

RECLAMATION

Managing Water in the West

Basin Hydrology, Operations and 2017 Hydrograph

Glen Canyon Technical Work Group
April 19-20, 2016

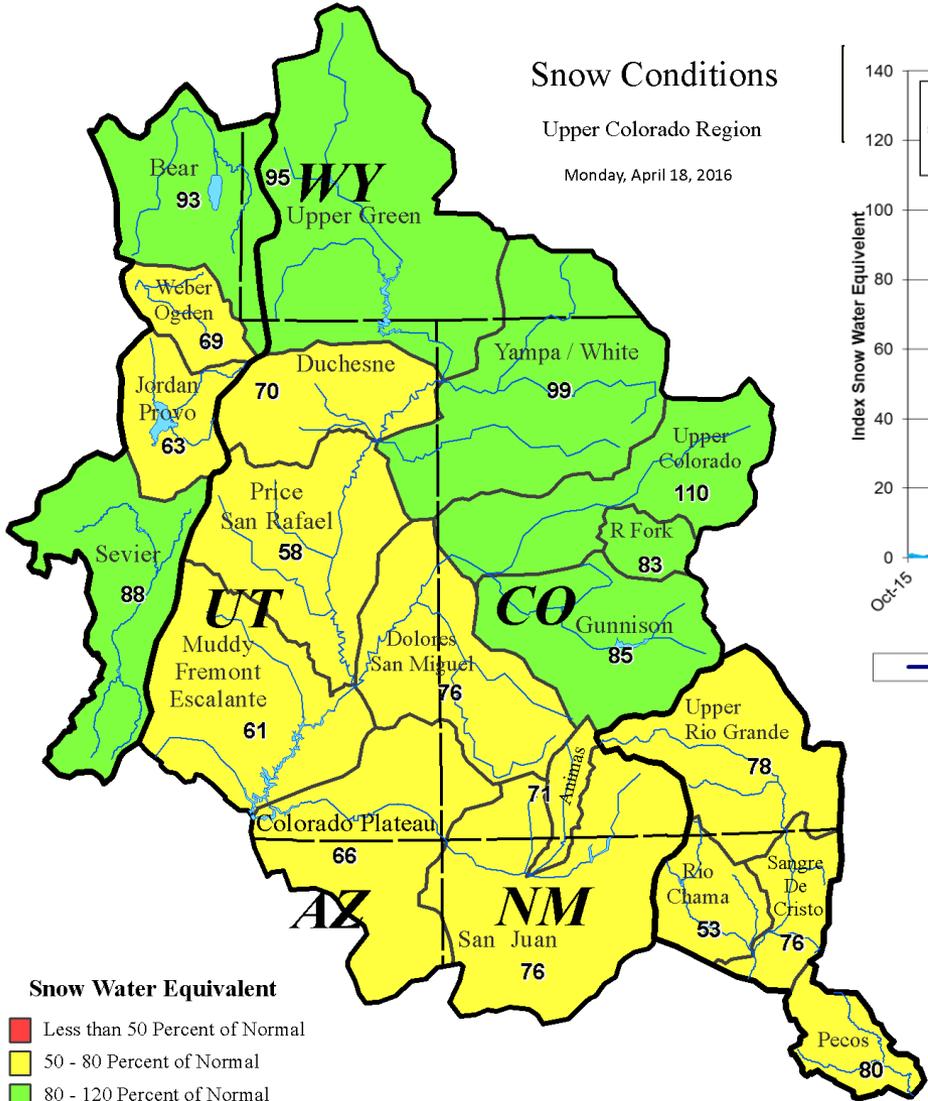


U.S. Department of the Interior
Bureau of Reclamation

Snow Conditions

Upper Colorado Region

Monday, April 18, 2016



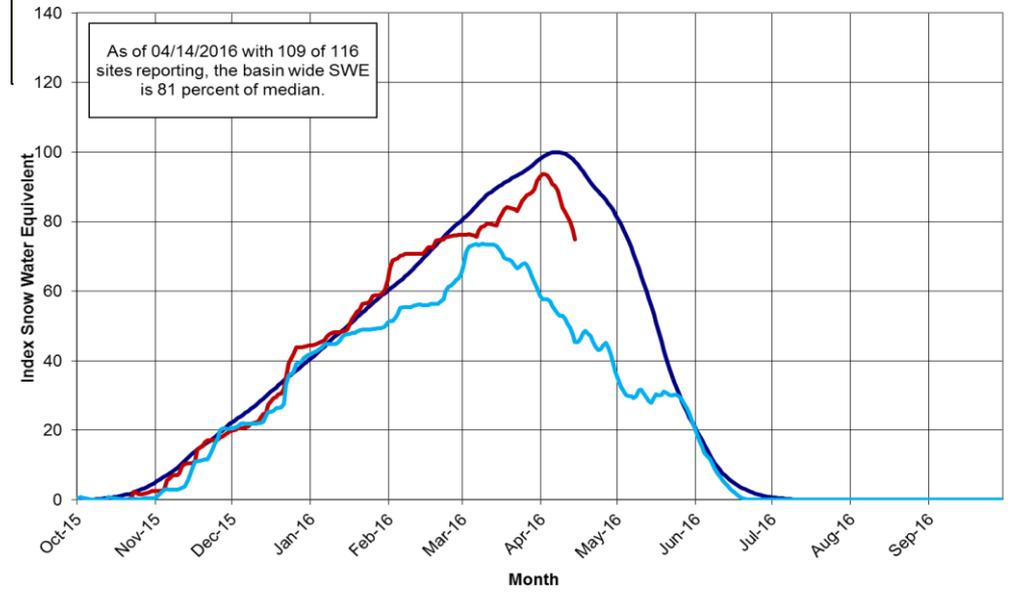
- Snow Water Equivalent**
- Less than 50 Percent of Normal
 - 50 - 80 Percent of Normal
 - 80 - 120 Percent of Normal
 - 120 - 150 Percent of Normal
 - Greater than 150 Percent of Normal

Upper Colorado
GIS
Region

Data Provided by the Natural Resource Conservation Service

Upper Colorado River Basin Snotel Tracking

Aggregate of 116 Snotel Sites above Lake Powell



— 30 Year Median Index — Current Year Index WY2016 — Comparison Year Index WY2015

