

**Glen Canyon Dam Adaptive Management Work Group**  
**Agenda Item Information**  
**August 8-9, 2013**

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Agenda Item

Basin Hydrology and Operations

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Action Requested

Information item only

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Presenter

Katrina Grantz, Hydraulic Engineer, Bureau of Reclamation, Upper Colorado Region

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Previous Action Taken

N/A

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Relevant Science

N/A

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Background Information

The presentation is intended to provide pertinent information to AMWG members on 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 2013 and provide a provisional outlook for water years 2014 and 2015.

The presentation will cover the implementation of the *Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations of Lake Powell and Lake Mead* and the potential for an annual release volume of 7.48 maf from Lake Powell in water years 2014 and/or 2015. Such information is provided to assist the AMWG in developing recommendations to the Secretary on the operation of Glen Canyon Dam for water year 2014.

# RECLAMATION

*Managing Water in the West*

## Upper Basin Hydrology and Projected Operations Water Years 2013 and 2014

Adaptive Management Work Group  
August 8-9, 2013



U.S. Department of the Interior  
Bureau of Reclamation

# Presentation Overview

- Current status upper basin reservoirs
- August inflow forecasts
  - Water year 2013 and water year 2014
- July\* modeling projections
  - \*August modeling is currently underway
  - releases and reservoir elevations
  - long-term modeling projections
- Scheduled Glen Canyon powerplant maintenance

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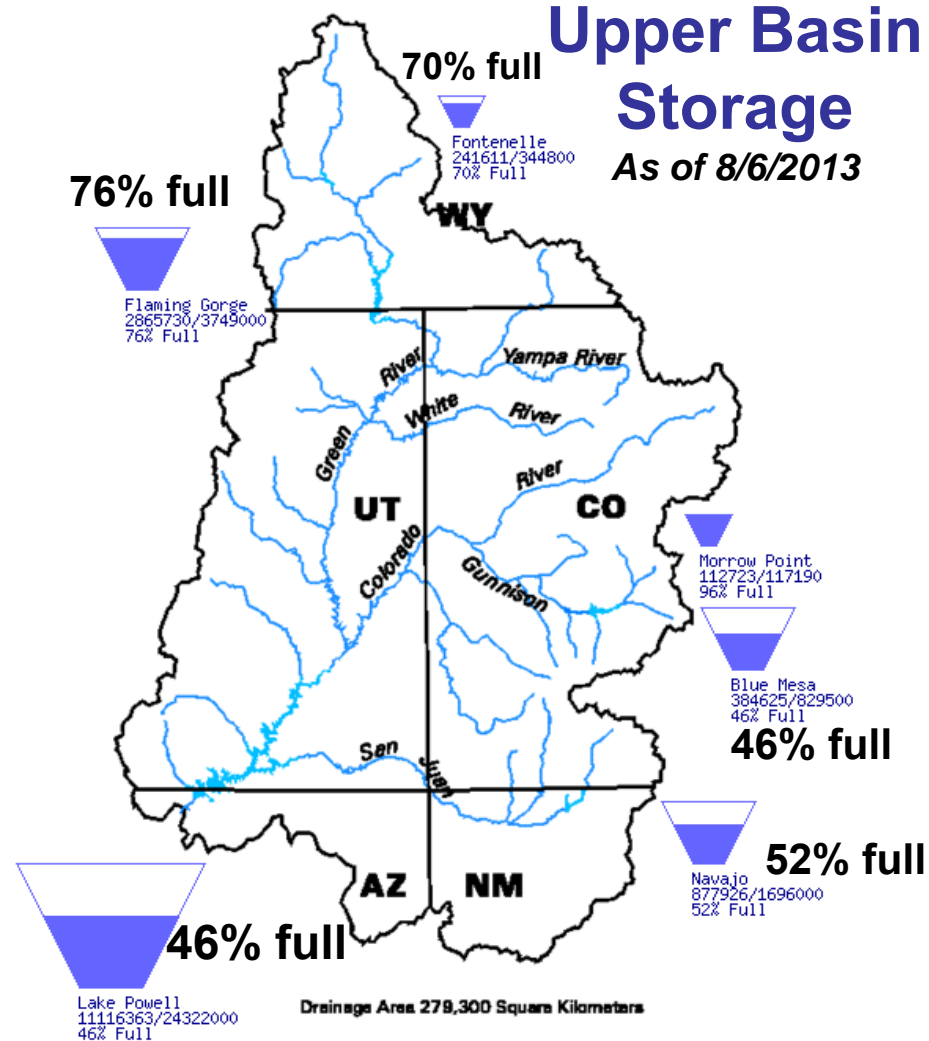
# Upper Basin Current Status

