Glen Canyon Dam Technical Work Group
Agenda Item Information
May 28, 2015 Webinar

Agenda Item

Basin Hydrology and WY 2016 Hydrograph

Action Requested

✓ Information item only; we will answer questions but no action is requested.

Presenters

Heather Patno, Hydraulic Engineer, Water Resources Group, Resources Management Division, Upper Colorado Region, Bureau of Reclamation

Glen Knowles, Chief, Adaptive Management Group, Environmental Resources Division, Upper Colorado Region, Bureau of Reclamation

Previous Action Taken

N/A

Relevant Science

N/A

Background Information

Basin Hydrology

The presentation is intended to provide pertinent information to AMWG members on the current water supply and forecasted hydrologic conditions within the Upper Colorado River Basin. The presentation will focus on projected reservoir conditions and operations at Lake Powell/Glen Canyon Dam for the remainder of water year 2015 and provide a general outlook for 2016. The presentation will cover the range of potential releases in the current and upcoming water years. Such information is provided to assist the AMWG in developing recommendations to the Secretary on the operation of Glen Canyon Dam for water year 2016.

WY 2016 Hydrograph

The second portion of the presentation will cover a brief review of the 2015 Hydrograph and an overview of the upcoming 2016 Hydrograph. In cooperation with the other federal agencies, Reclamation has developed a recommendation for the 2016 Hydrograph. The 2016 hydrograph for Glen Canyon Dam is designed to help retain sediment inputs in the system in anticipation of a possible high flow experiment, and also addresses a request from Western Area Power Administration to adjust July and August monthly volumes to better meet hydropower demand. DOI and DOE worked together to produce the following recommendation for the TWG's consideration. Note that this motion is for the June TWG webinar on June 11; the AMWG will consider the TWG's recommendation at its August 27-28, 2015 meeting.

TWG Motion Requested: TWG recommends the AMWG recommend to the Secretary of the Interior her approval of the DOI-DOE Proposed Hydrograph for Water Year 2016 as follows:

- Annual Release Volumes will be determined by the 2007 Interim Guidelines and shall be reviewed and adopted through the normal annual operating plan process (in consultation with the Basin States as appropriate).

- Monthly Release Volumes are anticipated to shift depending upon: (1) the projected Annual Release Volume, (2) powerplant capacity, and (3) the magnitude of a potential High Flow Experiment.

- Monthly Release Volumes may vary within the targets identified below. Any remaining monthly operational flexibility will be used for existing power production operations under the Modified Low Fluctuating Flow (MLFF) alternative selected by the 1996 ROD and contained in the 1995 FEIS and in compliance with all applicable NEPA compliance documents (HFE EA, NNFC EA, 2007 IG).

- Release objective for June is:
  600 to 650 kaf for annual releases below 9.0 maf
  800 kaf for annual releases of 9.0 maf to less than 9.5 maf
  900 kaf for annual releases of 9.5 maf to less than 10 maf
  Greater than 900 kaf for annual releases 10 maf and greater

- Release objective for August is:
  800 for annual releases below 9.0 maf
  900 kaf for annual releases of 9.0 maf to less than 10 maf
  Greater than 900kaf for annual releases 10 maf and greater

- Release objective for September is:
  600 kaf for annual releases below 9.0 maf
  700 kaf for annual releases of 9.0 maf to less than 10.0 maf
  800 kaf or greater for annual releases of 10.0 maf or greater; up to powerplant capacity for high equalization releases

- Monthly Release Volumes will generally strive to maintain 600 kaf levels in the shoulder months (spring and fall) and 800 kaf in the December/January and July/August timeframe.

Additionally, the Bureau of Reclamation will continue to apply best professional judgment in conducting actual operations and in response to changing conditions throughout the water year. Such efforts will continue to be undertaken in coordination with the DOI/DOE agencies, and in consultation with the Basin States as appropriate, to consider changing conditions and adjust projected operations in a manner consistent with the objectives of these parameters as stated above and pursuant to the Law of the River.

RECLAMATION

Managing Water in the West

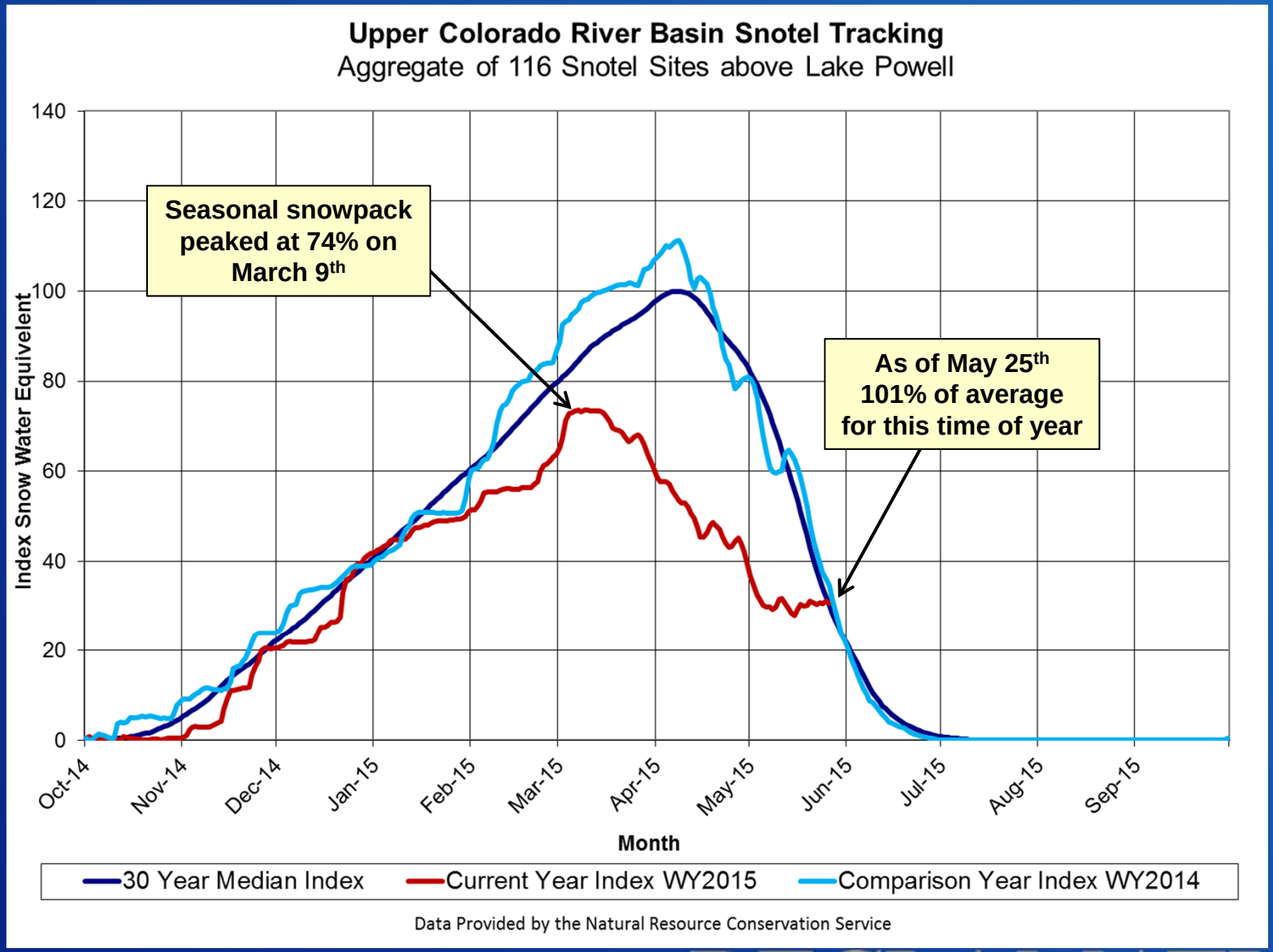
Basin Hydrology, Operations and 2016 Hydrograph