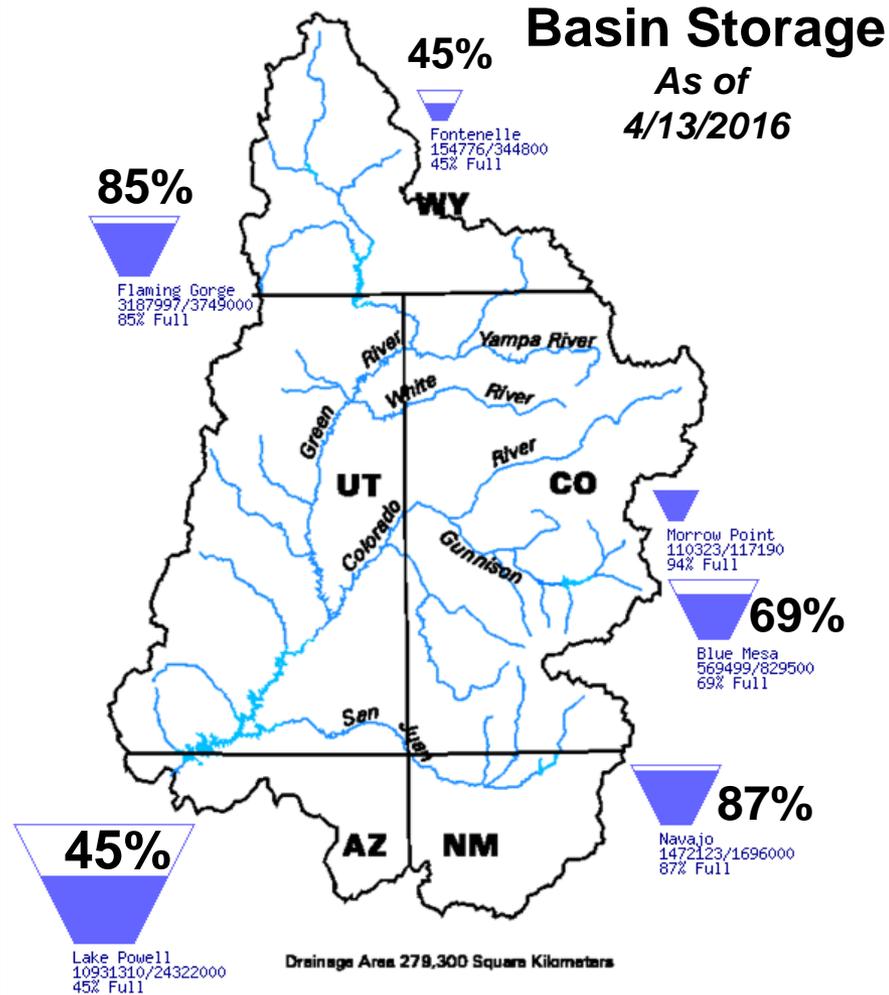
Data Provided by the Natural Resource Conservation Service

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Upper Basin Storage

Data Current as of:
04/17/2016

Upper Colorado River Drainage Basin



April to July 2016 Forecasted Inflow Issued April 4, 2016

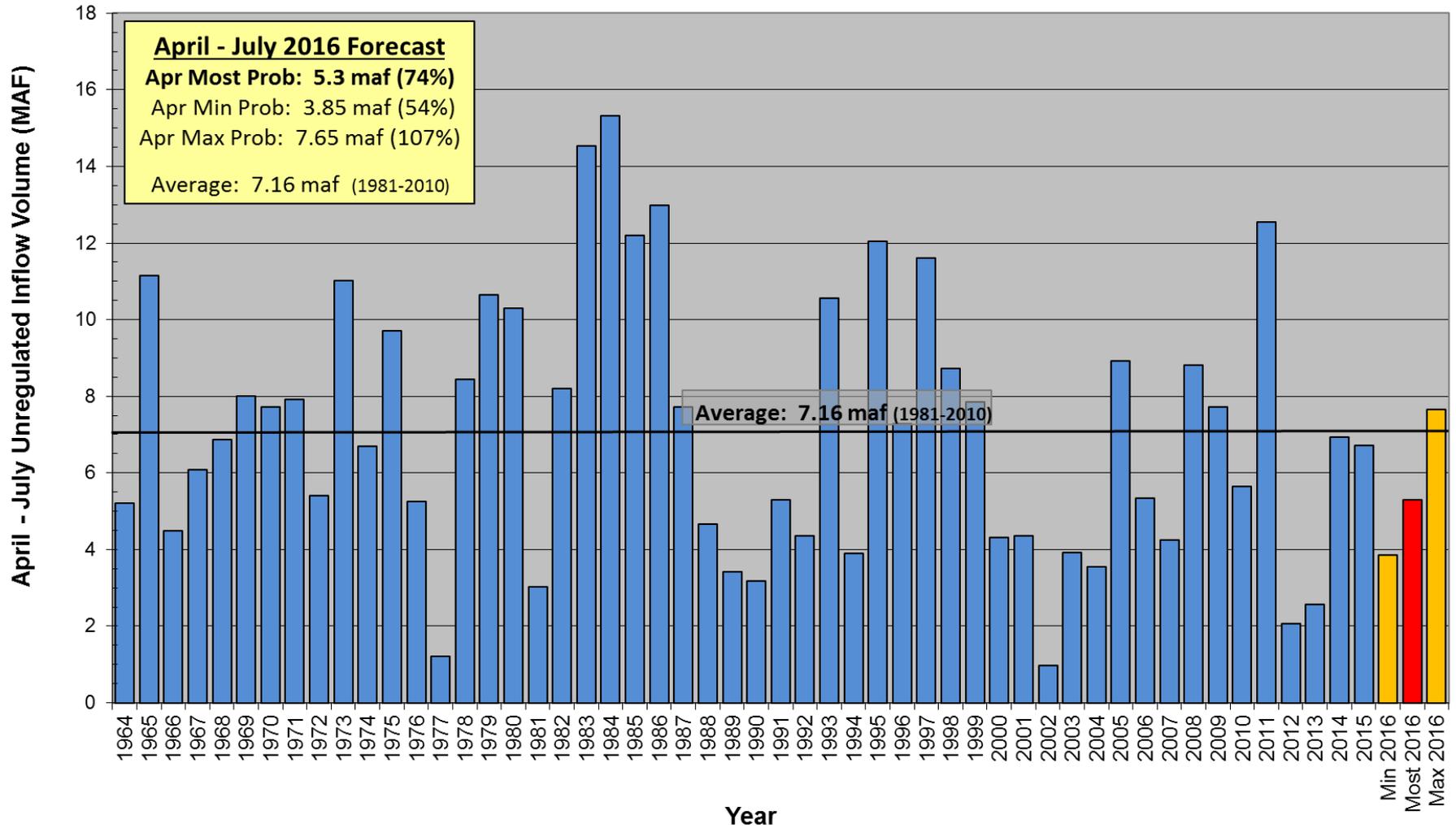
Reservoir	A-J Forecast (KAF)	Percent of Average ¹
Fontenelle	565	74%
Flaming Gorge	740	76%
Blue Mesa	515	76%
Navajo	530	72%
Powell	5,300	74%

¹ percent of average based on period 1981-2010.