Data Current as of:  
08/06/2013

## Upper Colorado River Drainage Basin

### Upper Basin Storage

As of 8/6/2013



## 2013 April – July Observed Unregulated Inflow

Reservoir	Volume (kaf)	Percent of Average <sup>1</sup>
Fontenelle	317	44
Flaming Gorge	361	37
Blue Mesa	346	51
Navajo	267	36
Powell	2559	36

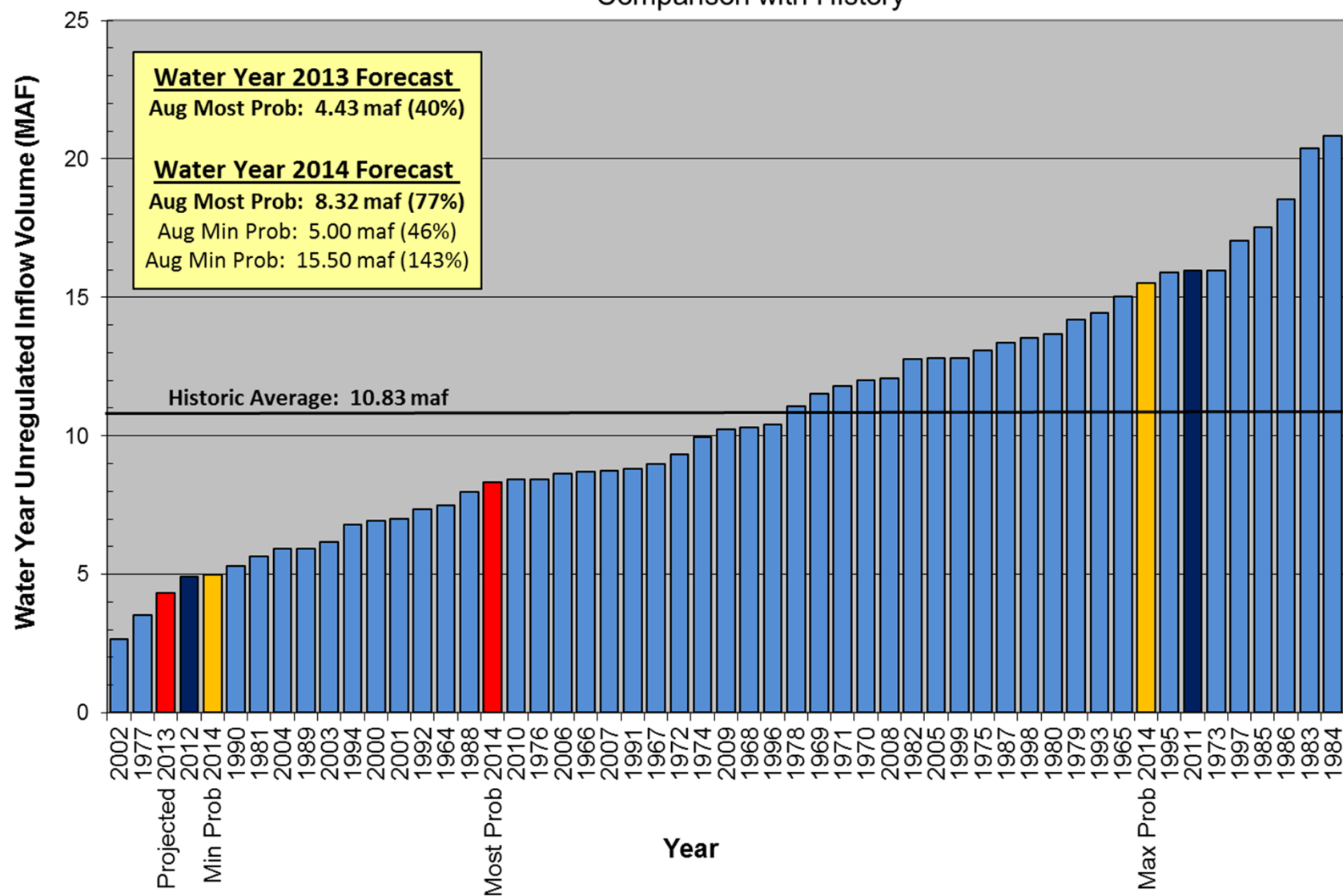
<sup>1</sup> Percentages and percent of average based on period of record from 1981-2010.

