Glen Canyon Dam Adaptive Management Work Group
Agenda Item Information
February 24-25, 2016

Agenda Item

Basin Hydrology, Operations, and 2017 Hydrograph

Action Requested

Information item only

Presenter

Lee Traynham, Hydraulic Engineer, Bureau of Reclamation, Upper Colorado Region

Previous Action Taken

By AMWG:

At the August 2015 Adaptive Management Work Group (AMWG) meeting, AMWG recommended to the Secretary of the Interior her approval of the Department of Interior – Department of Energy Proposed Hydrograph for Water Year 2016.

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. Projected reservoir conditions and operations at Lake Powell/Glen Canyon Dam, including the range of potential releases, for the current and upcoming water years will be discussed. This information is provided to assist the AMWG in developing recommendations to the Secretary on the operation of Glen Canyon Dam for water years 2016 and 2017.

The second portion of the presentation will briefly review the 2016 Hydrograph and provide an overview of the upcoming 2017 Hydrograph development process. In cooperation with the other federal agencies, Reclamation will begin the development of Interior's recommendation for the 2017 Hydrograph. This recommendation will be based upon information used to develop the 2016 Hydrograph and any new ideas that may become known through discussions. Reclamation will review the Hydrograph information and analyses with the Technical Work Group, and the Department of Interior will provide a recommendation for the AMWG's consideration later this year.

RECLAMATION

Managing Water in the West

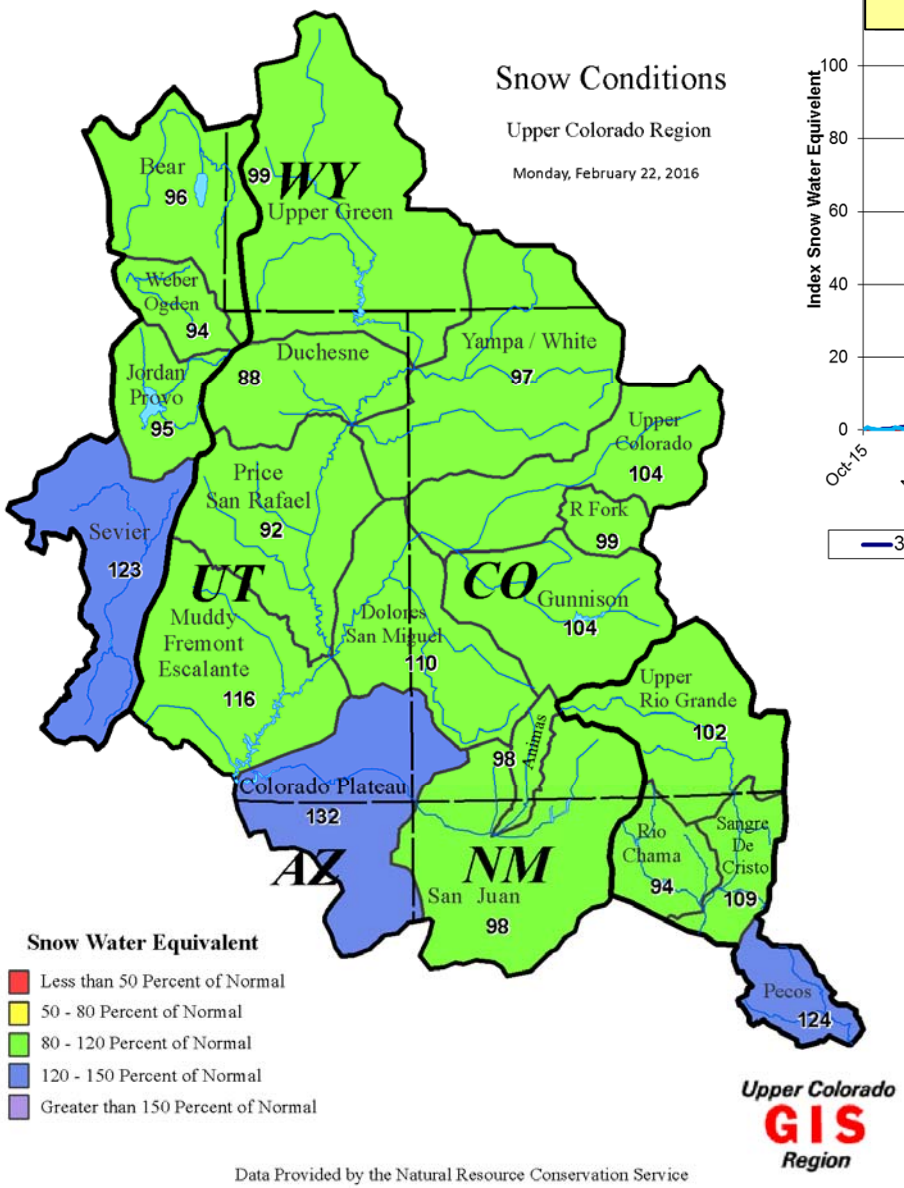
Basin Hydrology, Operations and 2017 Hydrograph

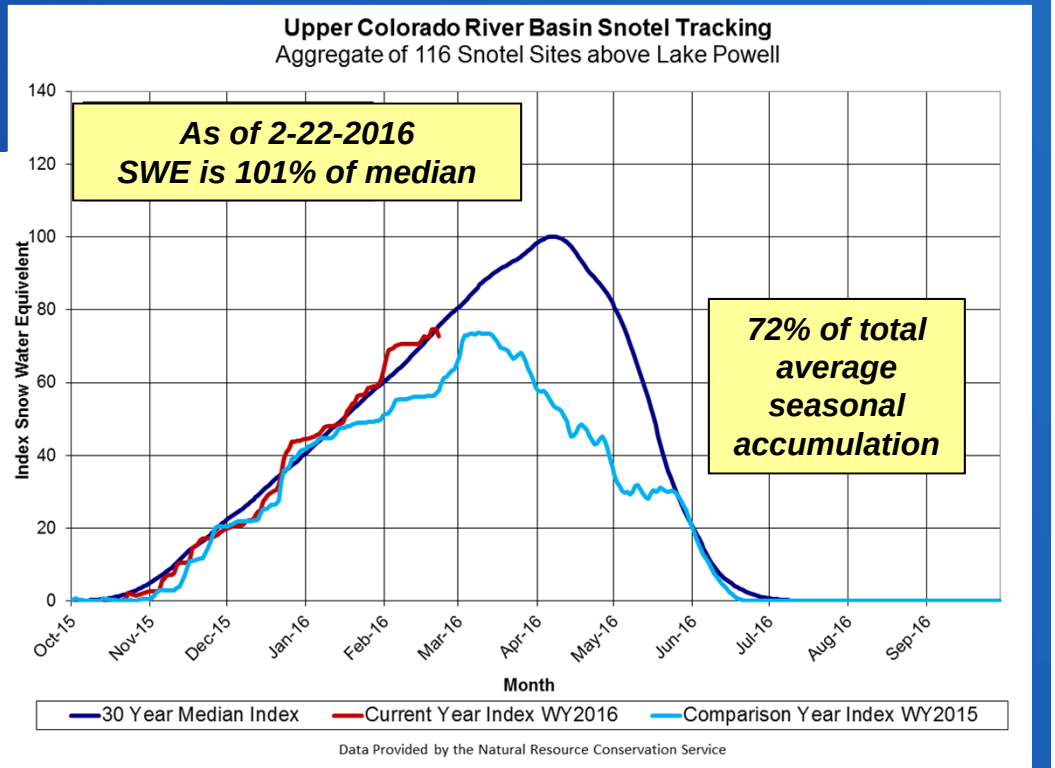
Adaptive Management Work Group

February 24, 2016

U.S. Department of the Interior
Bureau of Reclamation

Snow Conditions





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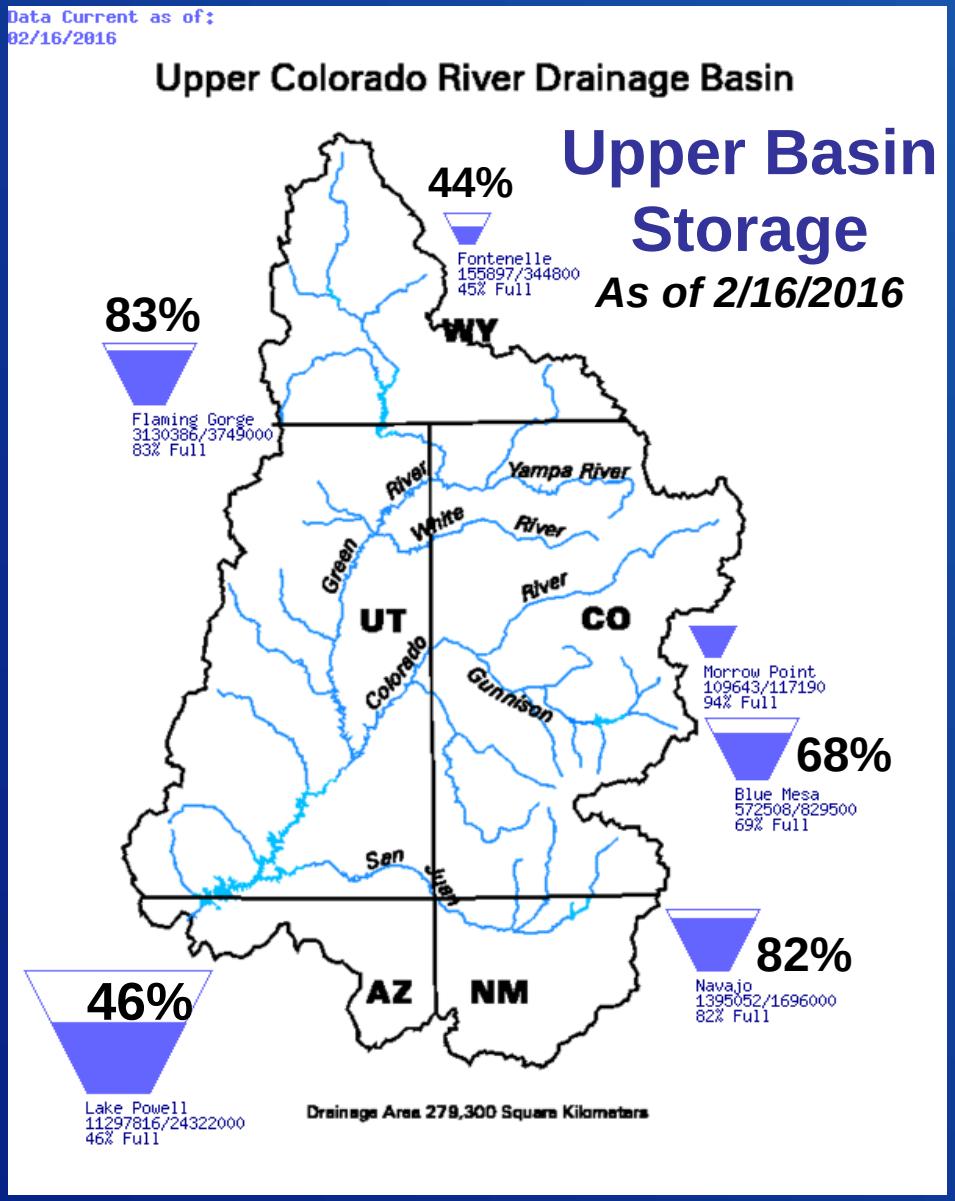