Lake Powell Unregulated Inflow

April - July 2016 Forecast

Comparison with History



* Water Year 2016 forecast: 8.44 maf (78%)

Lake Powell 2016 Operating Tier

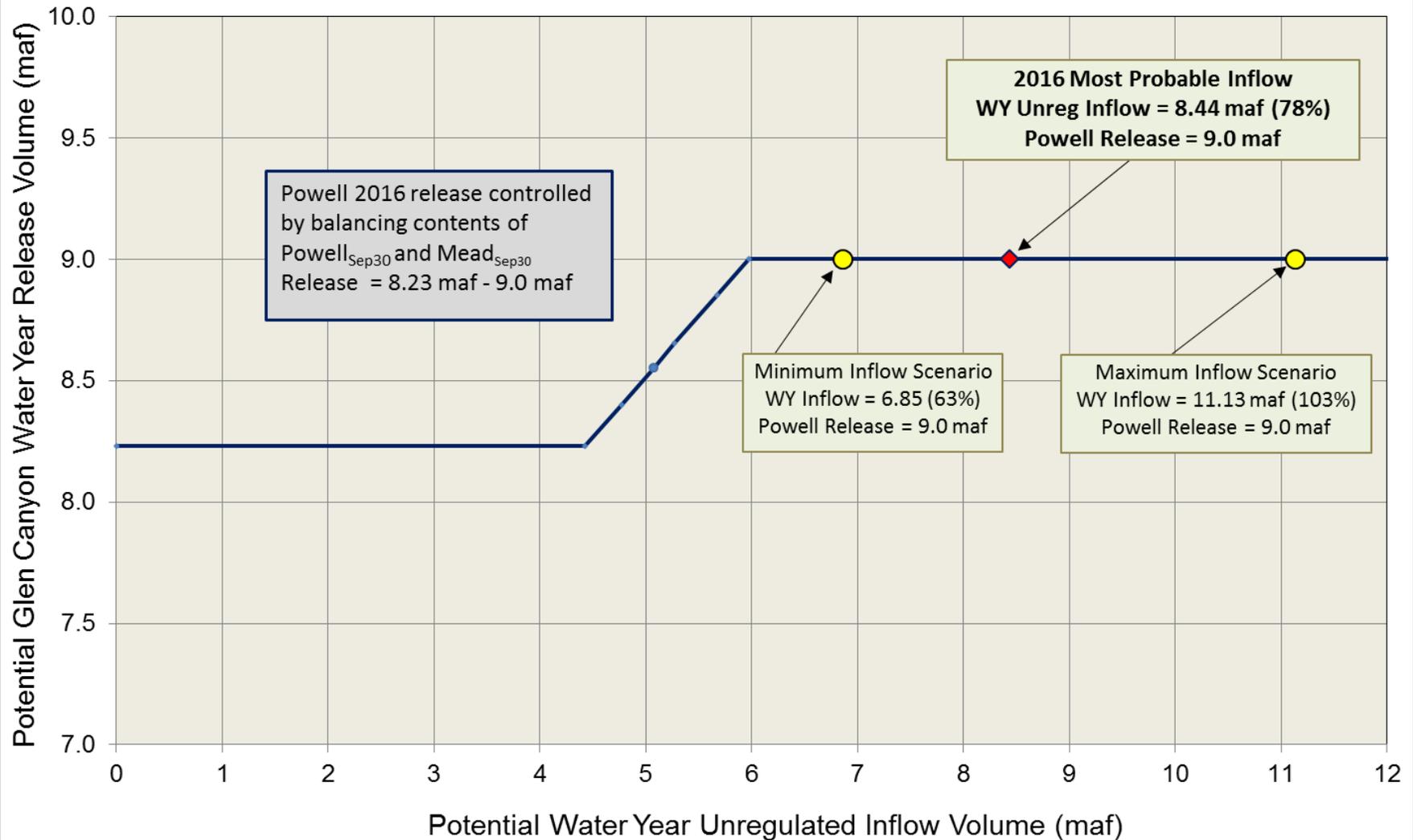
Upper Elevation Balancing

- Tier was set in August 2015
 - 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 Tier³ 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