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# Lake Powell Unregulated Inflow

## Water Years 2013 and 2014 Forecast *(issued August 1)*

### Comparison with History

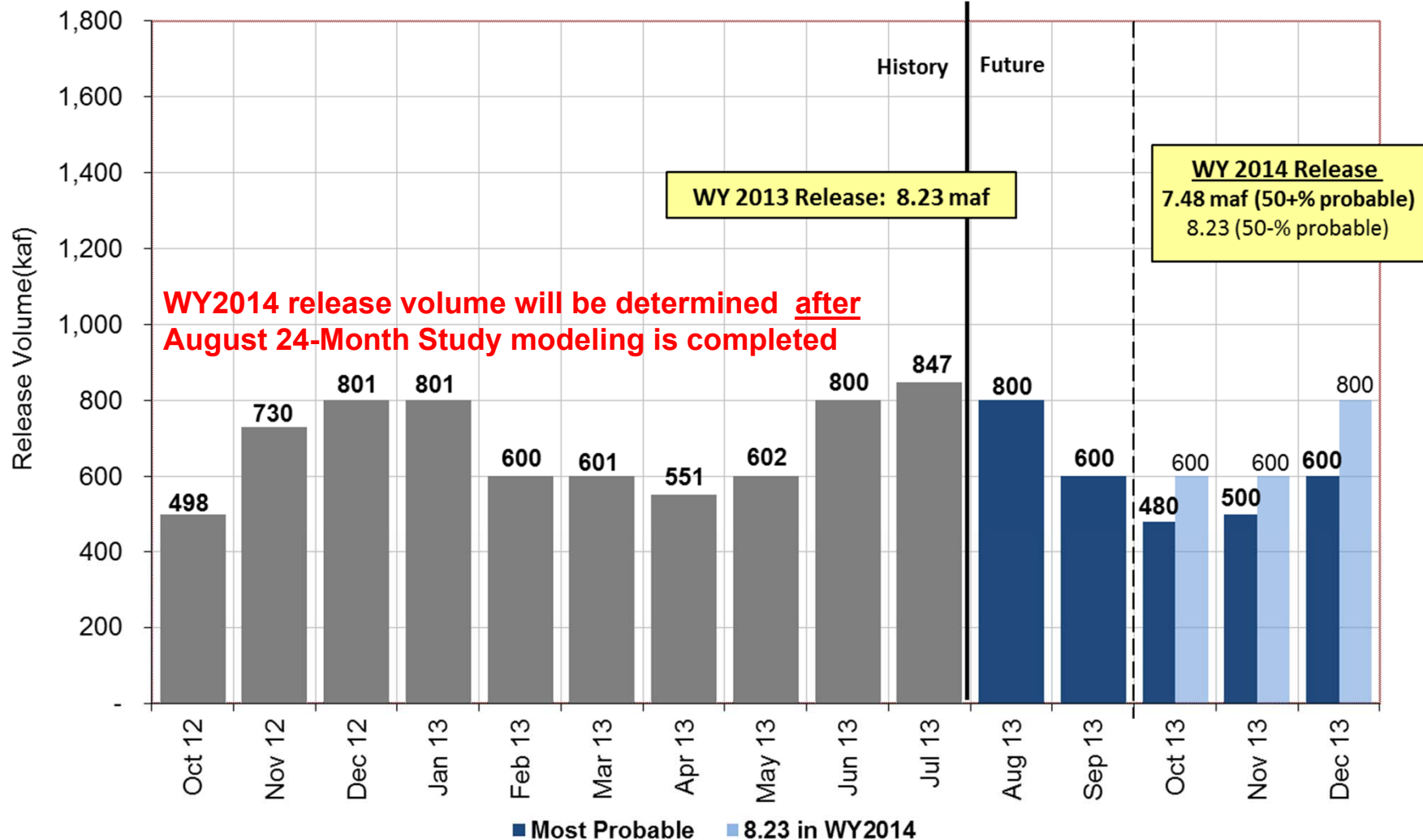


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# Lake Powell Monthly Release Volume Distribution