Adaptive Management Work Group

May 28, 2015

U.S. Department of the Interior
Bureau of Reclamation

Snow Conditions



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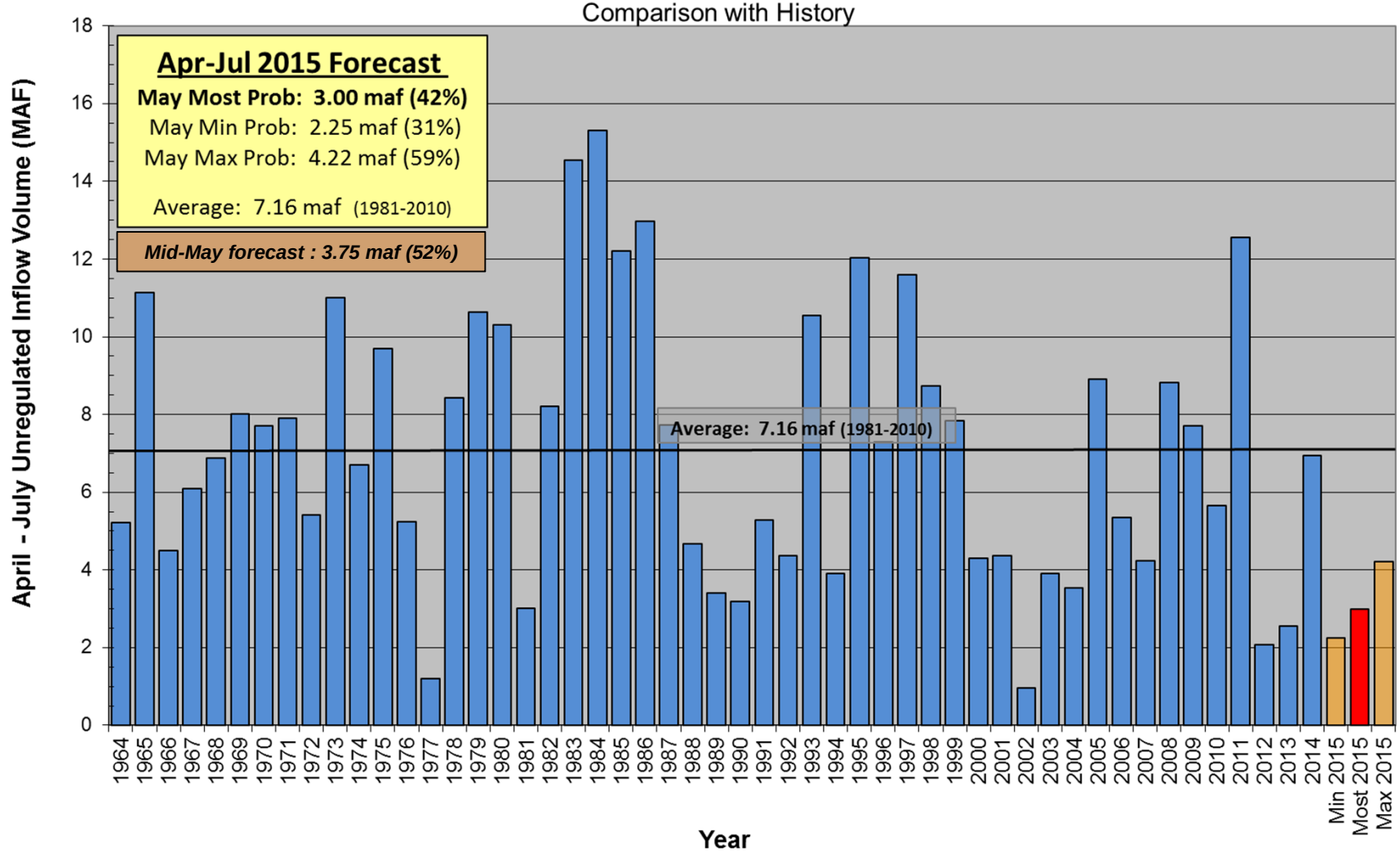
Lake Powell Unregulated Inflow
April - July 2015 Forecast
Issued May 4
Comparison with History



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Lake Powell 2015 Operating Tier
Upper Elevation Balancing

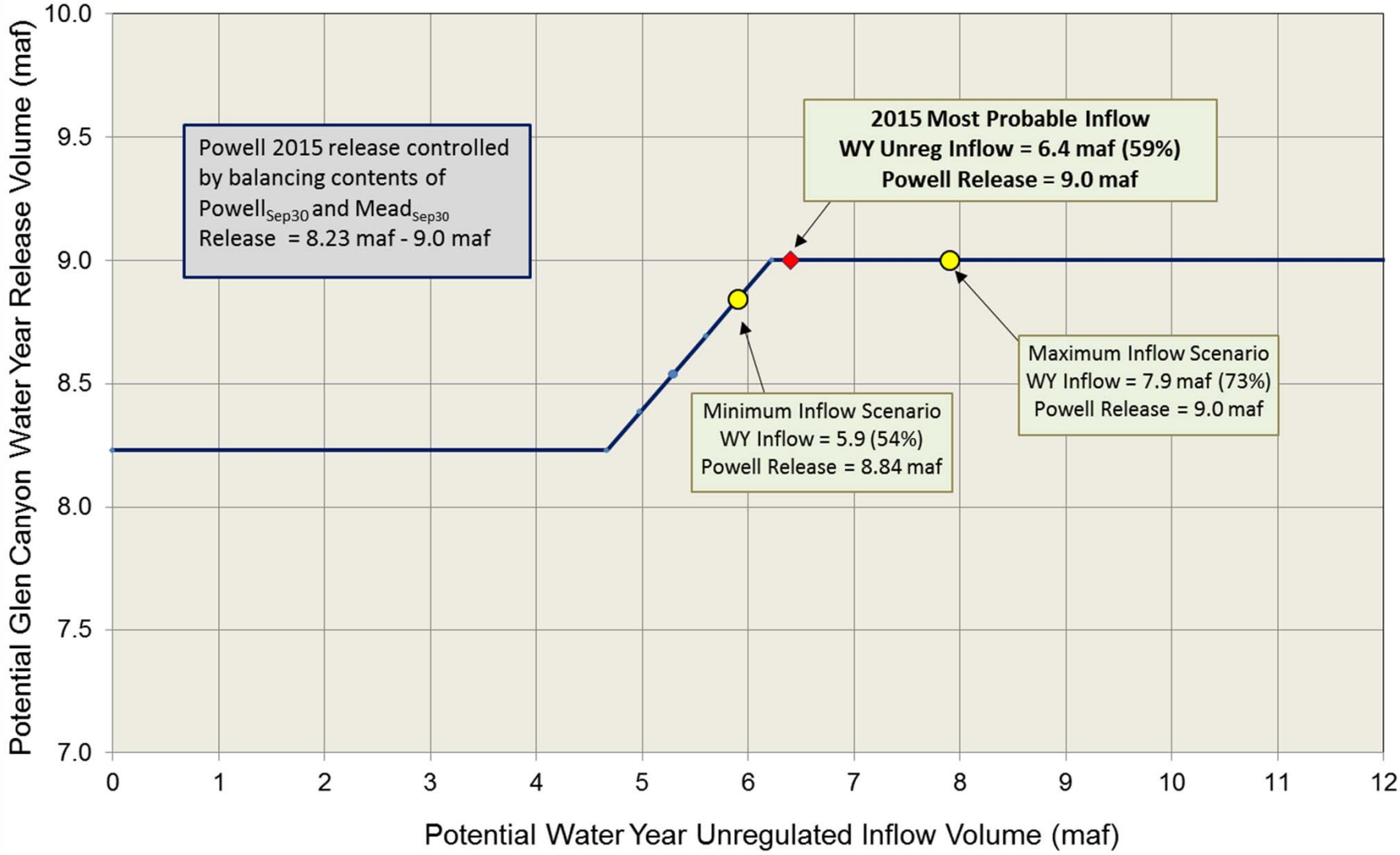
- Tier was set in August 2014
- April Adjustment to Balancing
- Goal: balance contents of Lake Powell and Lake Mead by end of water year
  - release 8.23 maf - 9.0 maf
  - Currently projecting 9.0 maf release

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)
3,575	**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

Potential Lake Powell Release Scenarios

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



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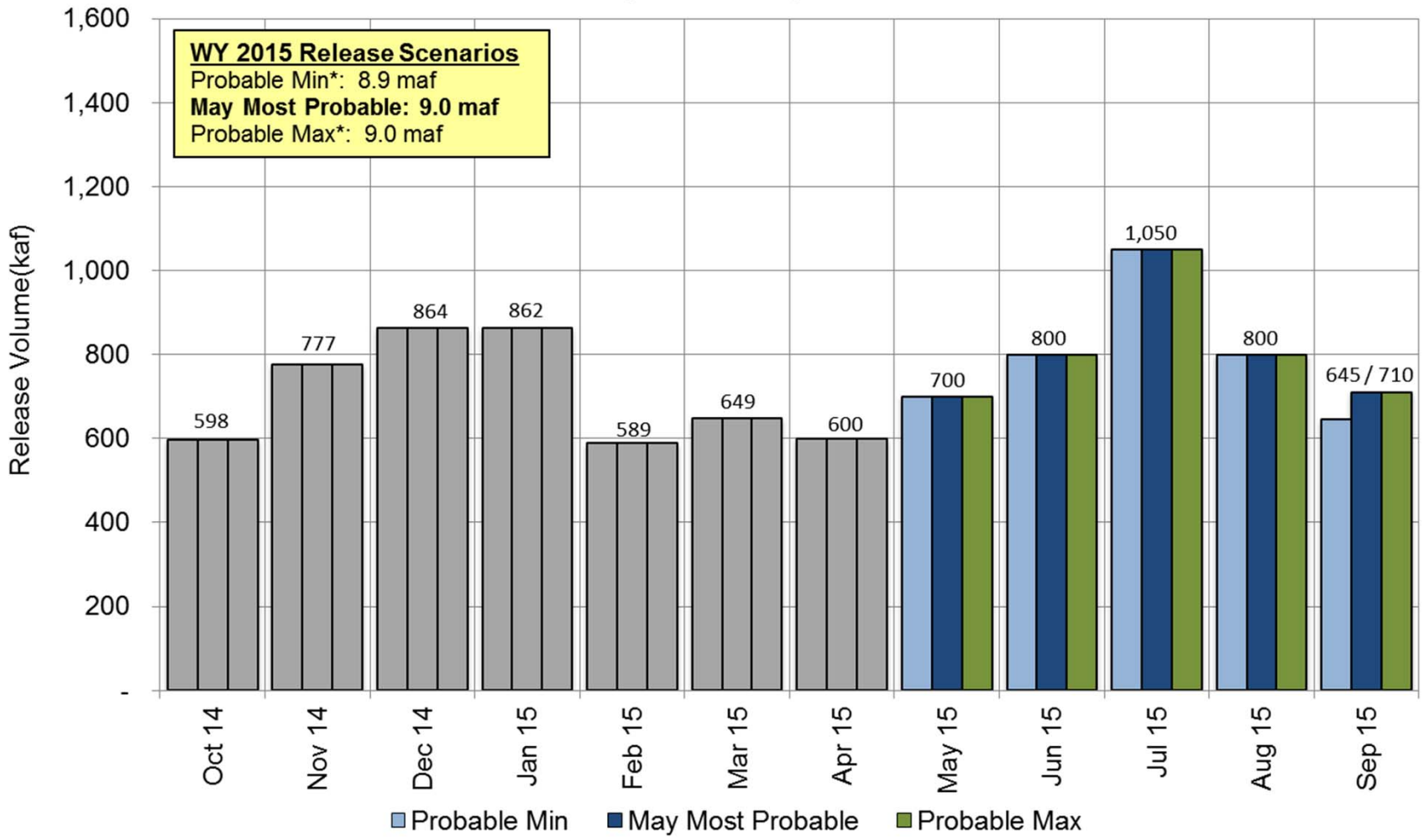
Projected Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2015