Potential Lake Powell Release Scenarios

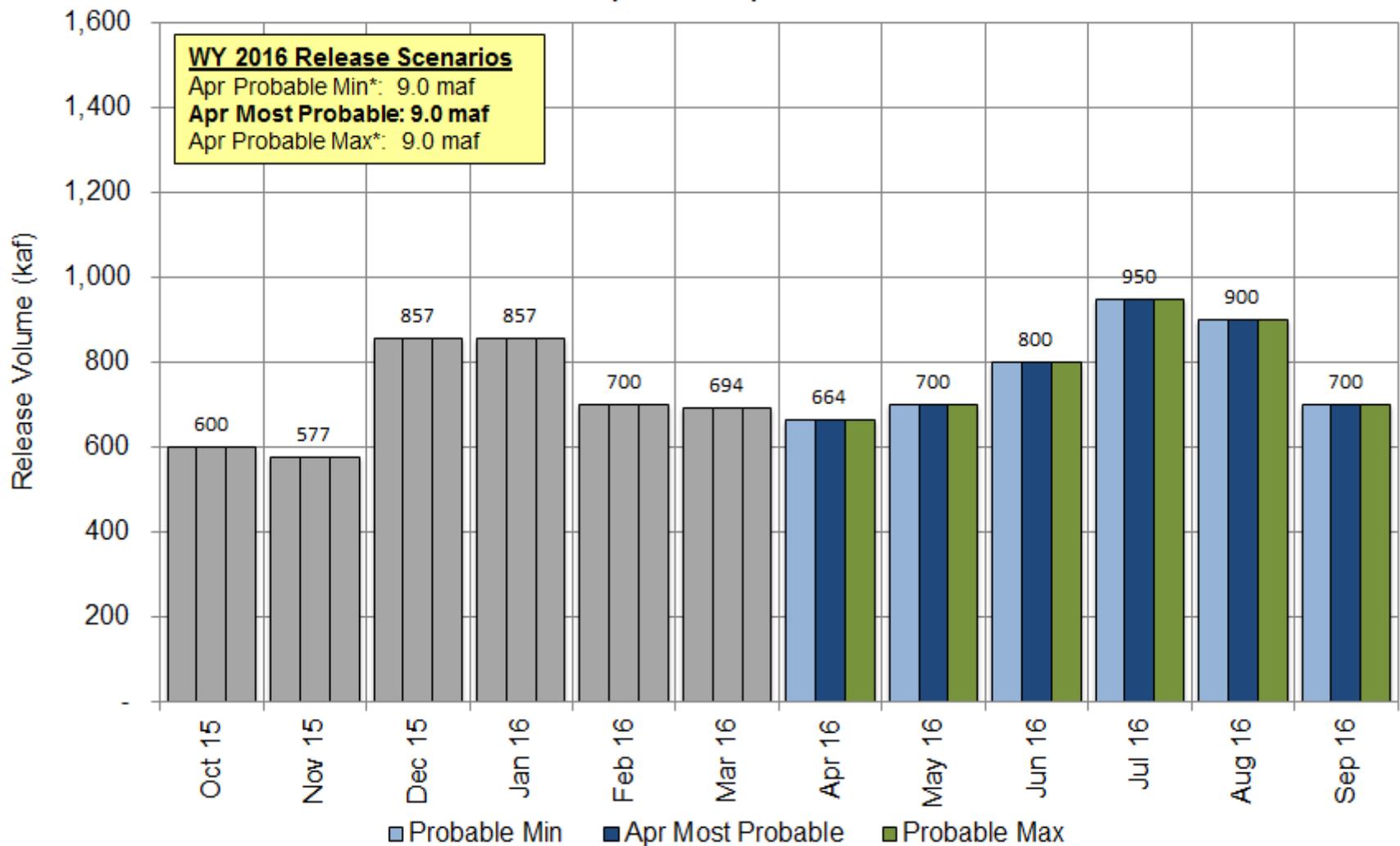
Water Year 2016 Release Volume as a Function of Unregulated Inflow Volume
based on April 2016 24-Month Study Conditions