July 2013 24-Month Study

Water Year 2013

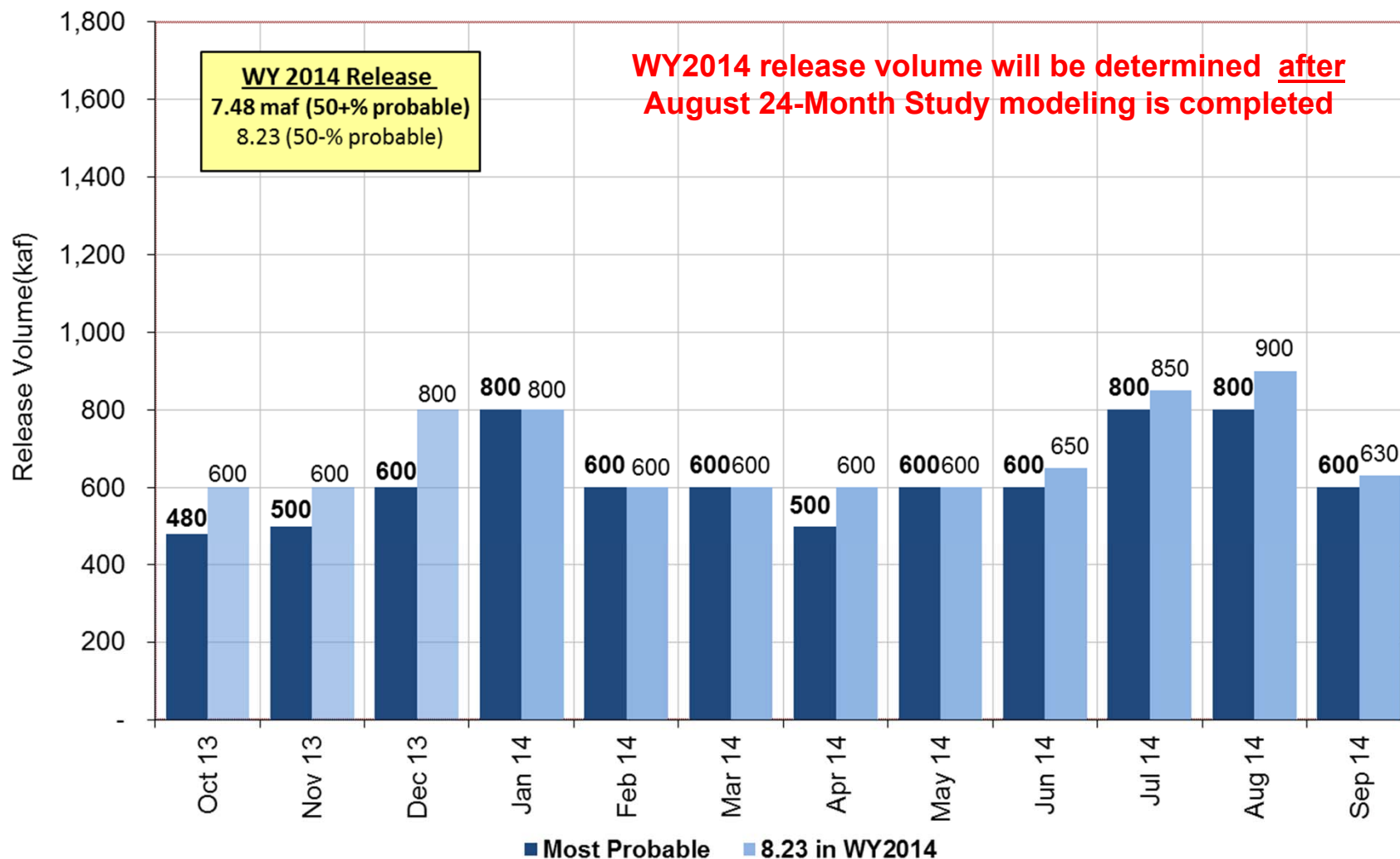


# RECLAMATION

# Lake Powell Monthly Release Volume Distribution

July 2013 24-Month Study

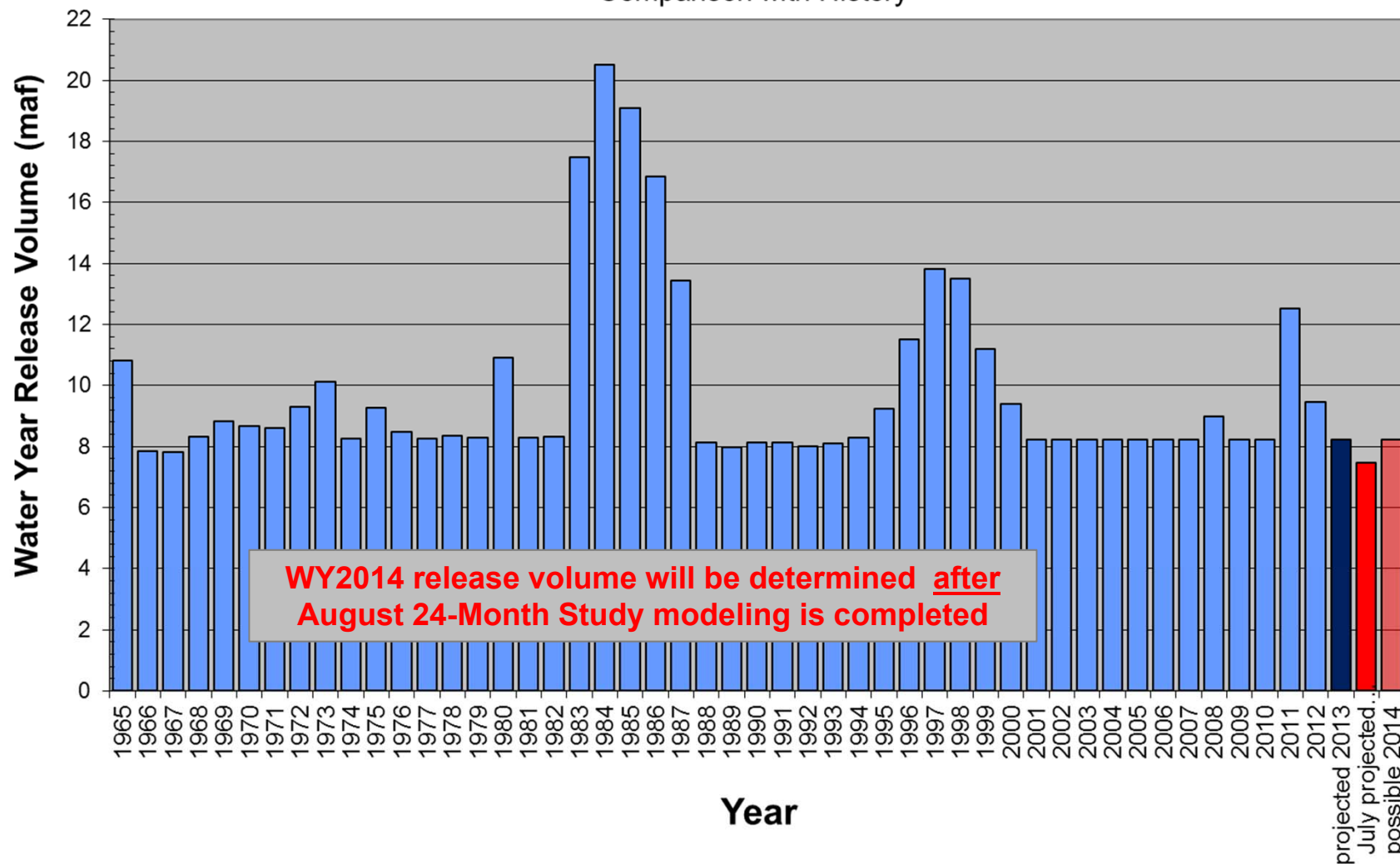
Water Year 2014



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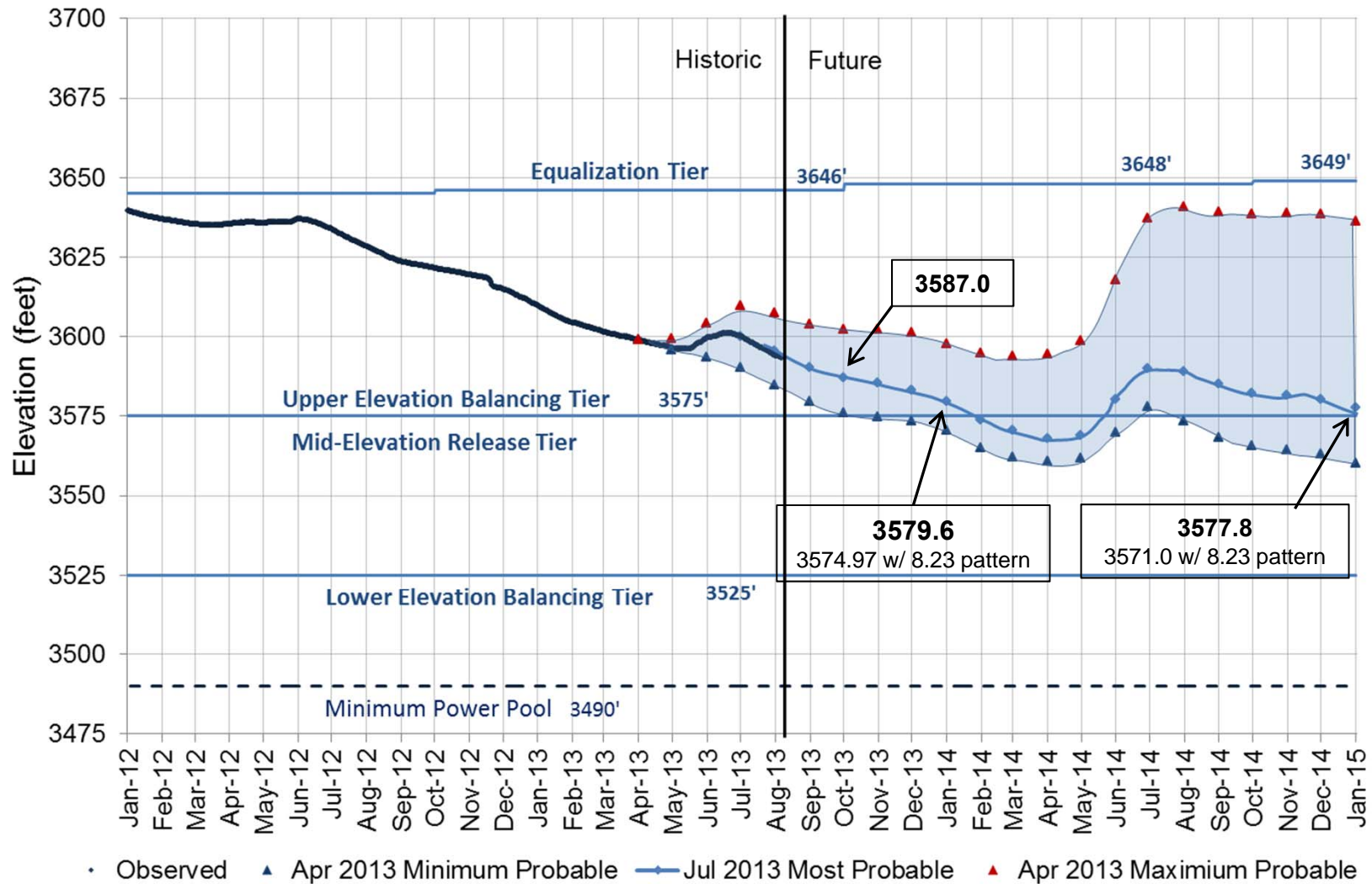
# **Lake Powell Release** **Water Year 2013 and 2014 Projected** Comparison with History



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## Lake Powell Elevations Historic and Projected based on JULY modeling



**WY2014 operational tier will be determined after August 24-Month Study modeling is completed**

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# Lake Powell & Lake Mead Operational Table

## Projected Operational Tiers for 2014 based on the July 2013 24-Month Study

Lake Powell			Lake Mead		
Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) <sup>1</sup>	Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) <sup>1</sup>
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)		15.5 - 19.3 (2008-2026)	1,200 (approx.) <sup>2</sup>	Domestic Surplus or ICS Surplus Condition Deliver > 7.5 maf	22.9 (approx.) <sup>2</sup>
	Upper Elevation Balancing Tier <sup>3</sup> Release 8.23 maf; if Lake Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf		1,145		15.9
3,575		9.5	1,105	Normal or ICS Surplus Condition Deliver ≥ 7.5 maf	11.9
3,525	Mid-Elevation Release Tier Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	5.9	1,075	Shortage Condition Deliver 7.167 <sup>4</sup> maf	9.4
			1,050	Shortage Condition Deliver 7.083 <sup>5</sup> maf	7.5
3,490	Lower Elevation Balancing Tier Balance contents with a min/max release of 7.0 and 9.5 maf	4.0	1,025	Shortage Condition Deliver 7.0 <sup>6</sup> maf	5.8
			1,000	Further measures may be undertaken <sup>7</sup>	4.3

**WY2014 operational tiers will be determined after August 24-Month Study modeling is completed**

Diagram not to scale

<sup>1</sup> Acronym for million acre-feet

<sup>2</sup> 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.

<sup>3</sup> Subject to April adjustments which may result in a release according to the Equalization Tier

<sup>4</sup> Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

<sup>5</sup> Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

<sup>6</sup> Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

<sup>7</sup> 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.