http://www.usbr.gov/uc/water/basin/tc_cr.html

2016 April – July Forecast
issued Feb 2

Reservoir	A-J Forecast (KAF)	Percent of Average[1]
Fontenelle	515	71%
Flaming Gorge	685	70%
Blue Mesa	640	95%
Navajo	735	100%
Powell	6,700	94%

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

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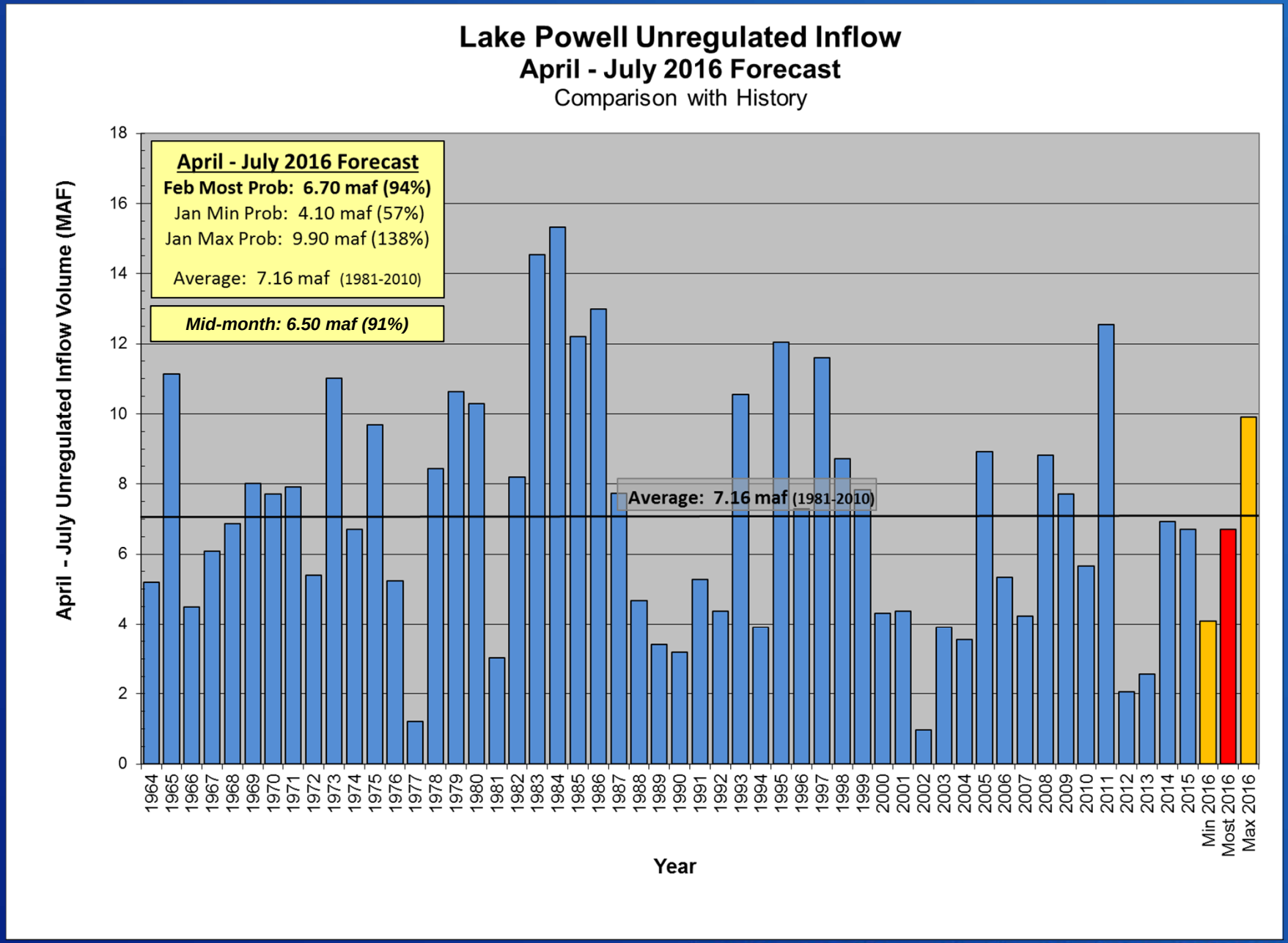

*** Water Year 2016 forecast: 9.92 maf (92%)**

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Water Year 2016 Operating Tier

Operating Tier determined with the August 2015 24-Month Study

Powell Inflow Scenario	WY 2016 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 Balancing 9.0 maf release

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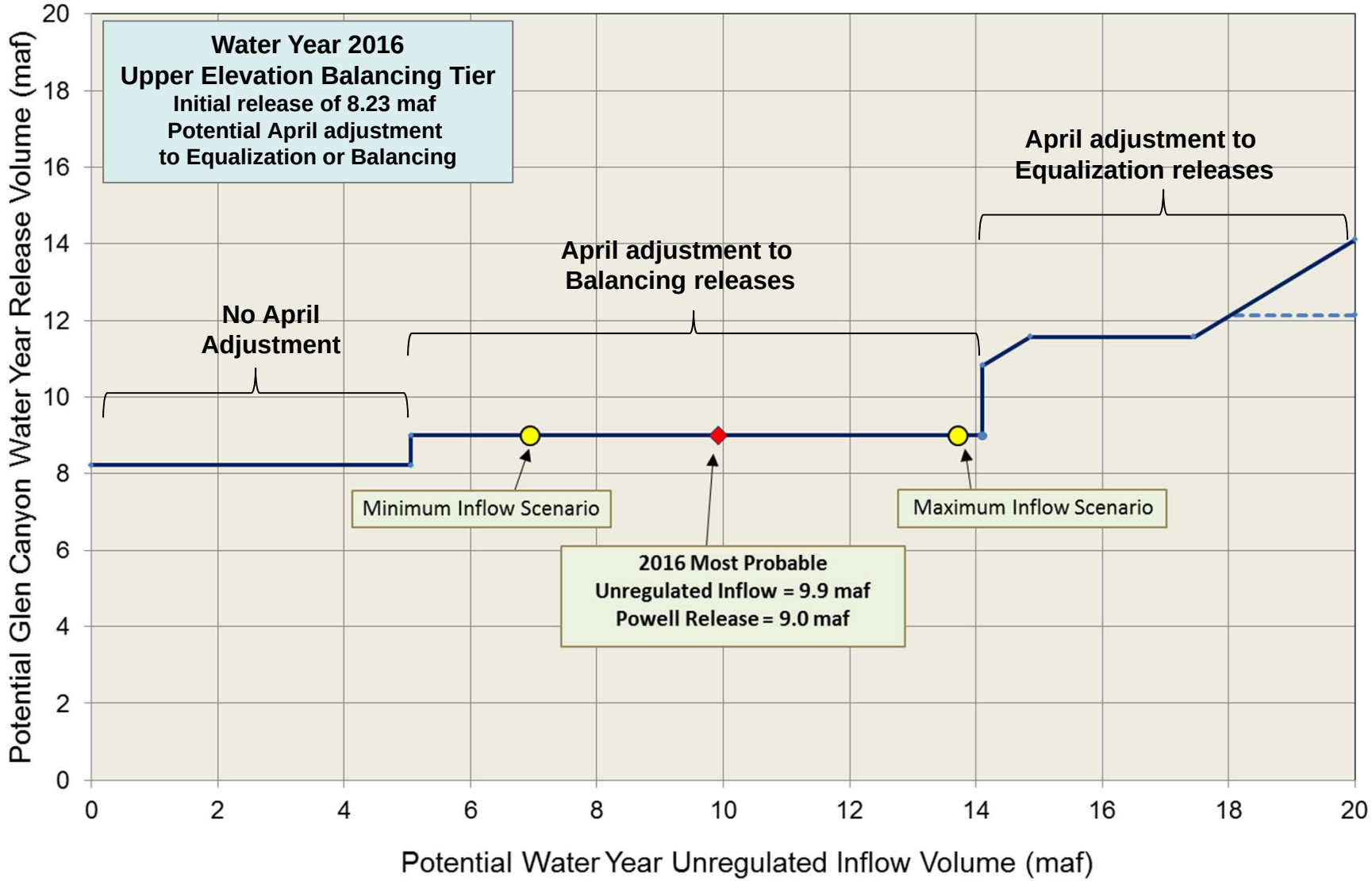
Potential Lake Powell Release Scenarios