Projected Lake Powell Monthly Release Volume Distribution

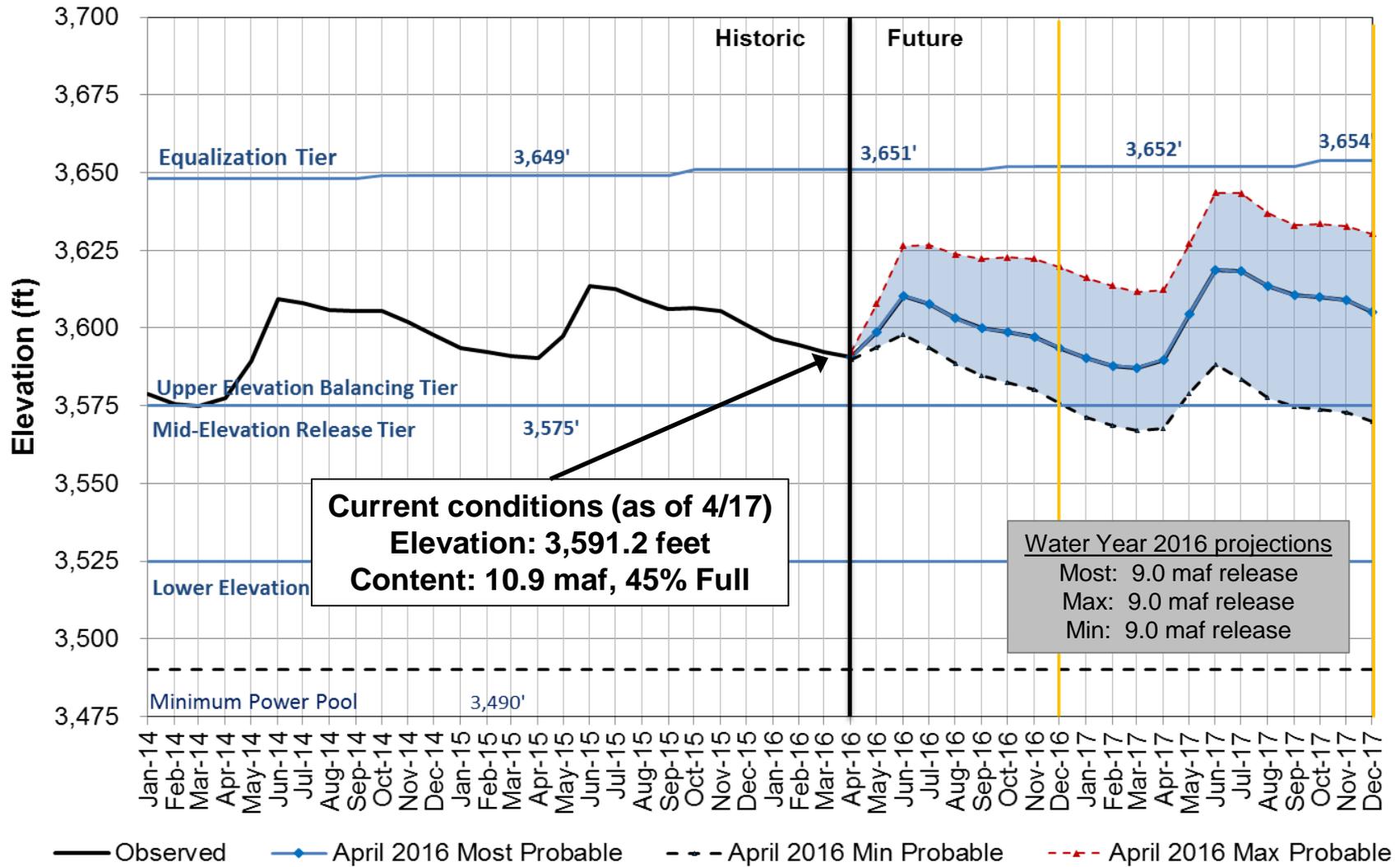
Release Scenarios for Water Year 2016

Updated April 2016



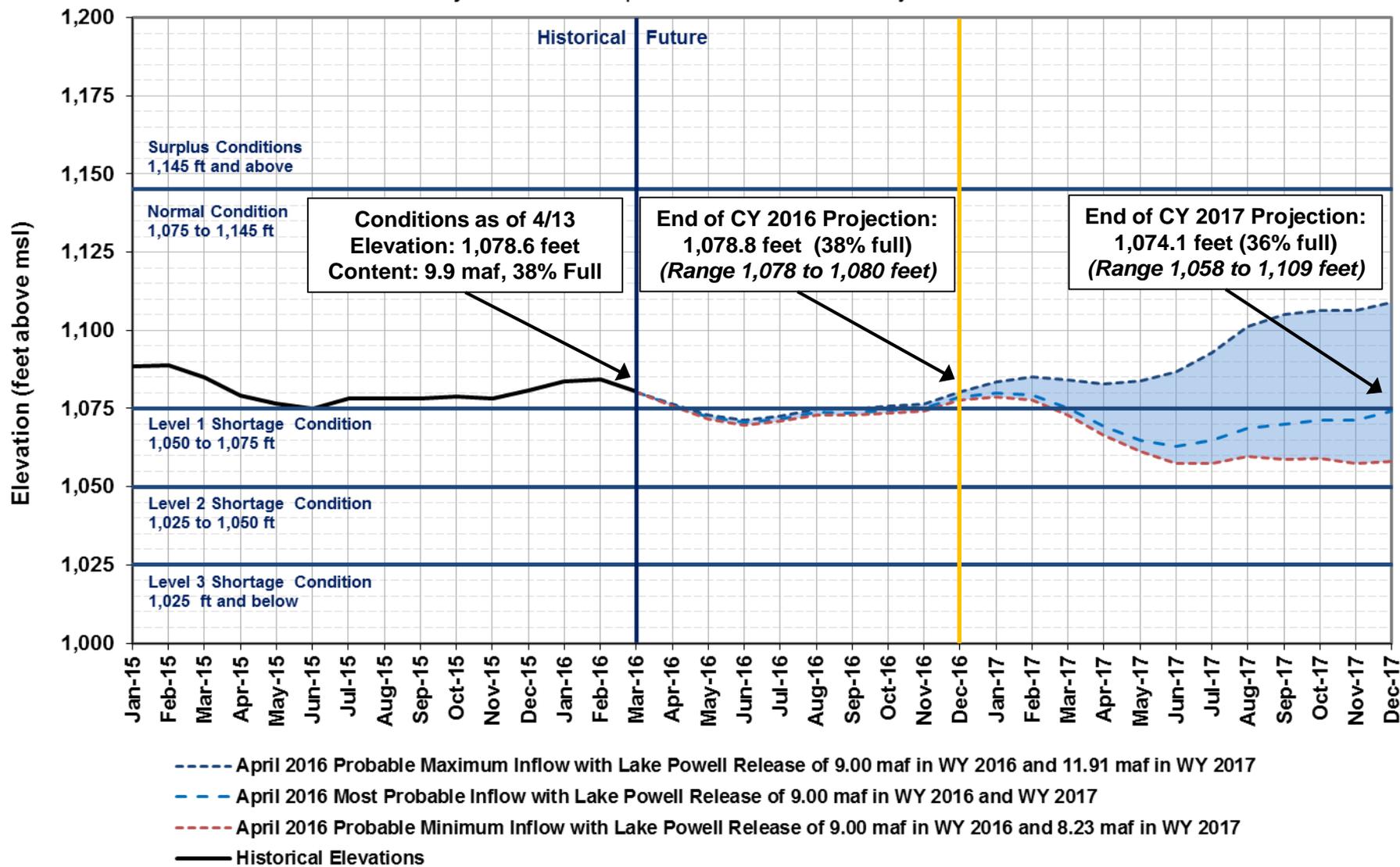
Lake Powell End of Month Elevations

Historic and Projected based on April 2016 Modeling



Lake Mead End of Month Elevations

Projections from April 2016 24-Month Study Inflow Scenarios



Glen Canyon Power Plant Provisional Unit Outage Schedule for Water Year 2016

Unit Number	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016	
1													
2													
3													
4													
5													
6													
7													
8													
Units Available	6	7	7	7	5	6	5	6	7 / 5	7	7	5	
Capacity (cfs)	18,400	22,100	22,100	22,100	15,500	15,300	15,300	18,800	22,100 / 15,300	22,100	22,100	14,900	
Capacity (kaf/month)	1,150	1,130	1,280	1,300	950	1,090	970	1,140	1,140	1,310	1,310	930	
Max (kaf) ¹	--	--	--	--	700	700	658	700	800	950	900	700	9.0
Most (kaf) ²	600	577	857	857	700	700	658	700	800	950	900	700	9.0
Min (kaf) ¹	--	--	--	--	700	700	658	700	800	950	900	700	9.0

¹ Projected release, based on January 2016 Min and Max Probable Inflow Projections and 24-Month Study model runs

² Projected release, based on February 2016 Most Probable Inflow Projections and 24-Month Study model runs

(updated 2-16-2016)



Glen Canyon Power Plant Provisional Unit Outage Schedule for Water Year 2017

Unit Number	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017	Jul 2017	Aug 2017	Sep 2017	
1													
2													
3													
4													
5													
6													
7													
8													
Units Available	6	7	7	7	5	5	7	7	7	7	8	7	
Capacity (cfs)	18,500	22,100	22,000	15,200	15,000	15,000	22,000	22,000	22,000	22,000	25,600	18,500	
Capacity (kaf/month)	1,170	1,310	1,380	1,330	870	1,020	1,310	1,350	1,310	1,370	1,570	1,290	
Max (kaf) ¹	600	600	850	950	800	900	1,000	1,100	1,200	1,400	1,500	1,049	11.9
Most (kaf) ²	600	600	800	800	650	650	600	650	800	1,000	1,050	800	9.0
Min (kaf) ¹	600	600	800	800	600	600	600	600	650	850	900	630	8.23