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# Probabilities of Occurrence of Event or System Condition

## Results from July 2013 CRSS<sup>1,2</sup> (values in percent)

	Event or System Condition	2014	2015	2016	2017	2018
<b>Upper Basin – Lake Powell</b>	<b>Equalization Tier</b>	<b>0</b>	<b>14</b>	<b>19</b>	<b>23</b>	<b>30</b>
	<i>Equalization – annual release &gt; 8.23 maf</i>	0	14	19	23	30
	<i>Equalization – annual release = 8.23 maf</i>	0	0	0	0	0
	<b>Upper Elevation Balancing Tier</b>	<b>0</b>	<b>45</b>	<b>50</b>	<b>48</b>	<b>39</b>
	<i>Upper Elevation Balancing – annual release &gt; 8.23 maf</i>	0	12	35	33	29
	<i>Upper Elevation Balancing – annual release = 8.23 maf</i>	0	33	15	15	9
	<i>Upper Elevation Balancing – annual release &lt; 8.23 maf</i>	0	0	0	0	1
	<b>Mid-Elevation Release Tier</b>	<b>100</b>	<b>38</b>	<b>19</b>	<b>17</b>	<b>18</b>
	<i>Mid-Elevation Release – annual release = 8.23 maf</i>	0	0	0	0	1
	<i>Mid-Elevation Release – annual release = 7.48 maf</i>	100	38	19	17	17
	<b>Lower Elevation Balancing Tier</b>	<b>0</b>	<b>3</b>	<b>12</b>	<b>12</b>	<b>13</b>
<b>Lower Basin – Lake Mead</b>	<b>Shortage Condition – any amount (Mead ≤ 1,075 ft)</b>	<b>0</b>	<b>2</b>	<b>51</b>	<b>59</b>	<b>60</b>
	<i>Shortage – 1<sup>st</sup> level (Mead ≤ 1,075 and ≥ 1,050)</i>	0	2	49	40	31
	<i>Shortage – 2<sup>nd</sup> level (Mead &lt; 1,050 and ≥ 1,025)</i>	0	0	2	18	24
	<i>Shortage – 3<sup>rd</sup> level (Mead &lt; 1,025)</i>	0	0	0	1	5
	<b>Surplus Condition – any amount (Mead ≥ 1,145 ft)</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>7</b>	<b>9</b>
	<i>Surplus – Flood Control</i>	0	0	0	1	2
	<b>Normal or ICS Surplus Condition</b>	<b>100</b>	<b>98</b>	<b>48</b>	<b>34</b>	<b>31</b>

<sup>1</sup> Reservoir initial conditions based on projected levels on December 31, 2013, from the July 2013 24-Month Study

<sup>2</sup> Hydrologic inflow traces based on resampling of the observed natural flow record from 1906-2010

## Glen Canyon Power Plant Planned Unit Outage Schedule for Water Year 2013

Unit Number	Oct 2012	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2013	Jun 2013	Jul 2013	Aug 2013	Sep 2013
1												
2												
3												
4												
5												
6												
7												
8												
Units Available	5	8 7	7	7	5	5 6	6	5	6	6	6	5
Capacity (cfs)	19,500	25,200 21,700	21,800	21,600	14,800	14,900 18,600	18,600	14,700	18,000	17,900	17,900	15,200
Capacity (kaf/month)	1310	1380	1290	1290	920	1090	1110	980	1070	1110	1110	910
Max (kaf) <sup>1</sup>	--	--	--	--	--	--	--	--	--	--	800	600
Most (kaf) <sup>2</sup>	494	730	801	801	600	600	551	602	800	847	800	600
Min (kaf) <sup>1</sup>	--	--	--	--	--	--	--	--	--	--	800	600

1 Based on Apr 2013 Min / Max probable 24-Month Study

2 Based on July 2013 Most probable 24-Month Study

(updated 8-7-2013)

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## Glen Canyon Power Plant Provisional Unit Outage Schedule for Water Year 2014

Unit Number	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014	May 2014	Jun 2014	Jul 2014	Aug 2014	Sep 2014
1												
2												
3												
4												
5												
6												
7												
8												
Units Available	5	6	6	6	4	5 6	6	5 6	6	6	6	5
Capacity (cfs)	15,100	17,800 <sup>3</sup>	17,800	17,800	12,800	14,300 17,800	17,800	14,300 17,800	17,800	17,900	17,900	14,600
Capacity (kaf/month)	930	1060	1100	1100	710	1000	1040	990	1080	1100	1100	890
Max (kaf) <sup>1</sup>	600	600	800	800	600	600	600	600	650	850	900	630
Most (kaf) <sup>2</sup>	480	500	600	800	600	600	500	600	600	800	800	600
Min (kaf) <sup>1</sup>	480	500	600	800	600	600	500	600	600	800	800	600

<sup>1</sup> Based on Apr 2013 Min/Max probable 24-Month Study

(updated 8-7-2013)

<sup>2</sup> Based on July 2013 Most probable 24-month Study

<sup>3</sup> Total release during a HFE = Capacity +15,000 cfs bypass  
( e.g., Nov 2013 Total Possible Release = ~32,800 cfs)