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



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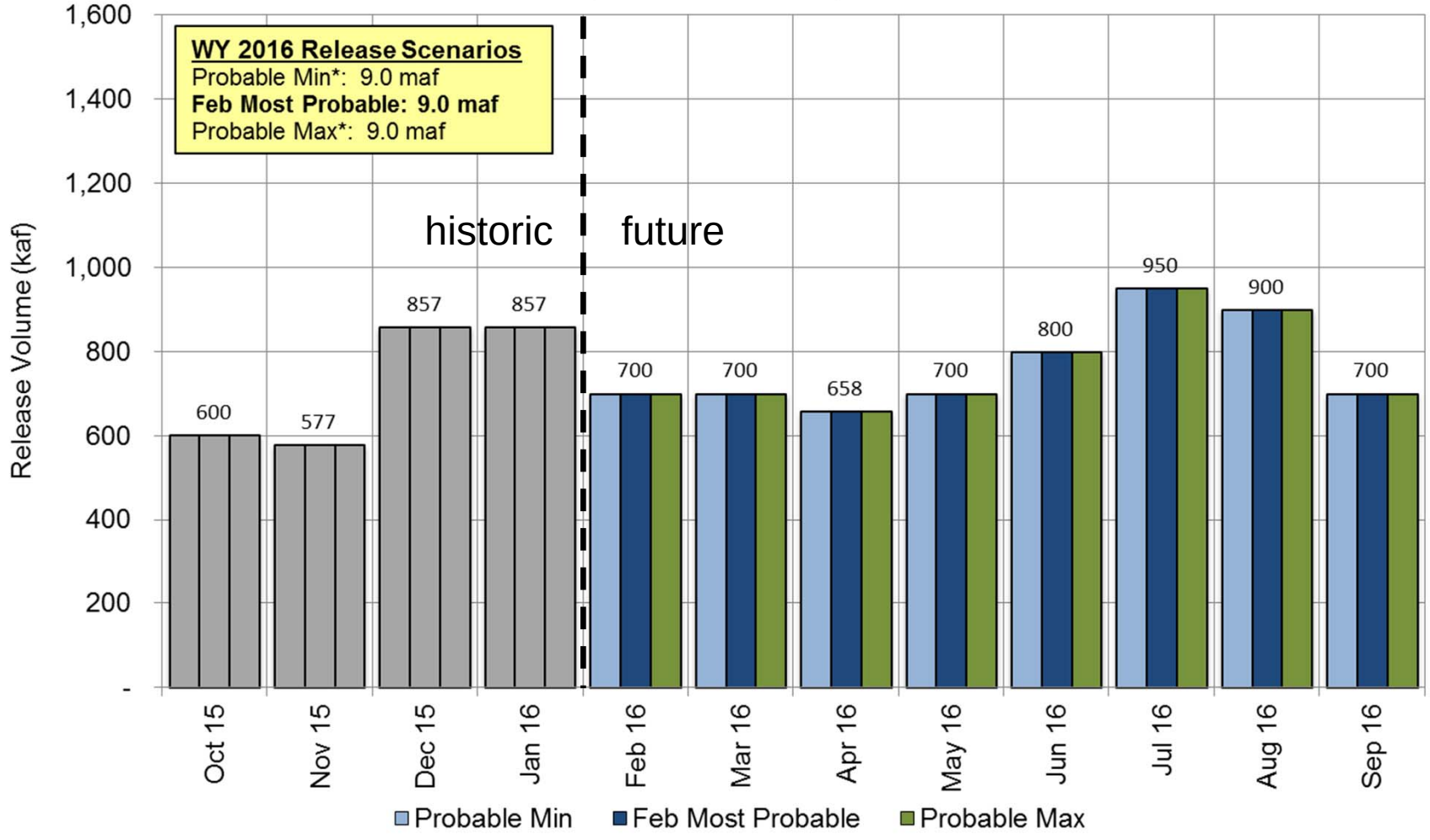
Projected Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2016

Updated February 2016



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

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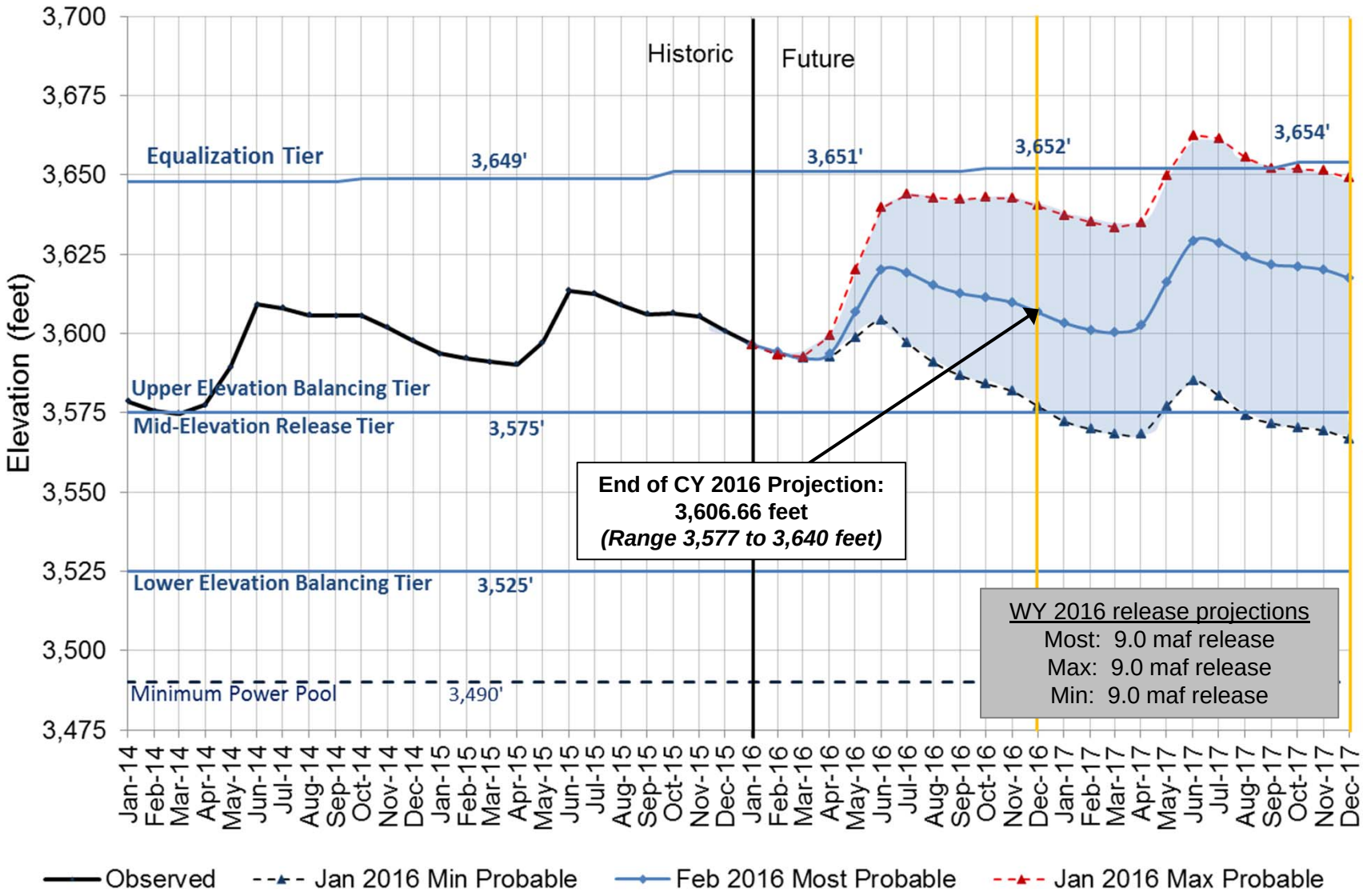
Lake Powell End of Month Elevations