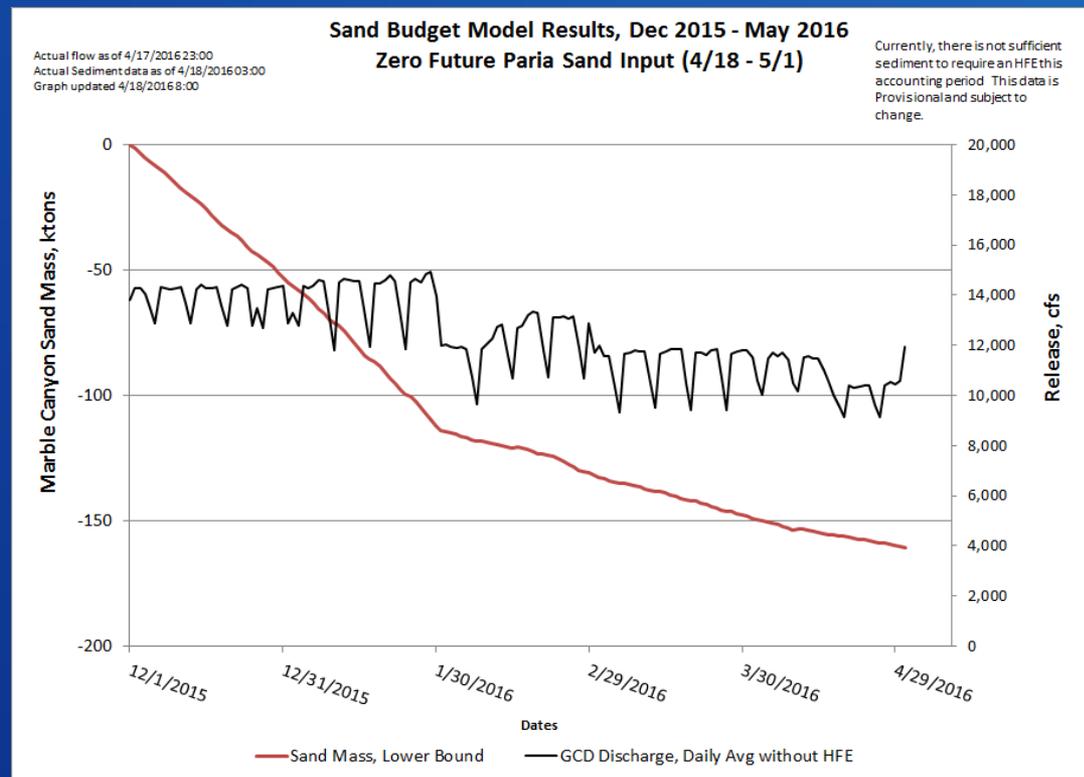
¹ Projected release, based on January 2016 Min and Max Probable Inflow Projections and 24-Month Study model runs

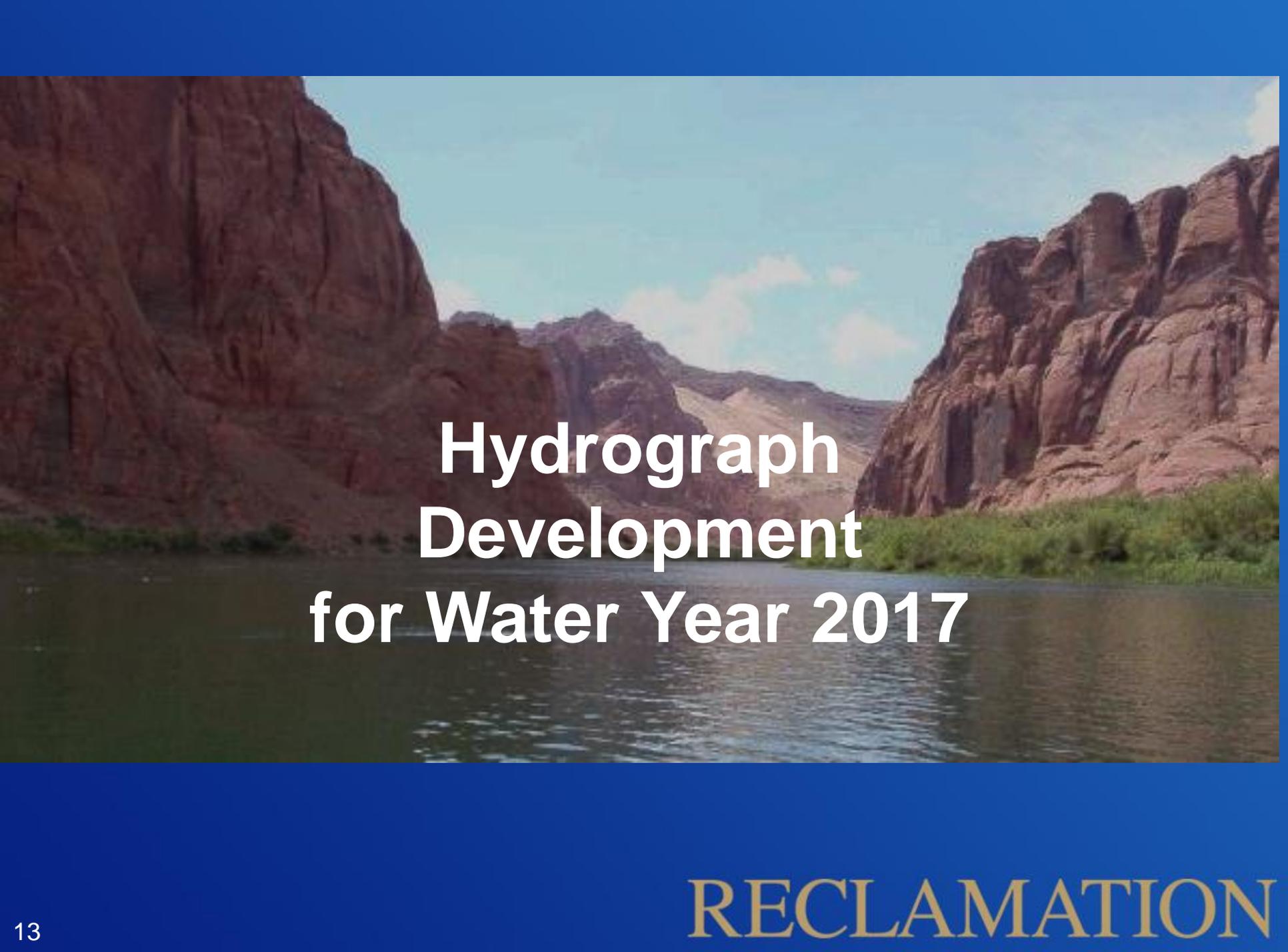
(updated 2-22-2016)

² Projected release, based on February 2016 Most Probable Inflow Projections and 24-Month Study model runs