Updated May 2015



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

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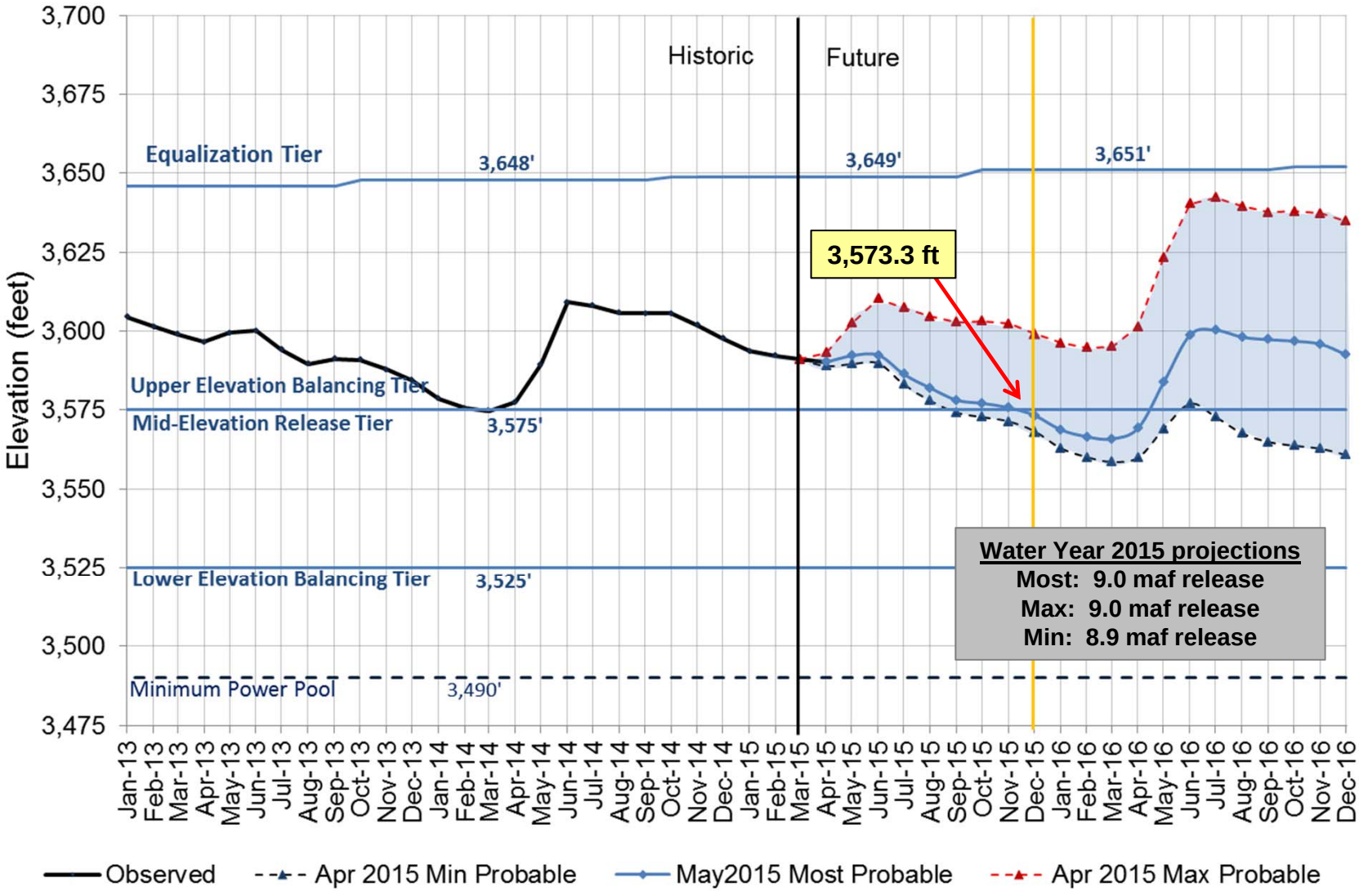
Lake Powell End of Month Elevations

Historic and projected based on May and April 2015 modeling

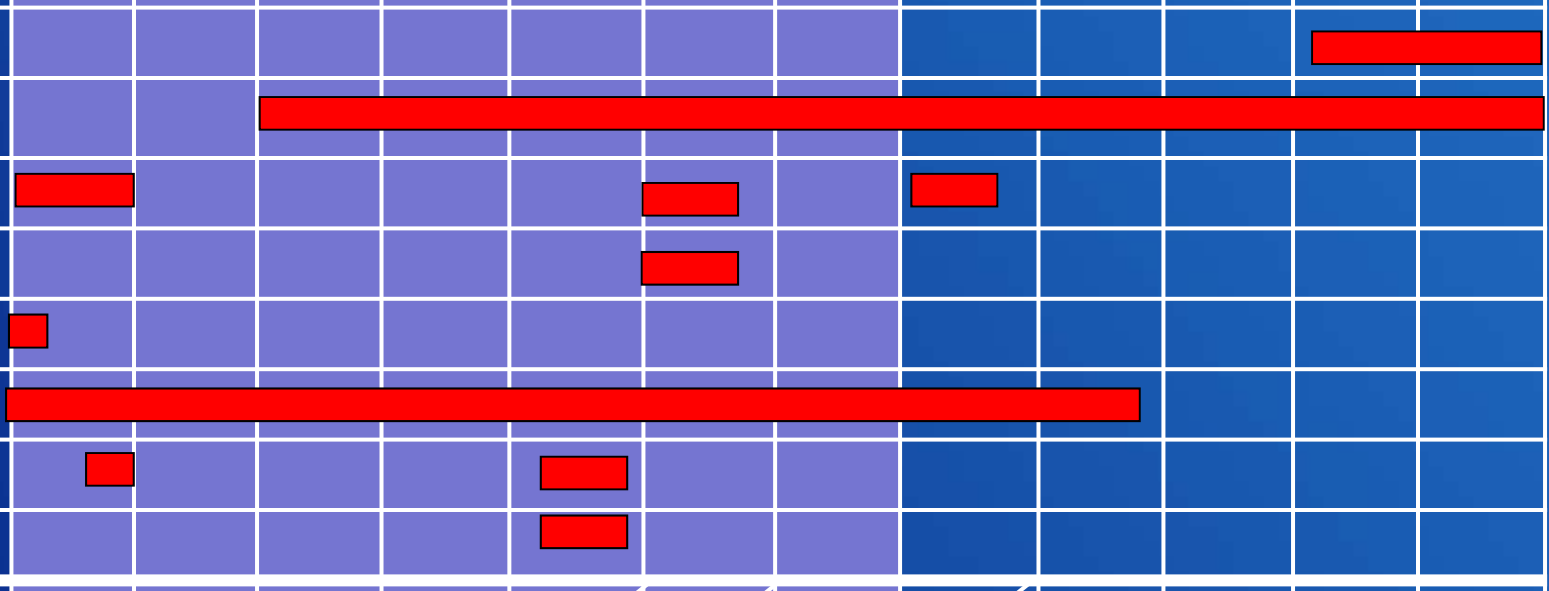


Water Year 2015 projections

Most: 9.0 maf release
Max: 9.0 maf release
Min: 8.9 maf release

RECLAMATION

Glen Canyon Power Plant Provisional Unit Outage Schedule for Water Year 2015



Unit Number	Oct 2014	Nov 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015	Apr 2015	May 2015	Jun 2015	Jul 2015	Aug 2015	Sep 2015	
Units Available	5	7	6	6	4 / 6	4 / 6	6	6 / 5	6	7	6	6	
Capacity (cfs)	14,400	**21,500**	**18,000**	**18,000**	11,400 / 18,000	11,300 / 18,000	**18,000**	18,000 / 14,500	**18,000**	**21,400**	**17,700**	**17,700**	
Capacity (kaf/month)	910	1,280	1,110	1,110	690	750	1,070	980	1,070	1,320	1,110	1,060	
Max (kaf) [1]	--	--	--	--	--	--	--	700	800	1,050	800	710	**9.0**
Most (kaf) [2]	598	776	864	862	589	649	600	700	800	1,050	800	710	**9.0**
Min (kaf) [1]	--	--	--	--	--	--	--	700	800	1,050	800	645	**8.9**