Historic and projected based on February 2016 modeling

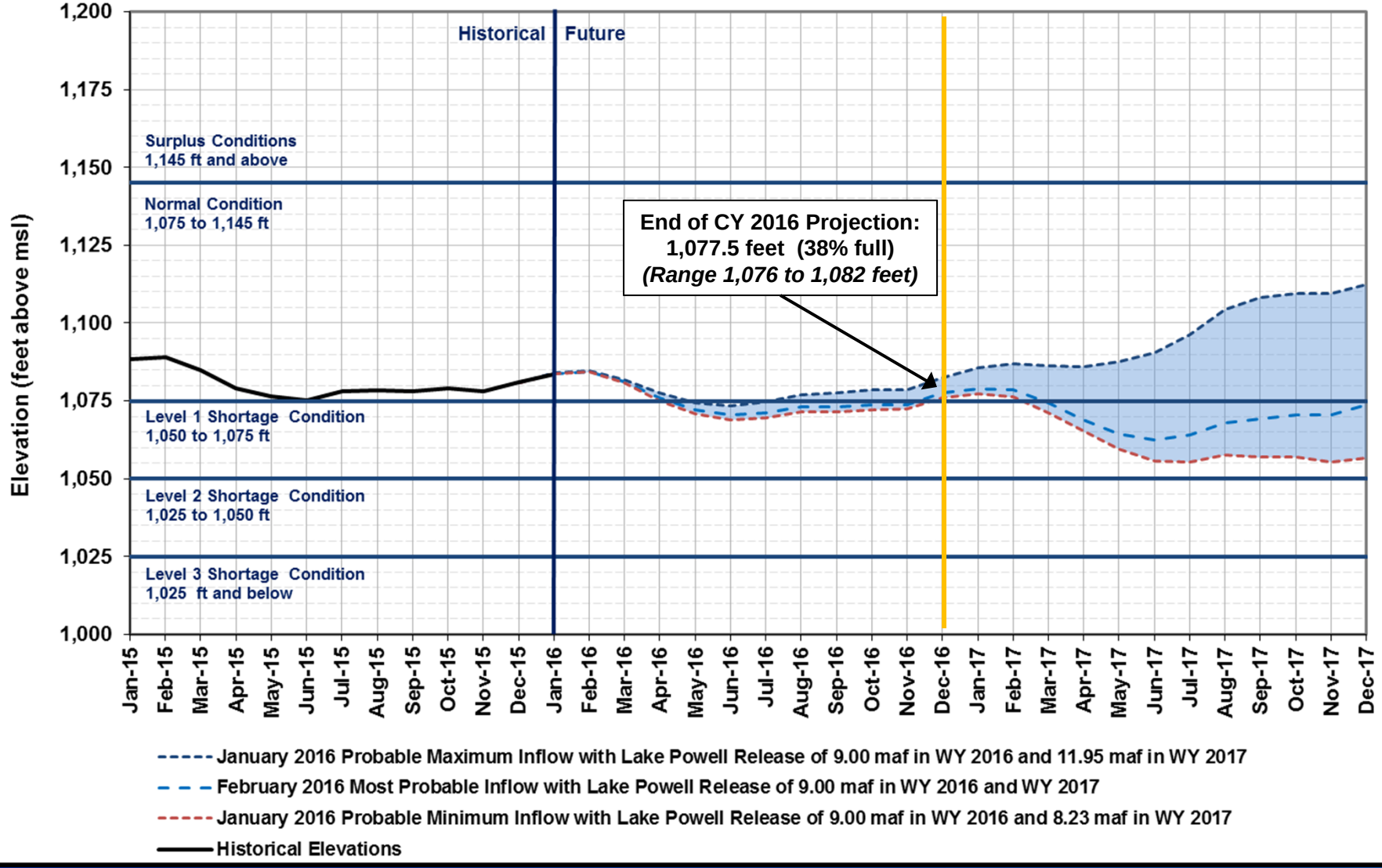


End of CY 2016 Projection:
3,606.66 feet
(Range 3,577 to 3,640 feet)

WY 2016 release projections
Most: 9.0 maf release
Max: 9.0 maf release
Min: 9.0 maf release

Lake Mead End of Month Elevations

Projections from January and February 2016 24-Month Study Inflow Scenarios



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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**

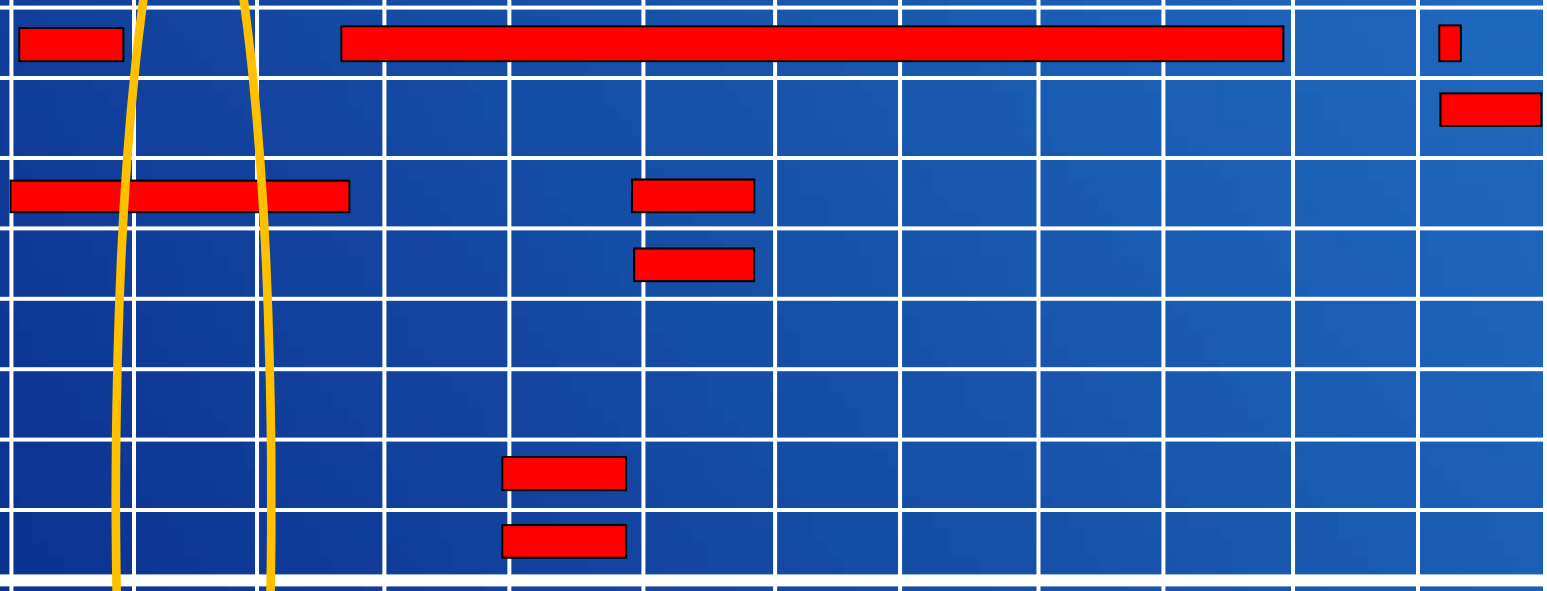
(updated 2-16-2016)

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**

RECLAMATION

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	
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

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

(updated 2-22-2016)

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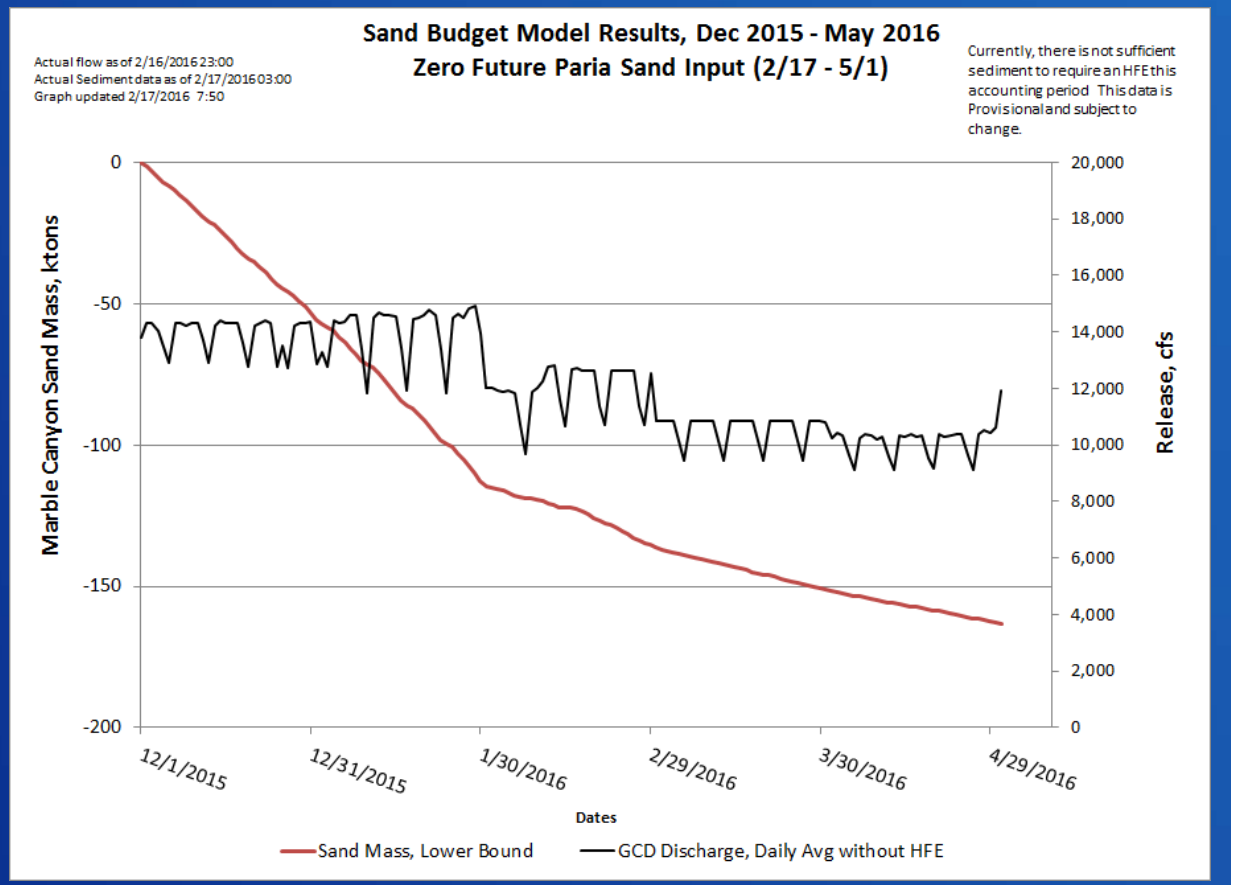
Sand Budget Model Results