Sand Budget Model Results

- As of 4/18/2016, not enough sediment input to trigger a spring 2016 HFE





Hydrograph Development for Water Year 2017

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2016 Hydrograph

Annual Release Volume	June	August	September
less than 9.0 maf	600 kaf - 650 kaf	800 kaf	600 kaf
9.0 maf – less than 9.5 maf	800 kaf	900 kaf	700 kaf
9.5 maf – less than 10 maf	900 kaf	900 kaf	700 kaf
10 maf and greater	900 kaf or more	900 kaf or more	800 kaf or more

2017 Hydrograph Initial Thoughts

- Start with 2016 Hydrograph
 - Target lower August and September releases
 - Move water to other equal value months for hydropower (Dec/Jan)
 - Avoid shifting “extra” water to June (which cools temperatures at the mouth of the LCR)
- Consider proposed modifications

2017 Projected Release Scenarios

Based on January 2016 24-Month Study Inflow Scenarios

Powell Inflow Scenario	WY 2017 Release Projection
Probable Minimum	Upper Elevation Balancing Tier w/ no Projected April shift 8.23 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 11.9 maf release

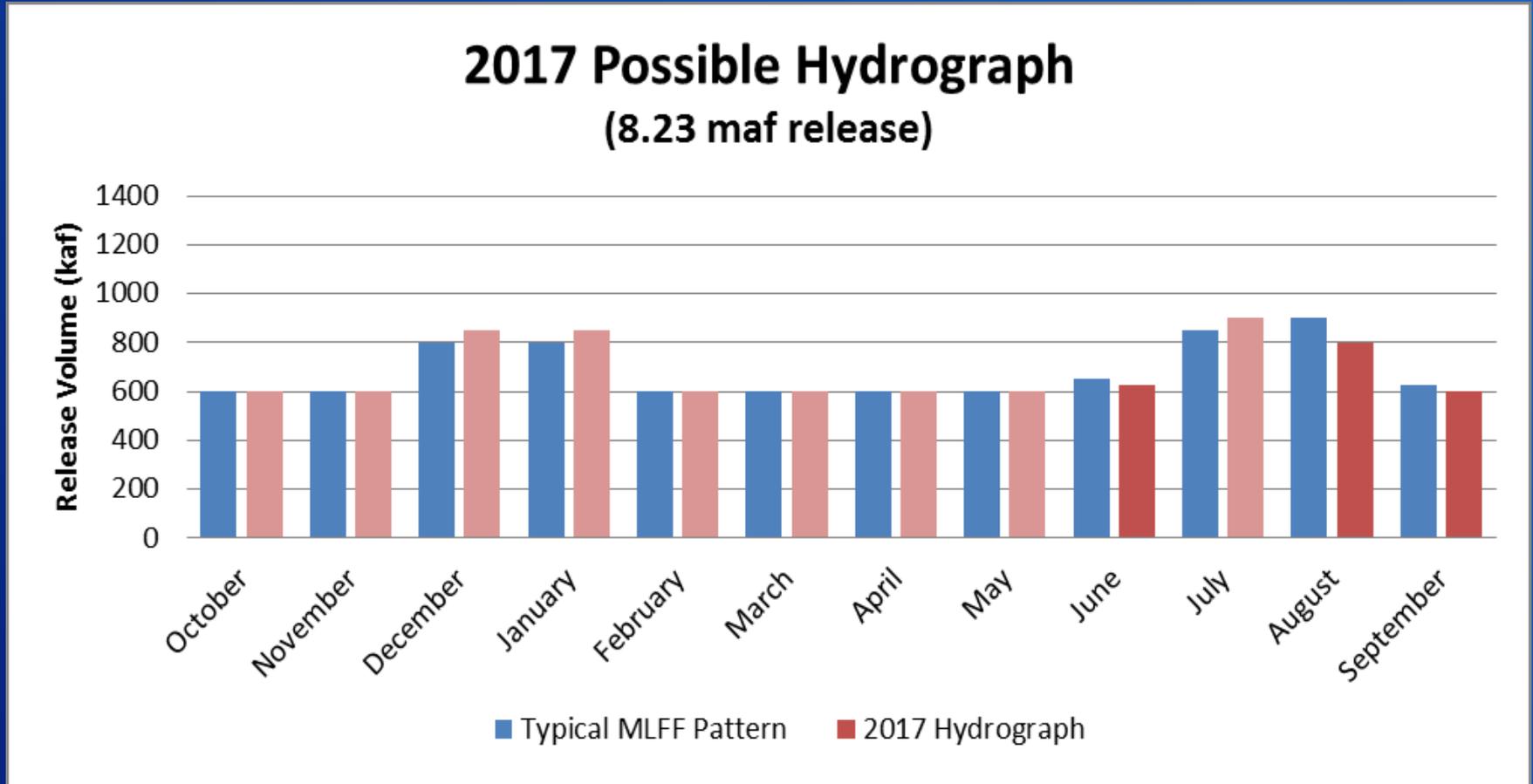
2017 Hydrograph

Initial Thoughts / Discussions

Annual Release Volume	June	August	September
less than 9.0 maf	600 kaf - 650 kaf	800 kaf	600 kaf
9.0 maf – less than 9.5 maf	800 kaf	900 kaf	700 kaf
9.5 maf – less than 10 maf	900 kaf	900 kaf	700 kaf
10 maf and greater	900 kaf or more	900 kaf or more	800 kaf or more