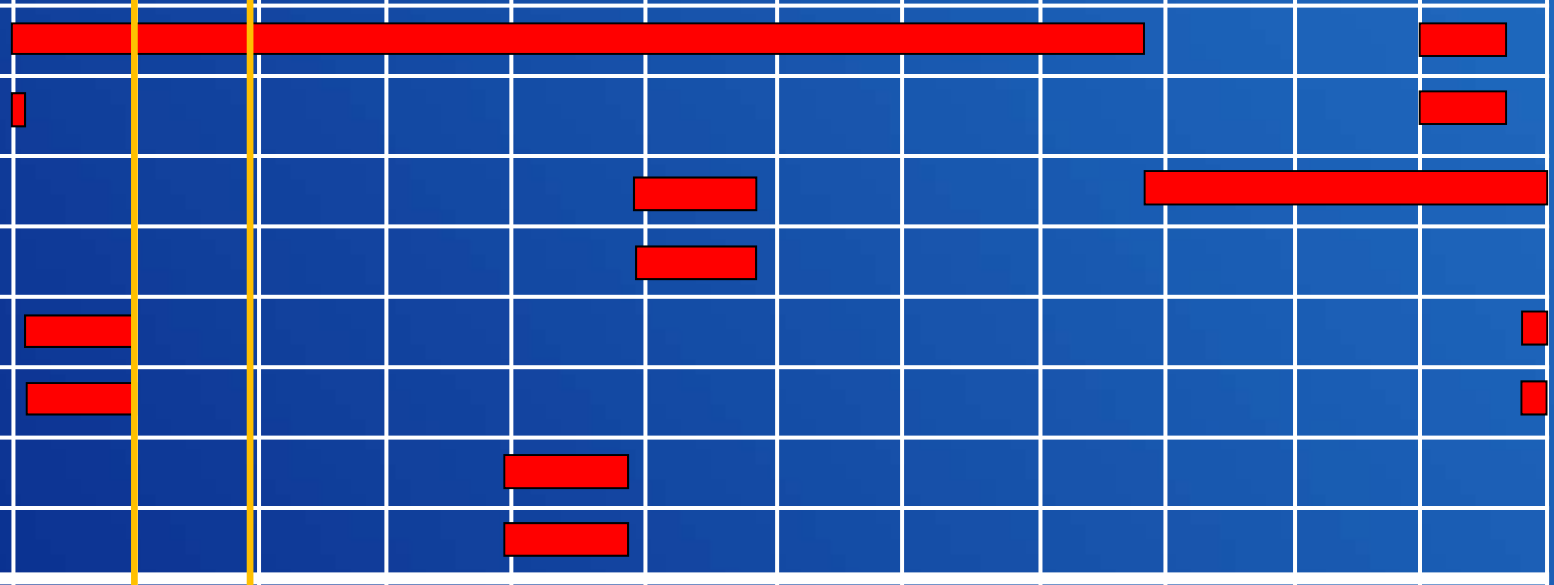
1 Projected release, based on April 2015 Min and Max Probable Inflow Projections and 24-Month Study model runs

2 Projected release, based on May 2015 Most Probable Inflow Projections and 24-Month Study model runs

(updated 5-19-2015)

RECLAMATION

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



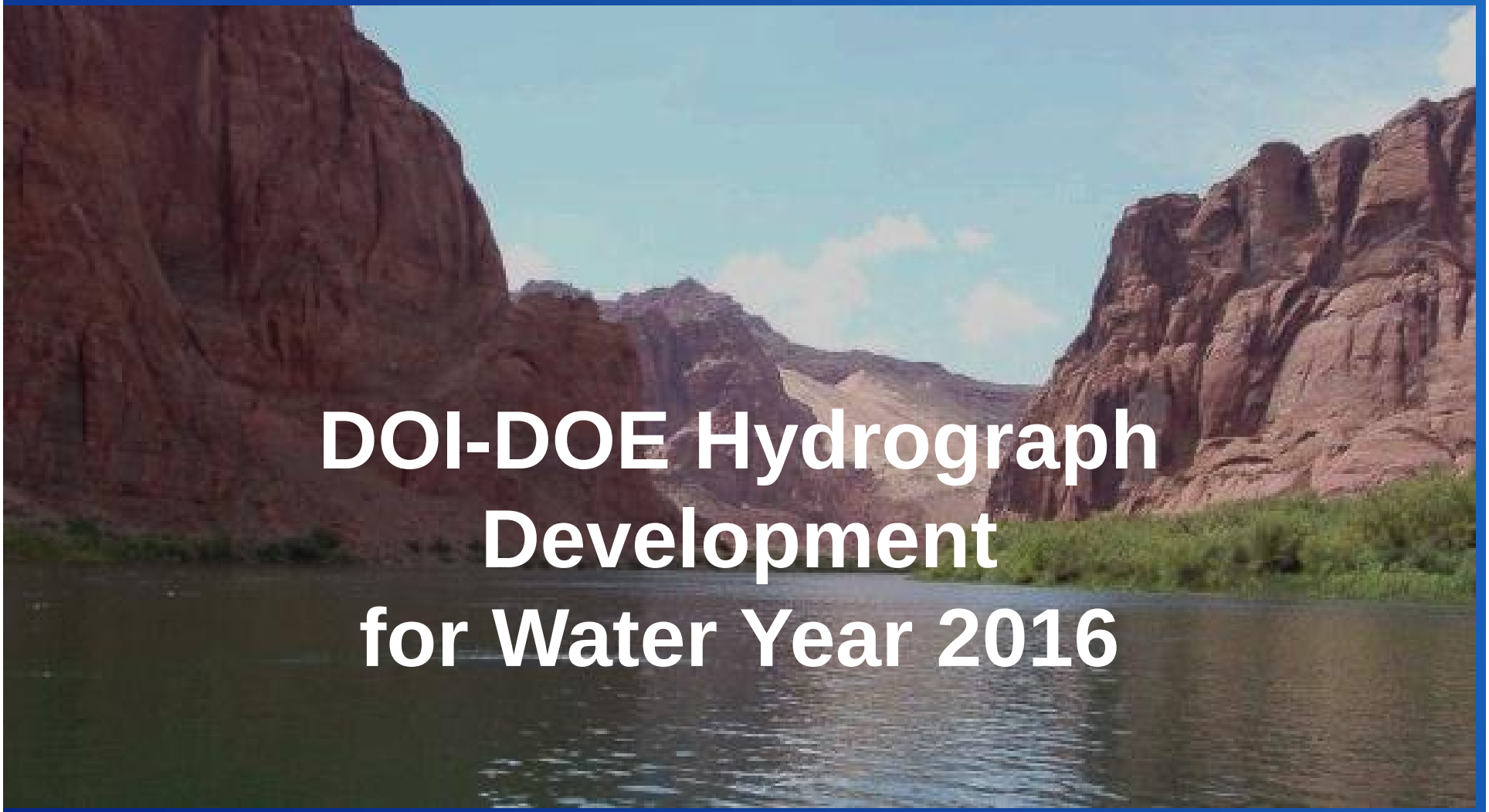
Unit Number	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016	
Units Available	5	7	7	7	5	5	7	7	7	7	7	5	
Capacity (cfs)	14,500	**21,200**	**21,200**	**21,200**	**14,900**	**14,500**	**21,500**	**21,500**	**21,500**	**21,400**	**21,400**	**14,300**	
Capacity (kaf/month)	900	1,260	1,260	1,250	880	940	1,280	1,280	1,290	1,270	1,270	940	
Max (kaf) [1]	600	600	800	800	650	650	600	650	800	1,000	1,050	800	**9.0**
Most (kaf) [2]	480	500	600	800	600	600	500	600	600	800	800	600	**7.48**
Min (kaf) [1]	480	500	600	800	600	600	500	600	600	800	800	600	**7.48**

(updated 5-19-2015)

1 **Projected release, based on April2015 Min and Max Probable Inflow Projections and 24-Month Study model runs**

2 **Projected release, based on May 2015 Most Probable Inflow Projections and 24-Month Study model runs**

RECLAMATION



DOI-DOE Hydrograph Development for Water Year 2016

RECLAMATION

2016 Hydrograph Concepts

- Retain sand inputs high in the system in anticipation of a potential HFE
- Target lower August through September releases
- Avoid shifting “extra” water to June (which cools temperatures at the mouth of the LCR)
- Move water from August to other equal value months for hydropower (Dec/Jan)
- Work within current year’s operating tier and annual release volume.
- Learn from past years’ experience

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2016 Projected Annual Release

(Based on April and May 2015 modeling)