- As of 2/17/2016, not enough sediment input to trigger a spring 2016 HFE



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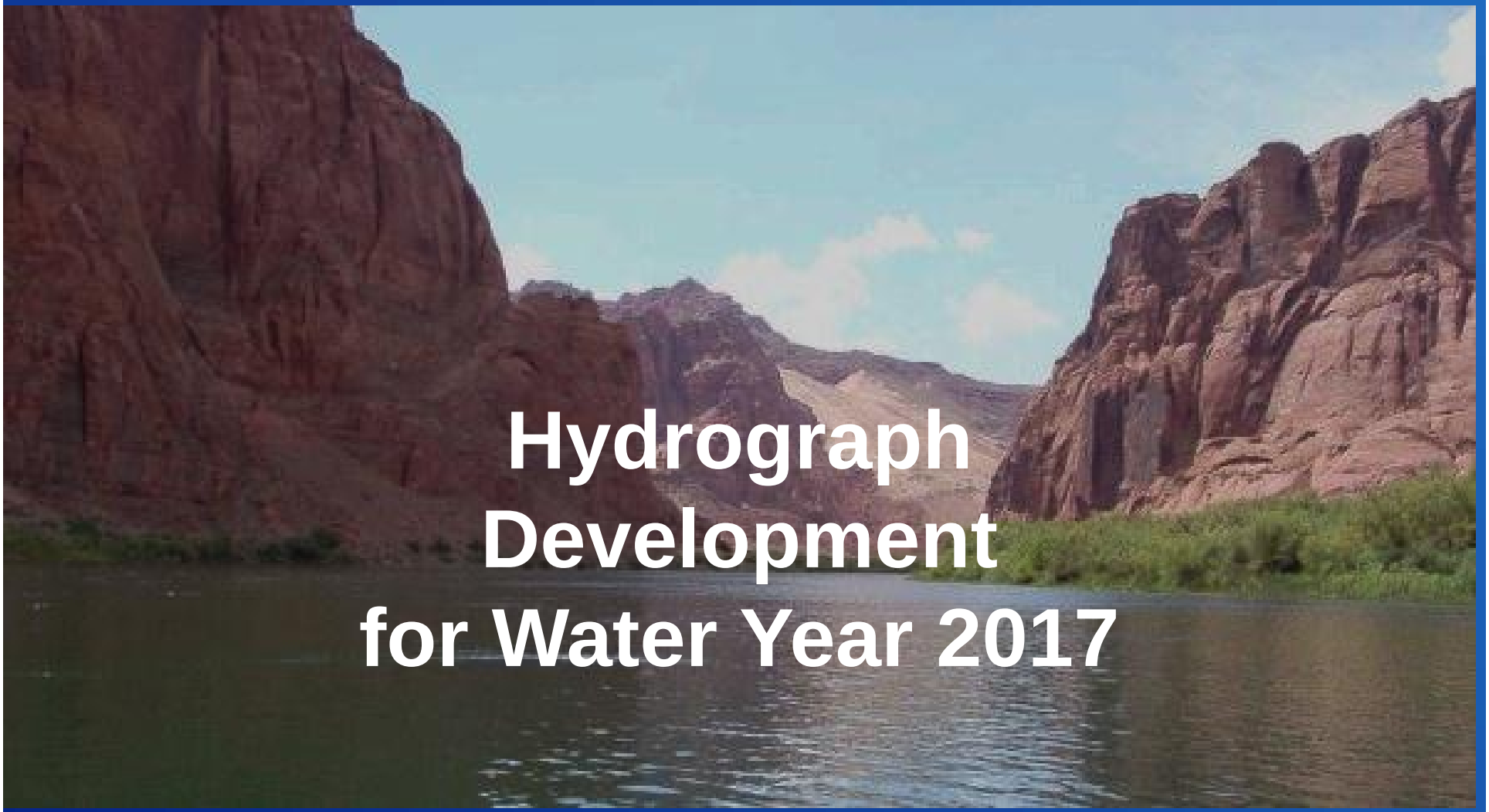

Hydrograph Development for Water Year 2017

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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

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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

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

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

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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	850 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

2017 Hydrograph Next Steps

- Continue to coordinate with AMWG Stakeholders
- Consider proposed modifications, if any
- Evaluate potential impacts of hydrograph release scenarios:
  - Hydropower
  - Sediment
  - Temperature
- Present to TWG in April
- Present to AMWG in August

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Questions?

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

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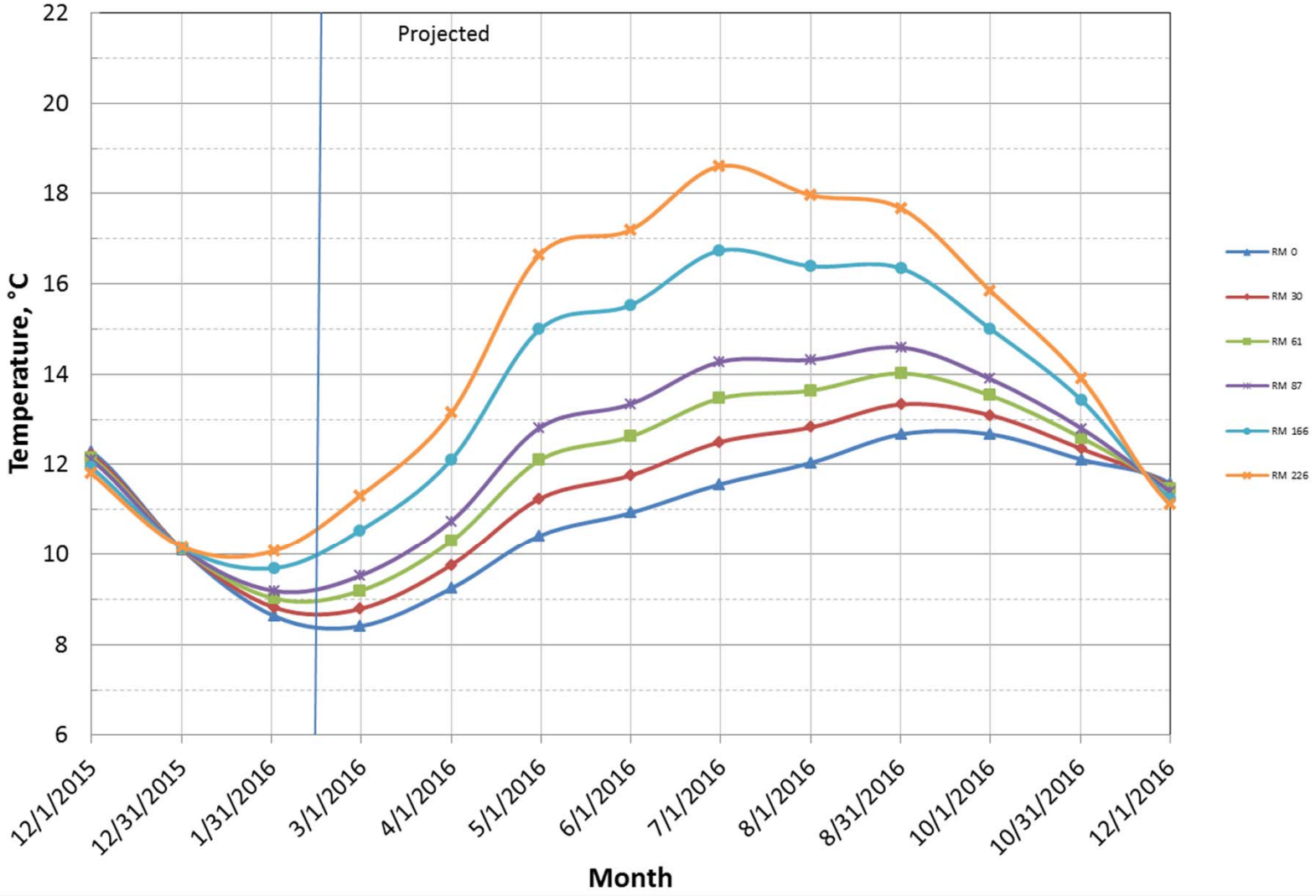
Colorado River, Grand Canyon Water Temperatures

Projections based on February 2016, Most Probable Hydrology



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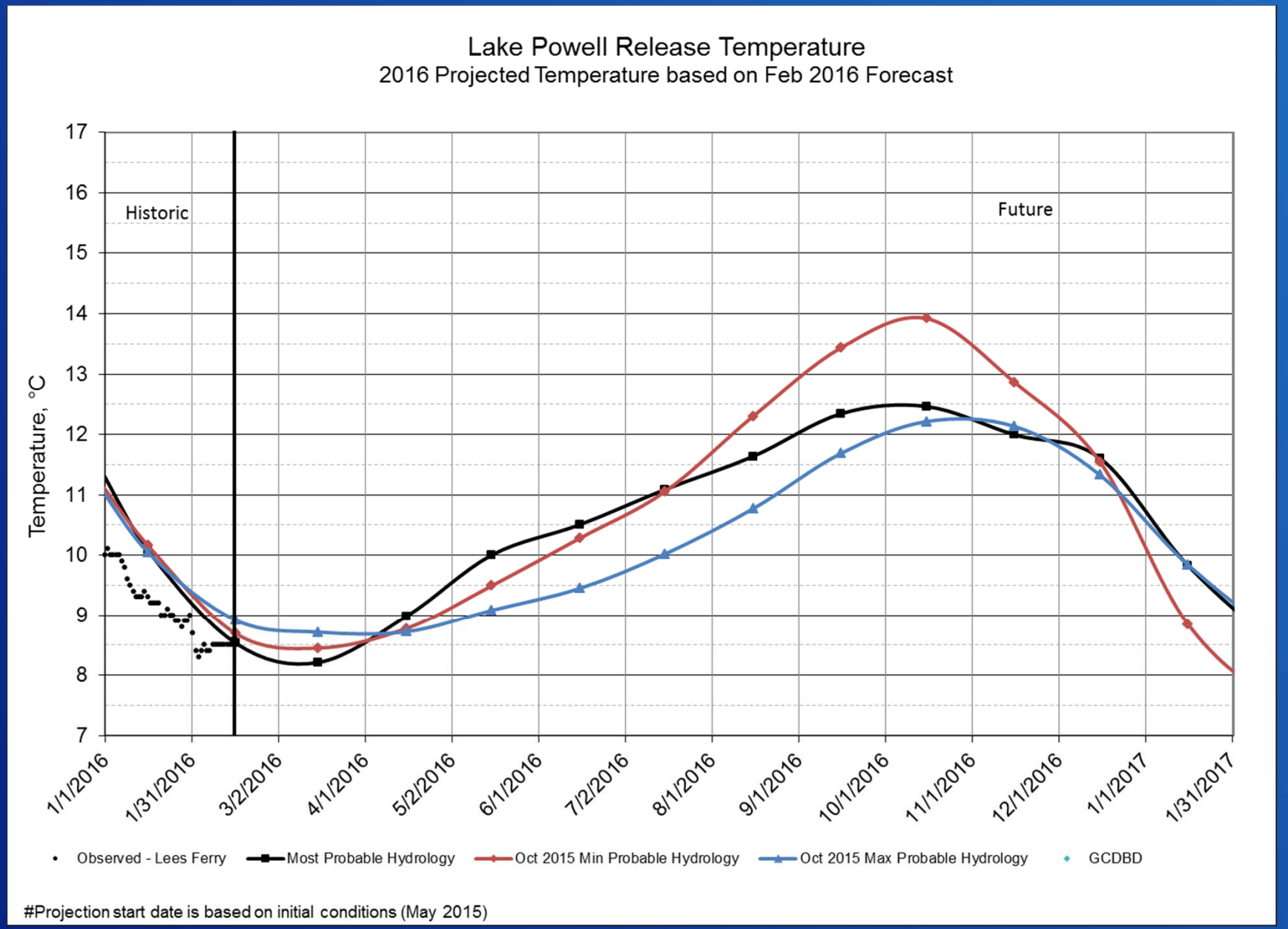