2017 Possible Hydrograph

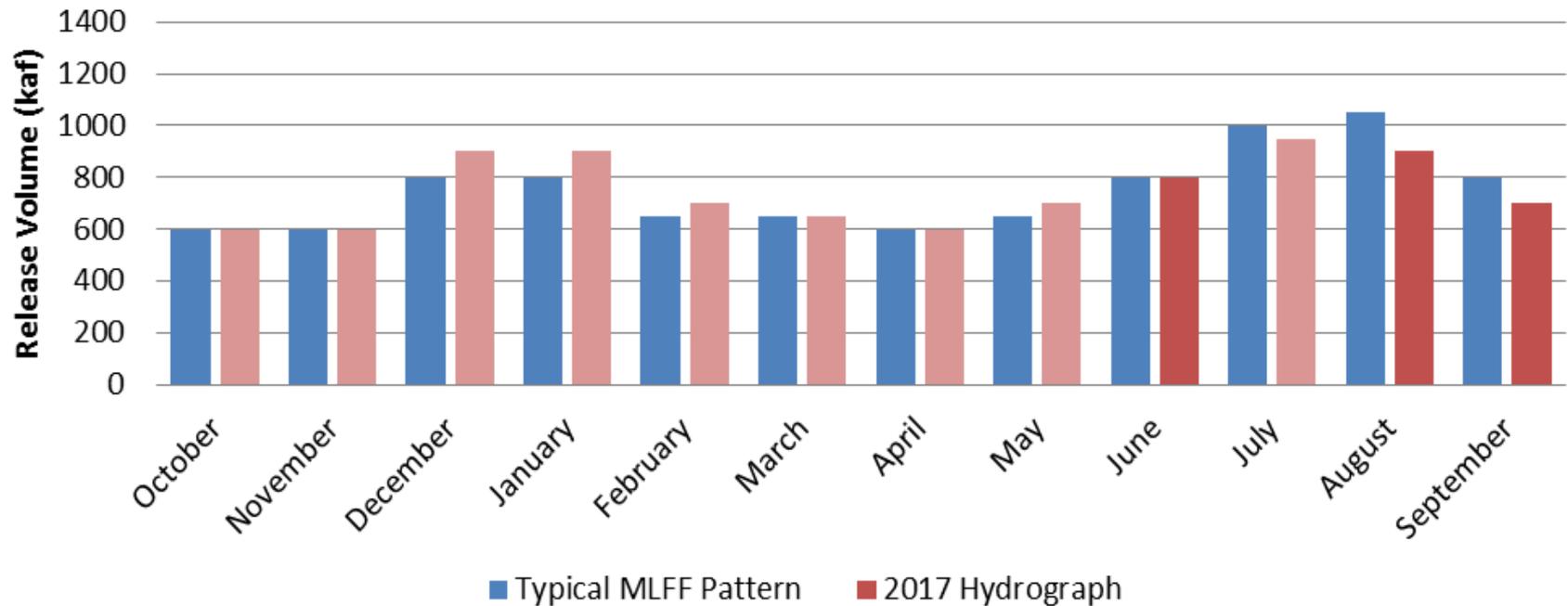
8.23 maf release scenario



2017 Proposed Hydrograph

9.0 maf release scenario

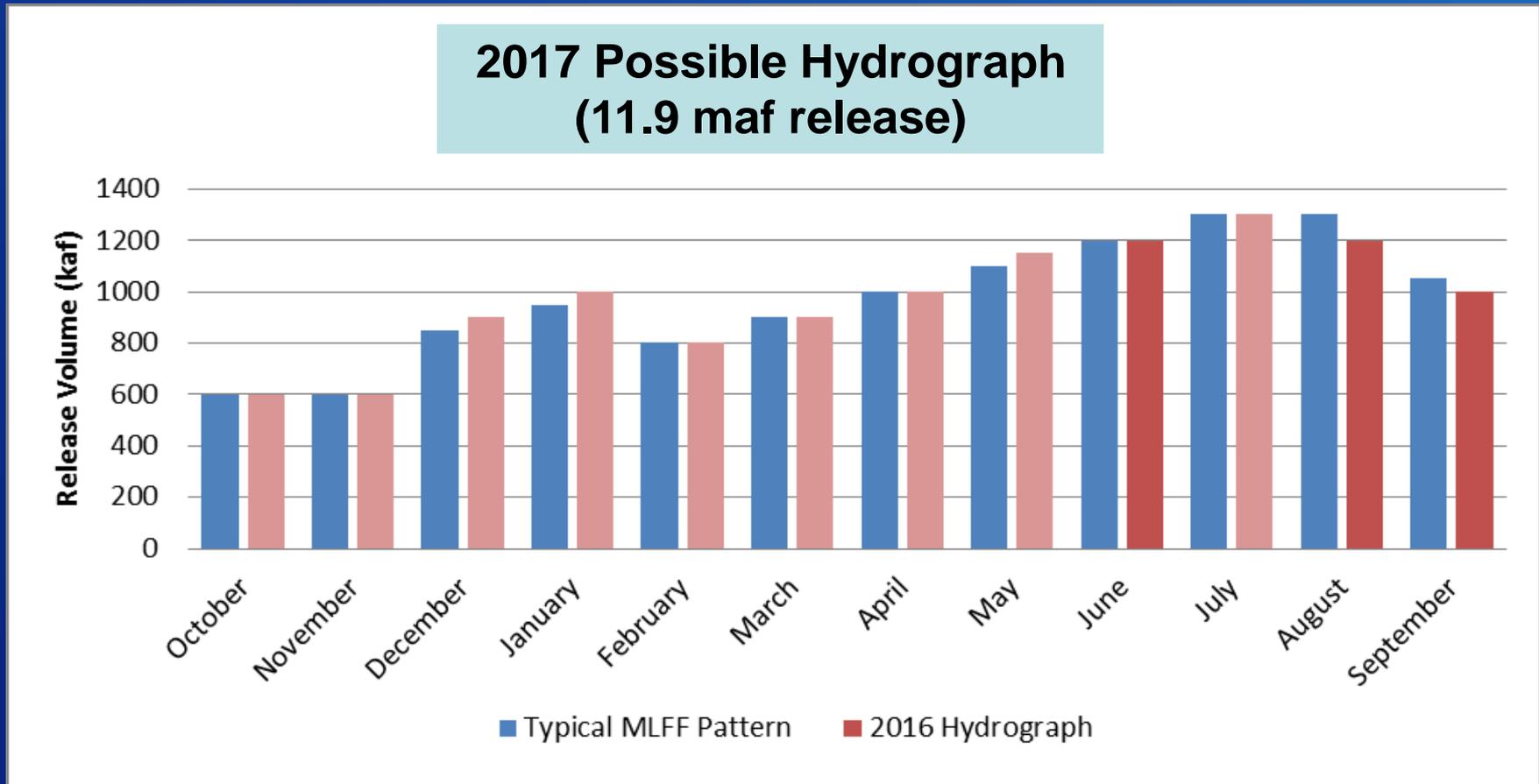
2017 Possible Hydrograph
(9.0 maf release)



2017 Proposed Hydrograph

11.9 maf release scenario

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



2017 Hydrograph Next Steps

- Consider Feedback from TWG
- Continue to coordinate with DOI-DOE agencies
- Present to AMWG in May for review
- Draft motion to TWG in June
 - TWG discuss and make recommendation to AMWG in June
- TWG present recommendation to AMWG in August for approval

Questions?

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