- **Min probable**: 7.48 maf release

  (Mid-Elevation Release Tier – release is set for entire year)

- **Most probable**: 7.48 maf release

  (50/50 chance of 7.48 maf / 9.0 maf given current hydrology)

  (Mid-Elevation Release Tier – release is set for entire year)

- **Max probable**: 9.0 maf release

  (Upper Elevation Balancing Tier
  with projected April adjustment to Balancing 8.23-9.0 maf release)

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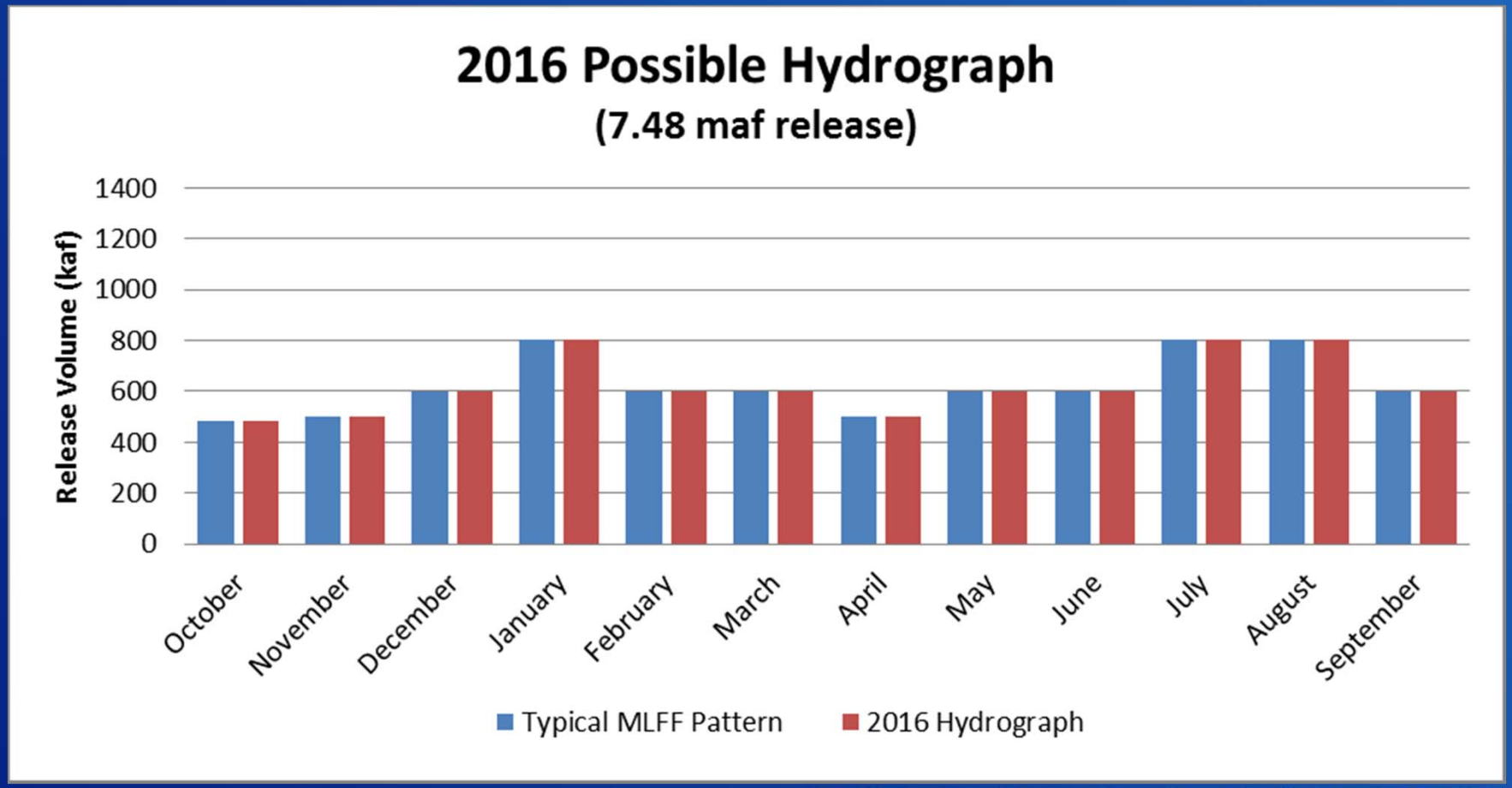
2016 Hydrograph
Current Proposal

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

RECLAMATION

2016 Proposed Hydrograph
7.48 maf release

Release is already low in June, Aug and Sep, no difference



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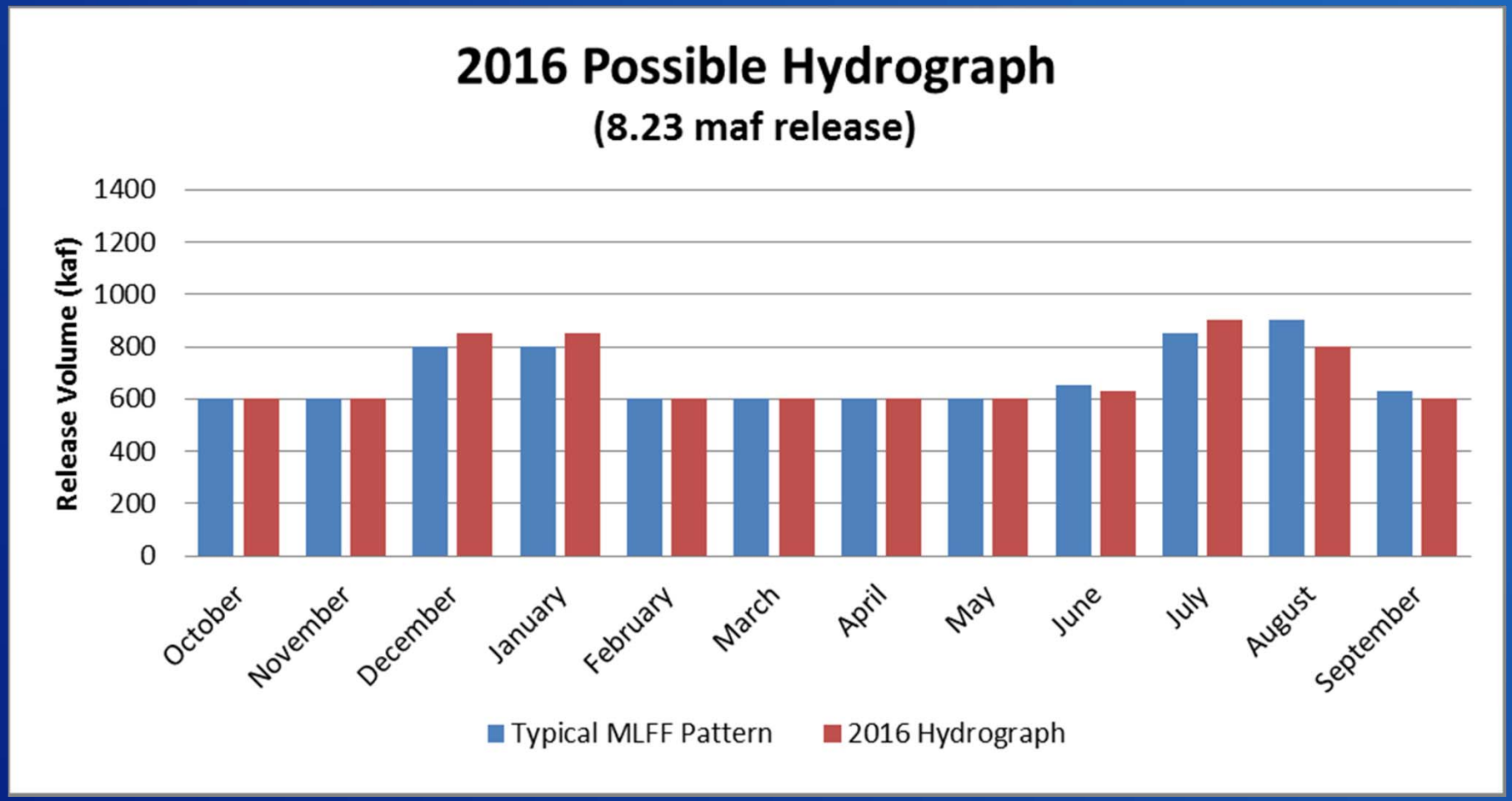
2016 Proposed Hydrograph
8.23 maf release