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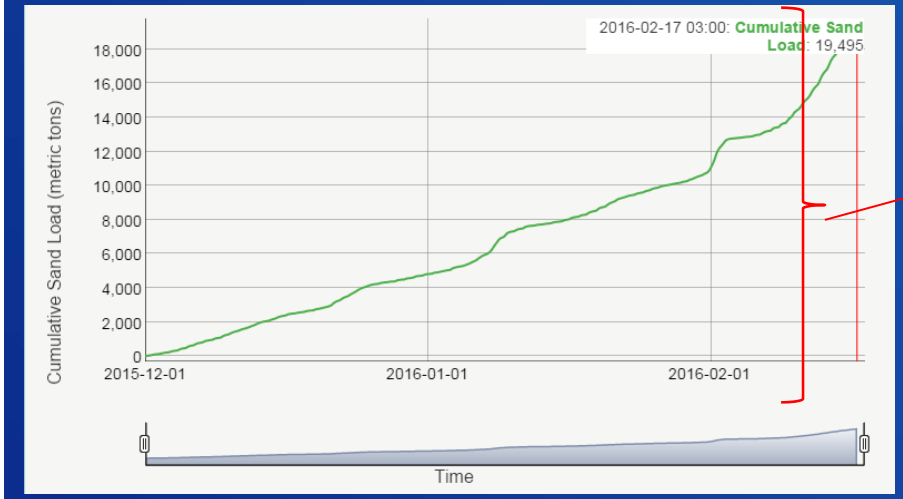
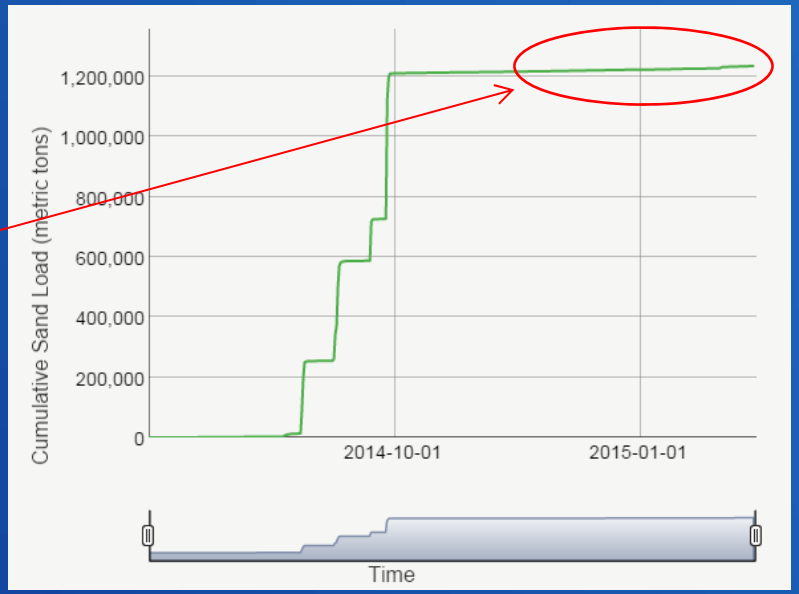
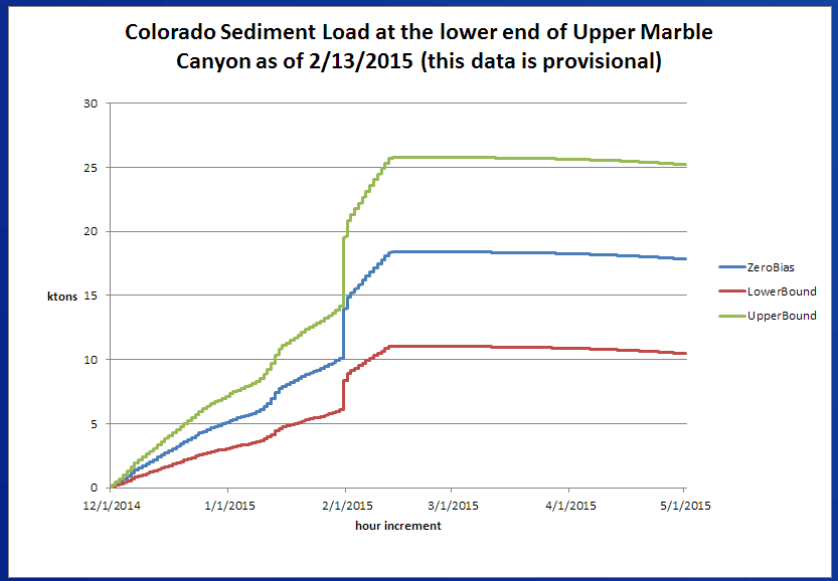
Sediment Conditions *As of 2-13-2015*



Paria Sand Load Dec 1 though Feb 13



Paria Sand Load July 1 though Feb 13



Sediment Model Results

As of 2-13-2015

Have: ~18 ktons

Need: several hundred ktons (for the smallest HFE)

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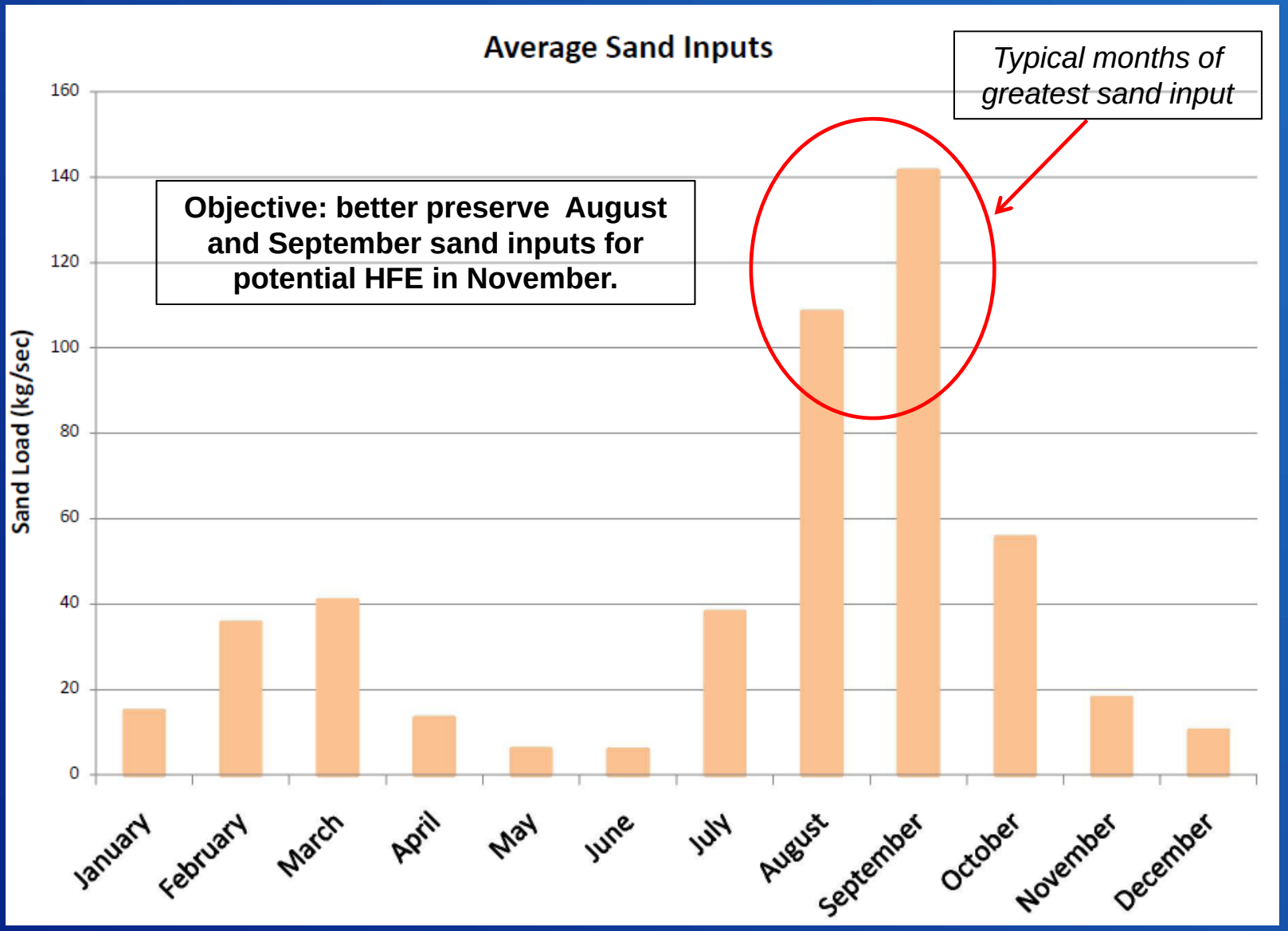
If we end up with a 8.23 maf release instead of 9.0 maf, we will need to reduce the remaining months by 770kaf

	Typical pattern (9.0 maf)	Proposed 2016 Hydrograph (9.0 maf)	*Possible monthlies after maintenenace considerations and discussions with Western*			*(maintaining 2016 Hydrograph*		
			9.0 maf	**96 hr HFE 9.0 maf**	**spring HFE 9.0**	**8.23 maf**	**96 hr HFE 8.23 maf**	**spring HFE 8.23**
October	600	600	600	600	600	**600**	600	600
November	600	600	600	770	600	**600**	770	600
December	800	900	900	900	900	**900**	900	900
January	800	900	900	900	900	**900**	900	900
February	650	700	700	665	700	**700**	665	700
March	650	650	650	615	650	**650**	**615**	650
April	600	600	600	600	770	**540**	540	710
May	650	700	700	600	600	540	500	500
June	800	**800**	800	800	800	600	600	500
July	1000	950	950	950	950	800	800	800
August	1050	900	900	900	900	800	800	800
September	800	700	700	700	630	600	540	570
	9000	9000	9000	9000	9000	8230	8230	8230

