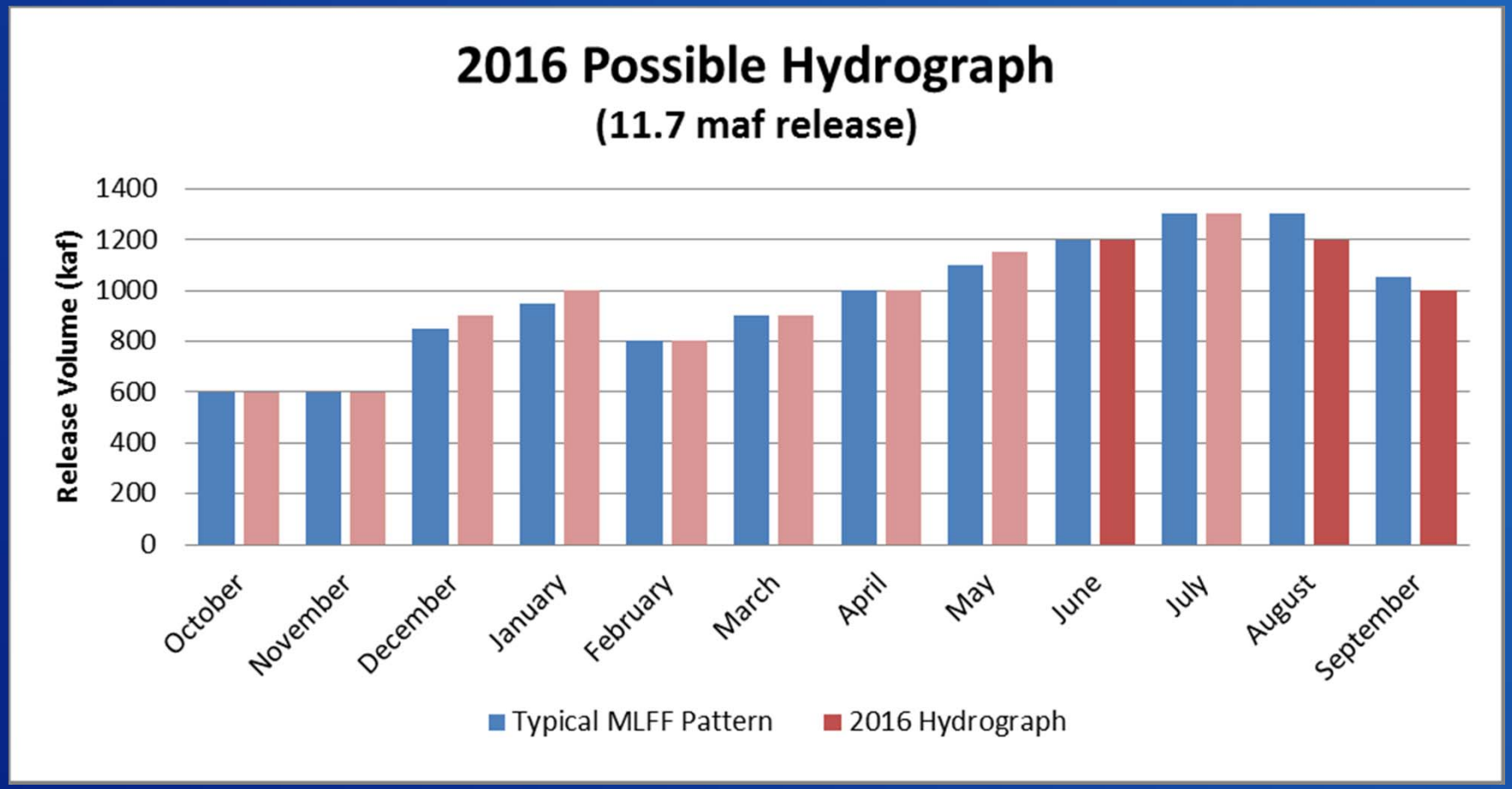
2016 Proposed Hydrograph
9.0 maf release scenario



RECLAMATION

2016 Proposed Hydrograph
11.7 maf release scenario

- Lots of water to move: limited flexibility, minimal difference



RECLAMATION