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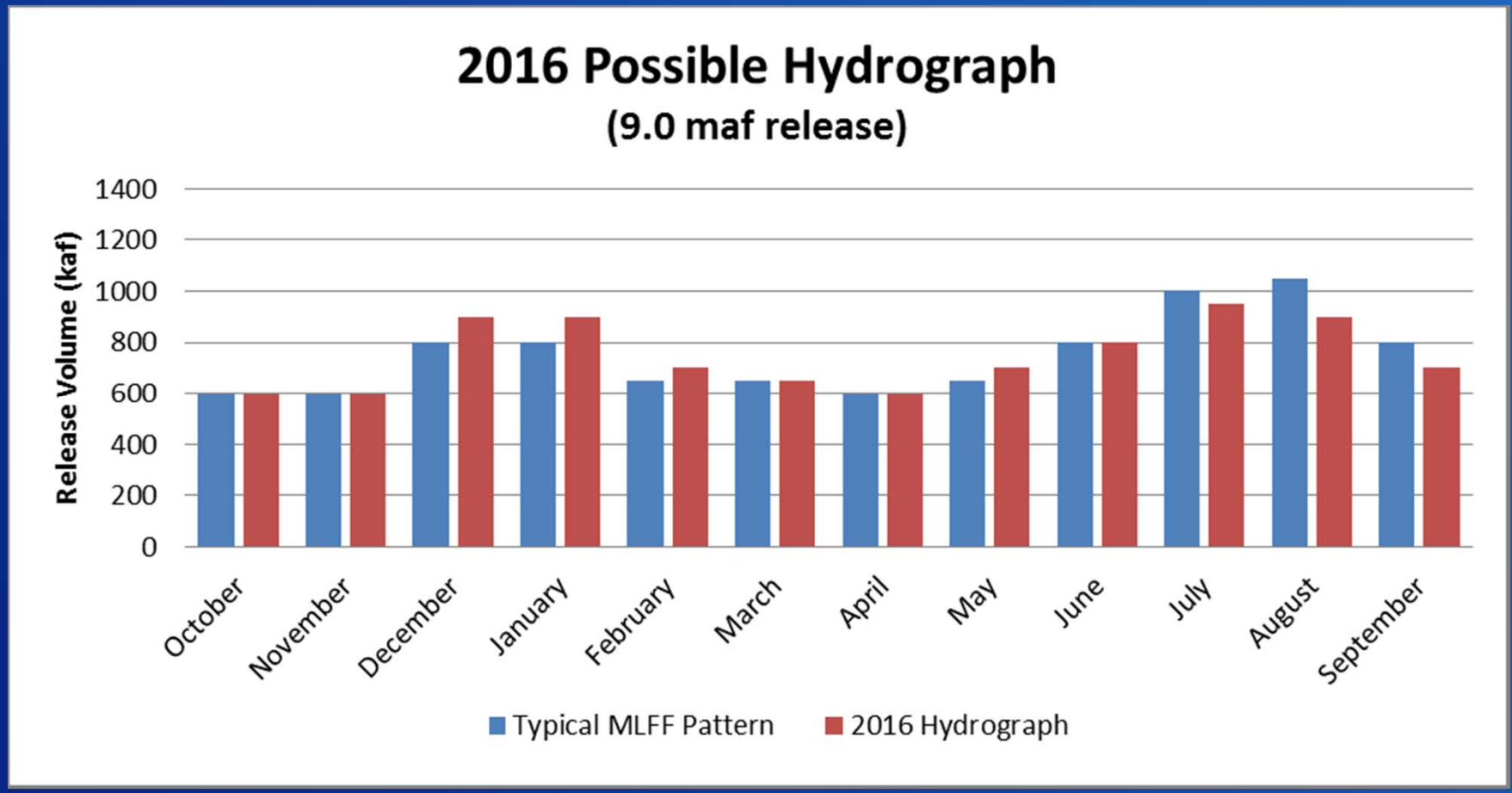
2016 Proposed Hydrograph
9.0 maf release



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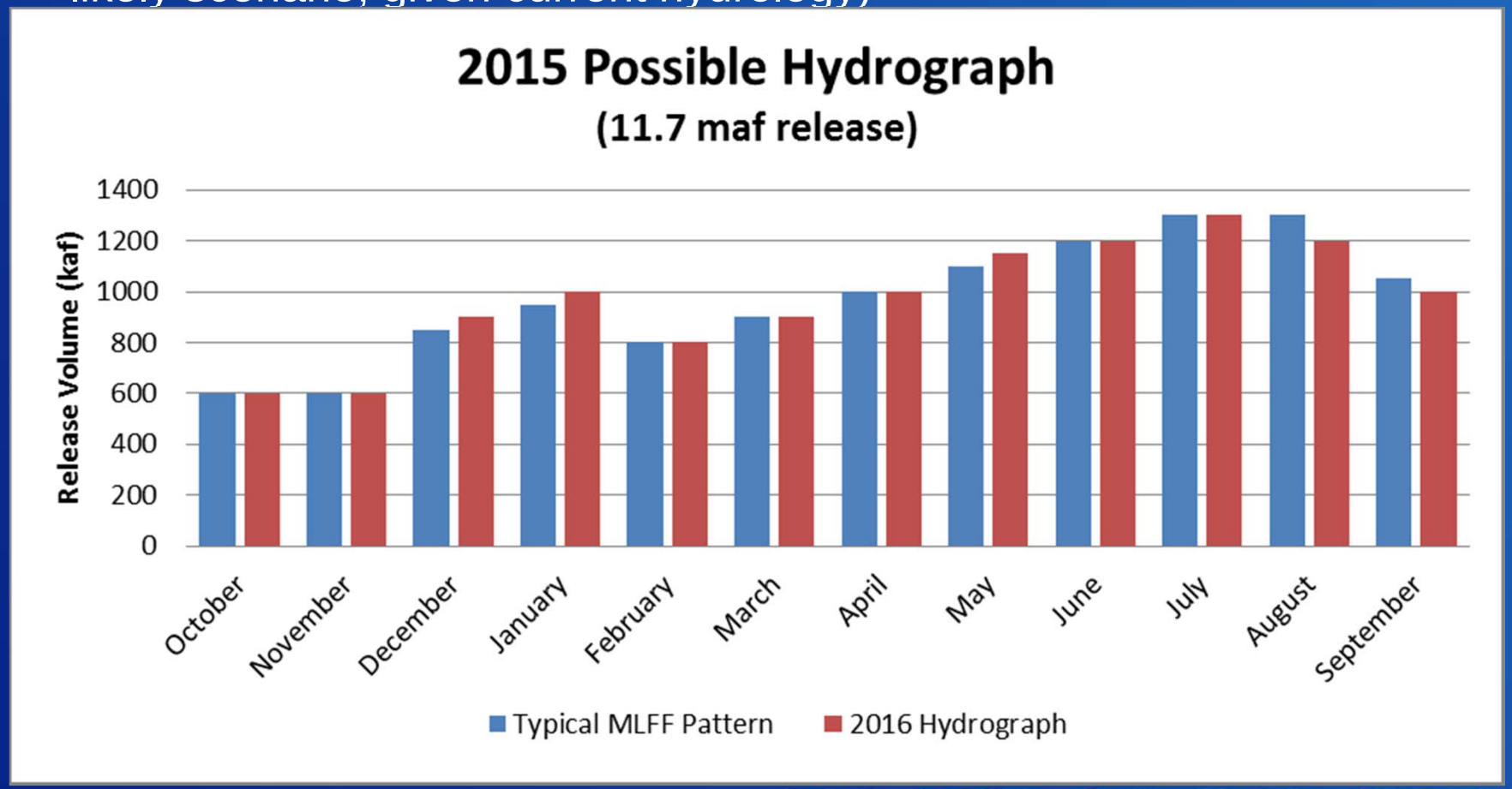
2016 Proposed Hydrograph
11.7 maf release

- Lots of water to move: limited flexibility, minimal difference (not a likely scenario, given current hydrology)



RECLAMATION

2016 Hydrograph Next Steps

- Continue to coordinate with AMWG member agencies
- Present to TWG in June for evaluation
- TWG present to AMWG August 26-7 with motion for approval to recommend to Secretary

Questions?