RECLAMATION



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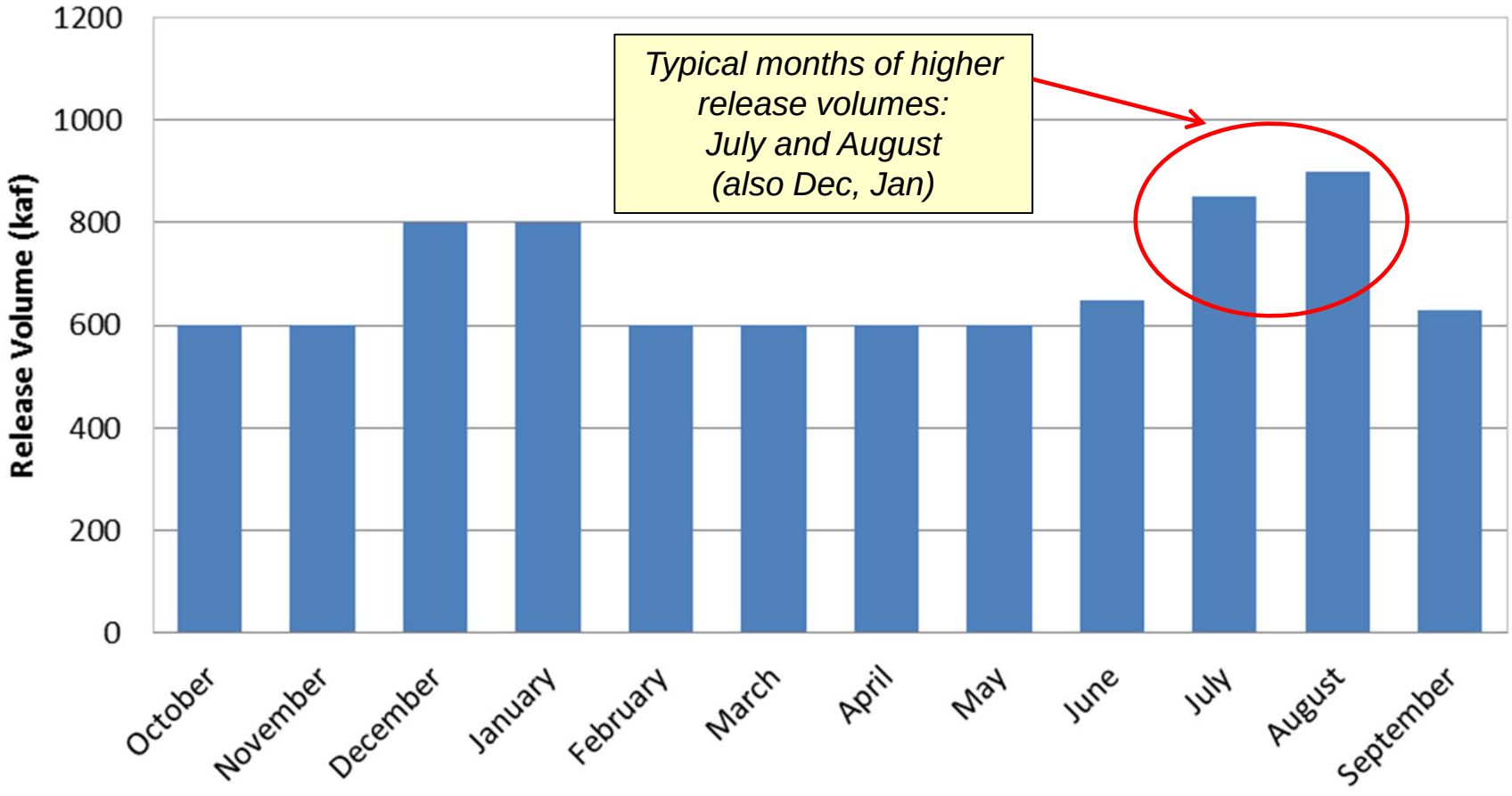
Typical Annual Release Pattern

8.23 maf year



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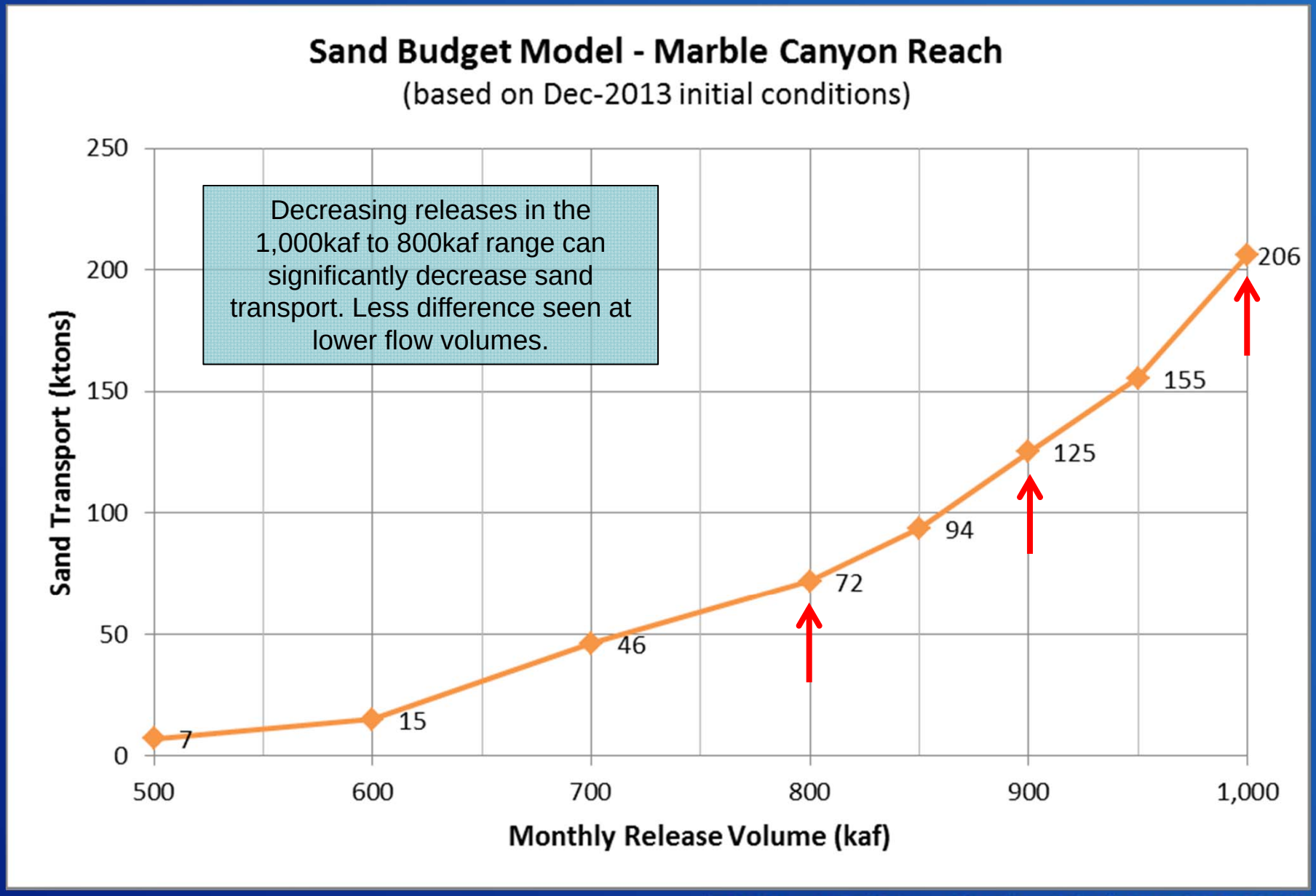

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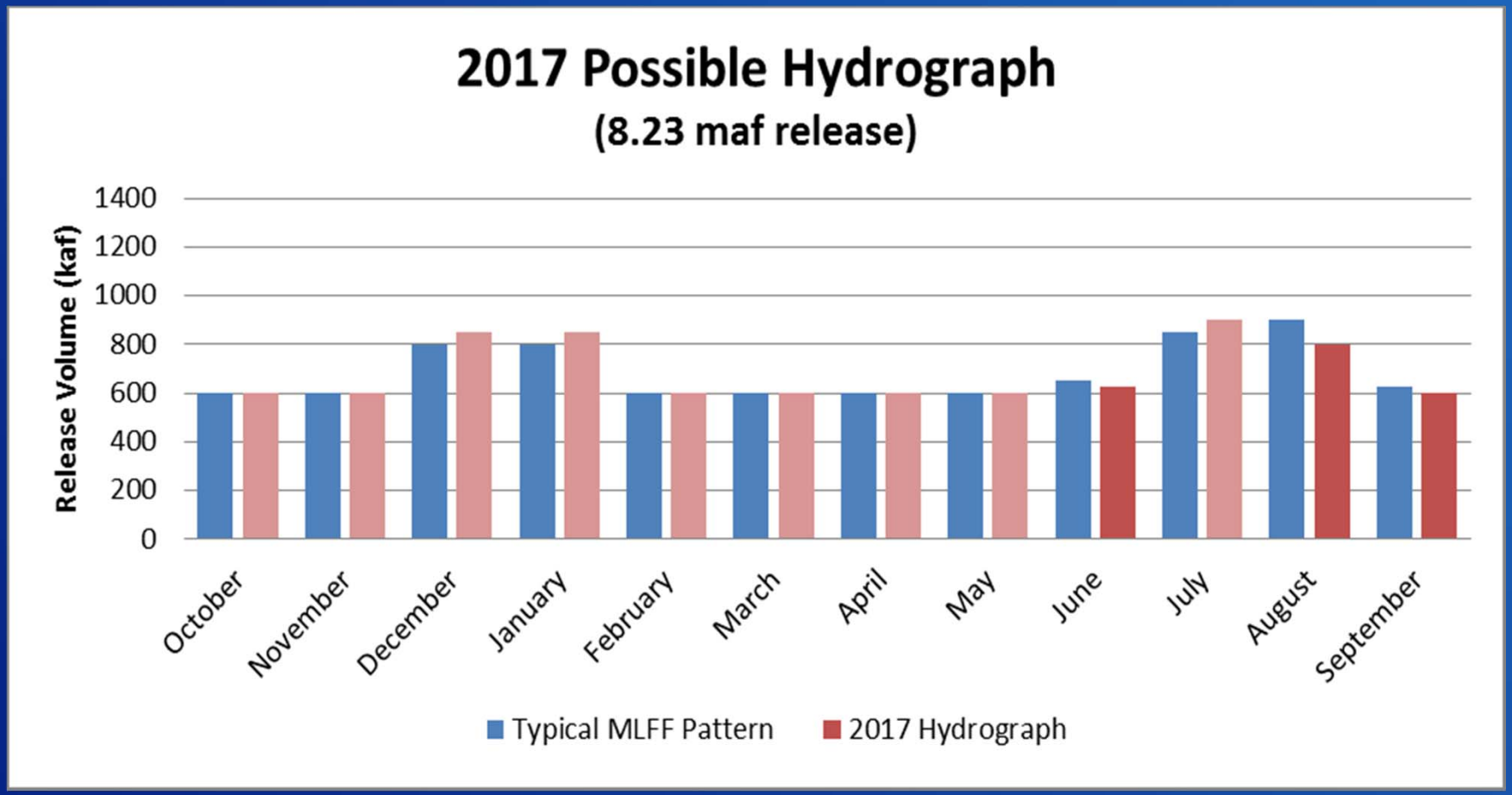
2017 Possible Hydrograph
8.23 maf release scenario



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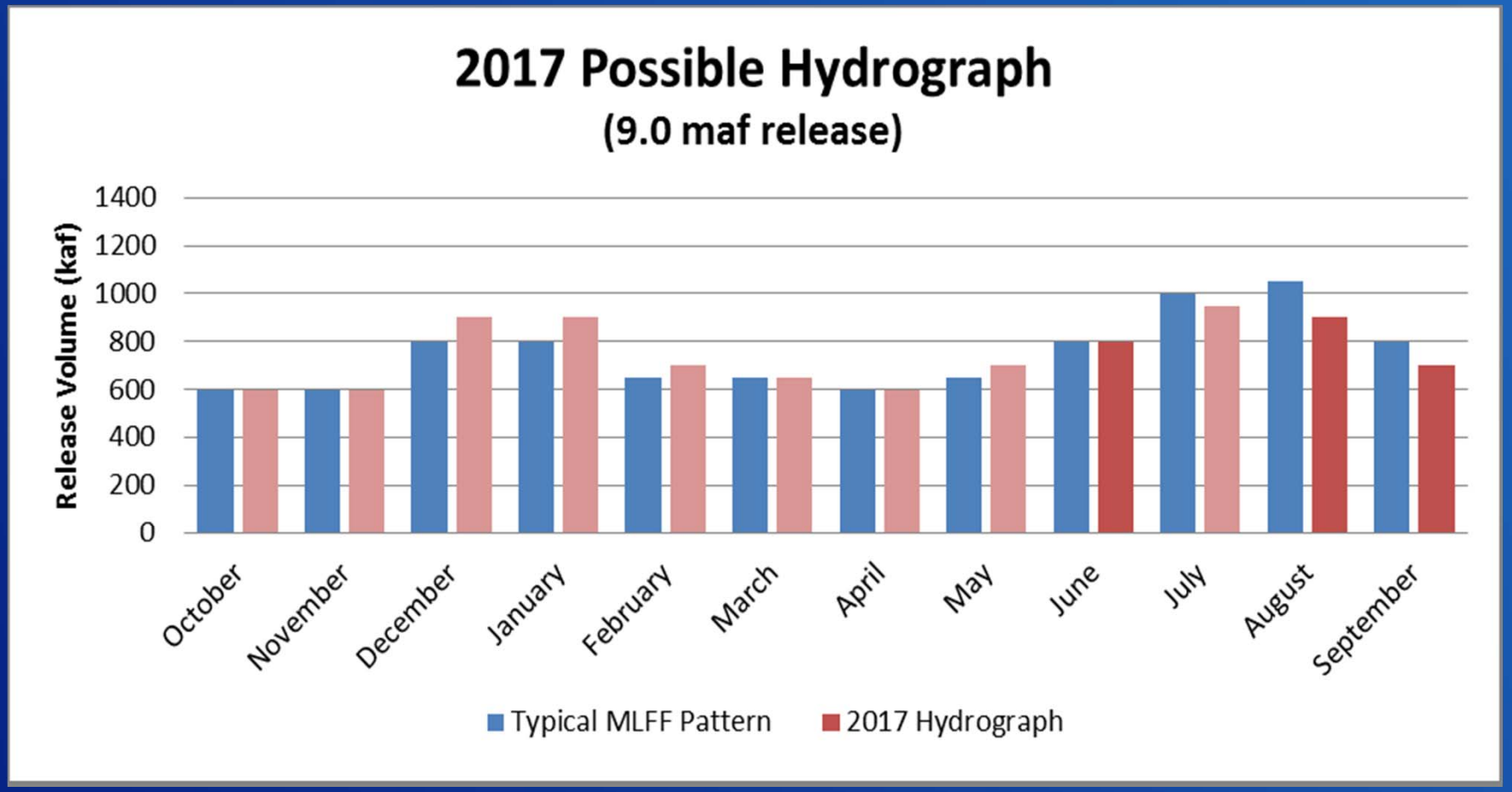
2017 Proposed Hydrograph
9.0 maf release scenario



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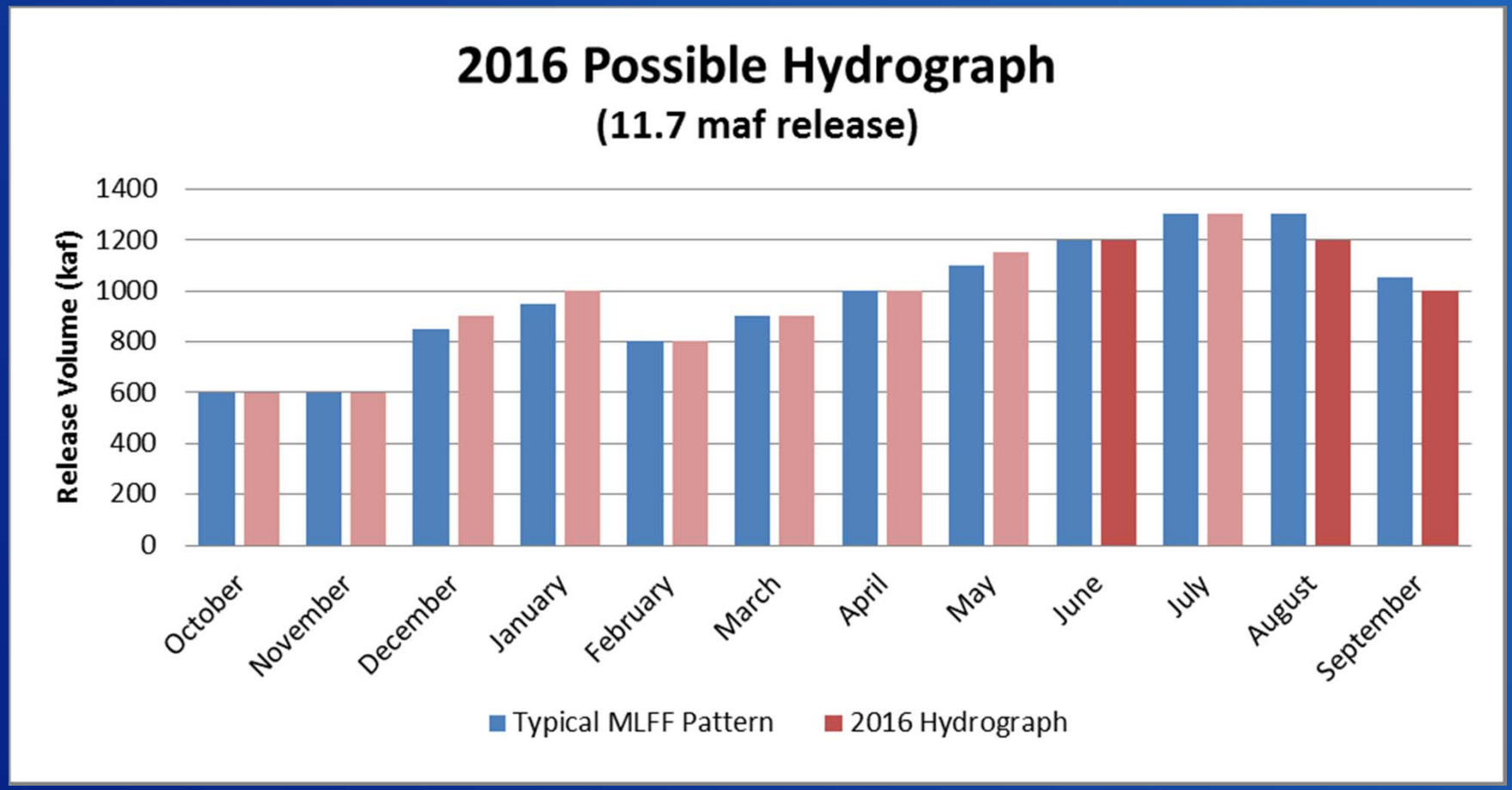
2017 Proposed Hydrograph
11.7 maf release scenario

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



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