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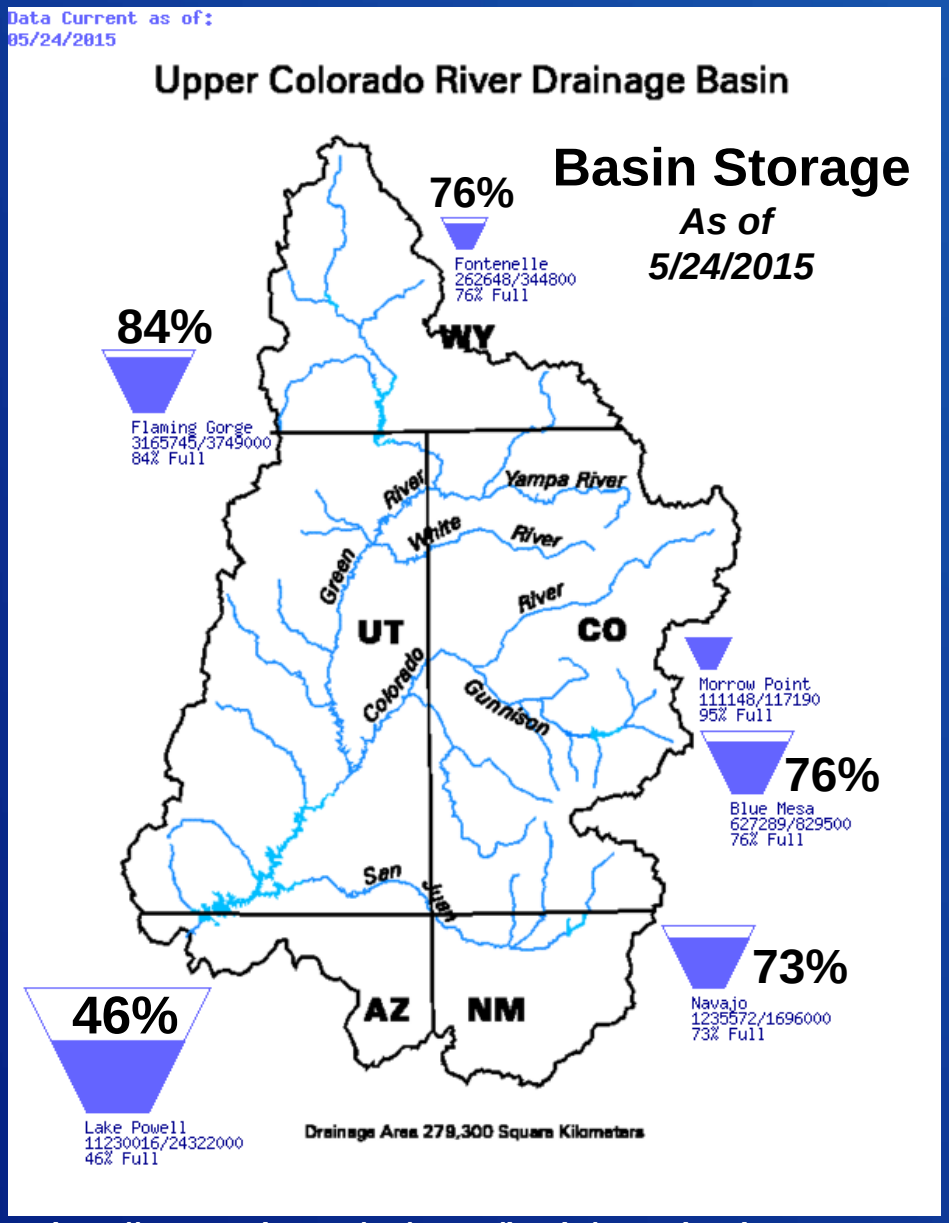
Hydraulic Engineer, Glen Canyon
Reclamation, Upper Colorado Region
Resource Management Division
Water Resources Group

RECLAMATION



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

April to July 2015 Forecasted Inflow

Issued May 4, 2015

Reservoir	A-J Forecast (KAF)	Percent of Average[1]
Fontenelle	495	68%
Flaming Gorge	570	58%
Blue Mesa	440	65%
Navajo	230	31%
Powell	3,000	42%

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

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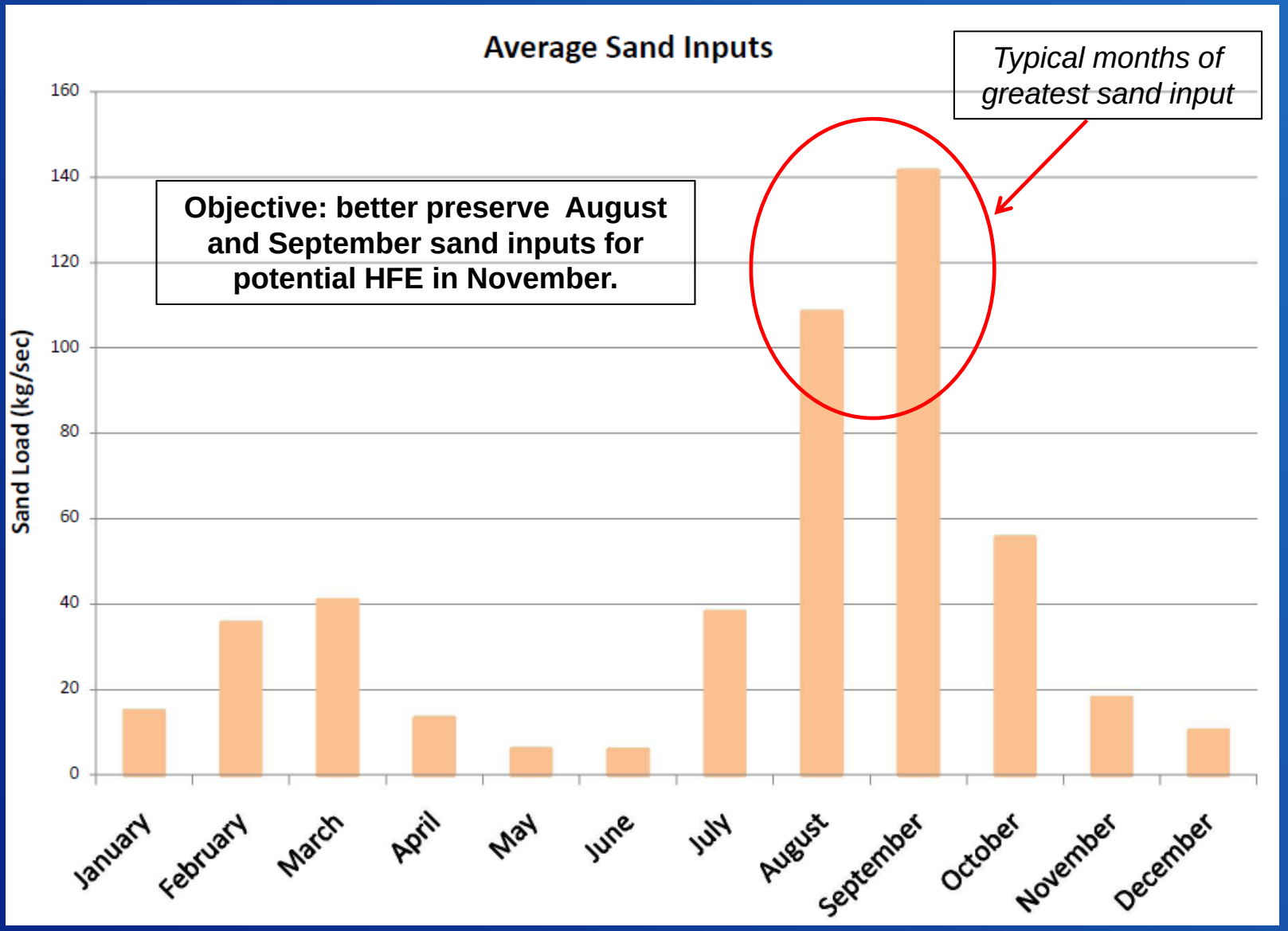

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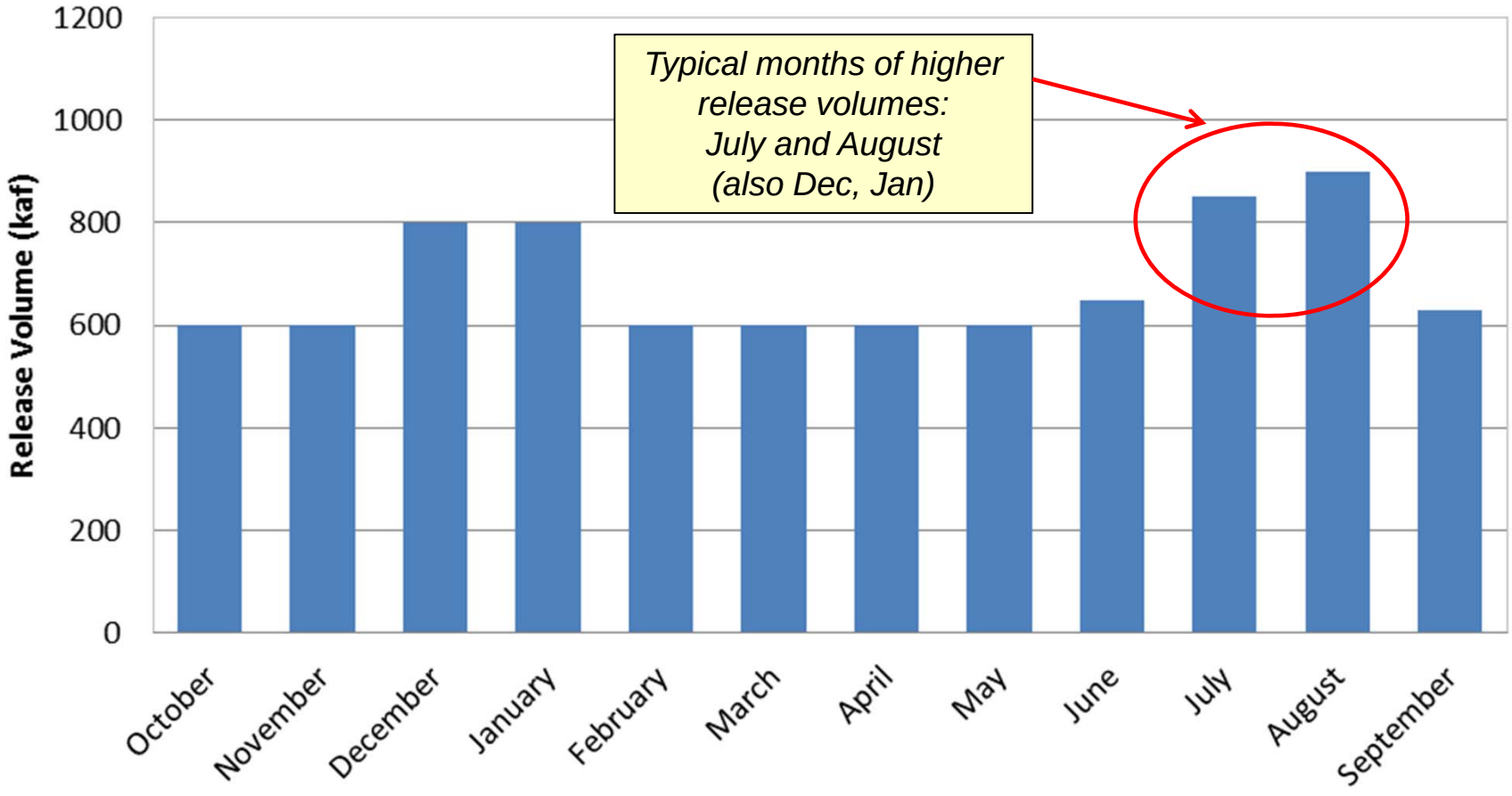
Typical Annual Release Pattern

8.23 maf year



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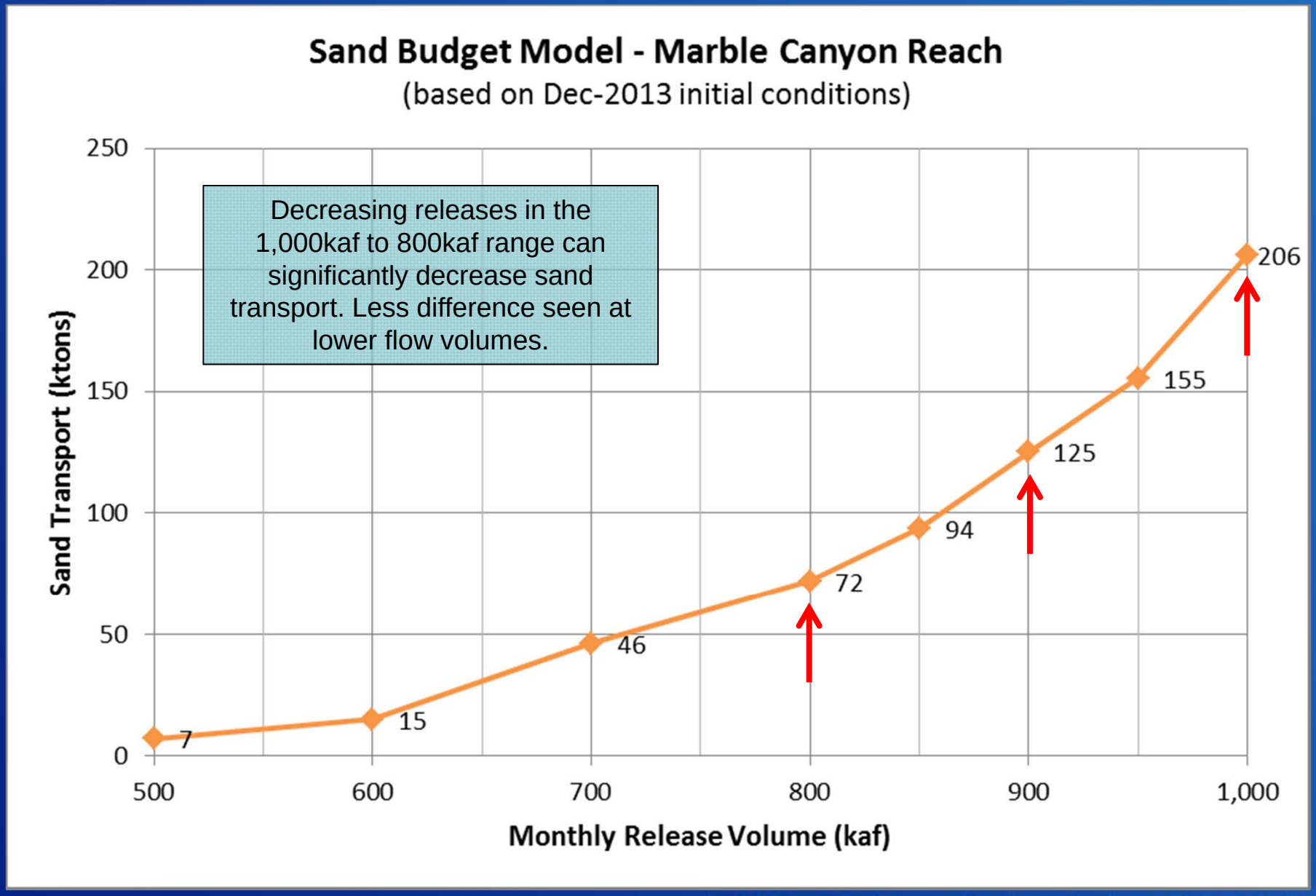

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2015 Hydrograph
Monthly Release Objectives

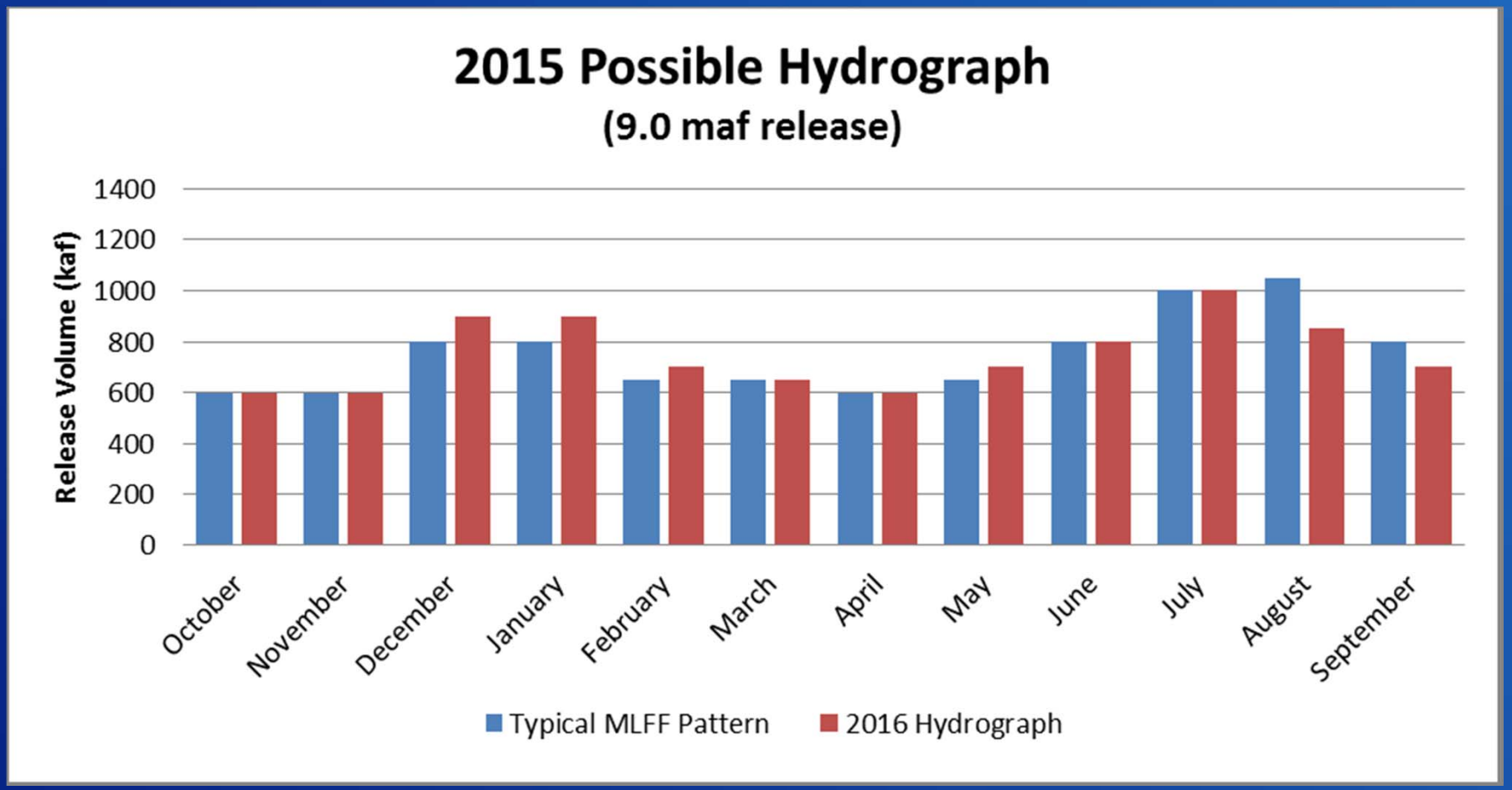
Annual Release Volume	June	August	September
less than 9.0 maf	600 kaf - 650 kaf	800 kaf	600 kaf
9.0 maf – less than 9.5 maf	800 kaf		700 kaf
9.5 maf – less than 10 maf	900 kaf		700 kaf
10 maf and greater	more than 900 kaf		800 kaf or more

RECLAMATION

2016 Possible Hydrograph

9.0 maf release – initial consideration

presented at Feb AMWG meeting



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