# RECLAMATION

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Resource Management Division  
Water Resources Group

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Extra slides follow

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# 2013 Annual Operating Plan (retrospective)

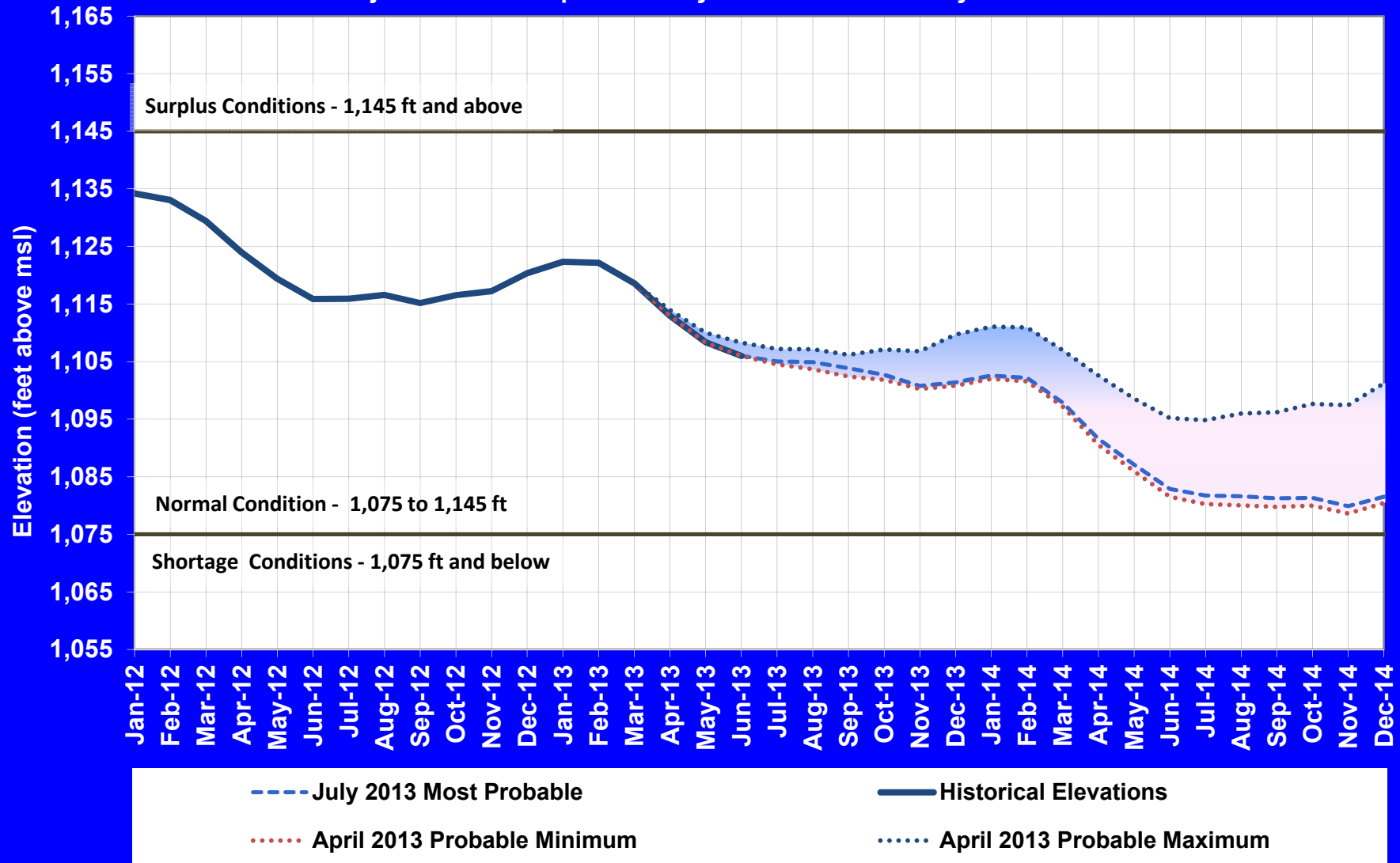
## Lake Powell Unregulated Inflow WY2013

Scenario	2013 AOP WY 2013  Developed Aug 2012	Current Most Probable WY 2013  Developed Aug 2013
Minimum Probable	5.00 maf (46 %) <sup>1</sup>	4.43 maf (40 %)
Most Probable	8.85 maf (82 %)	
Maximum Probable	16.00 maf (148 %)	

<sup>1</sup> Percentages and percent of average based on period of record from 1981-2010.

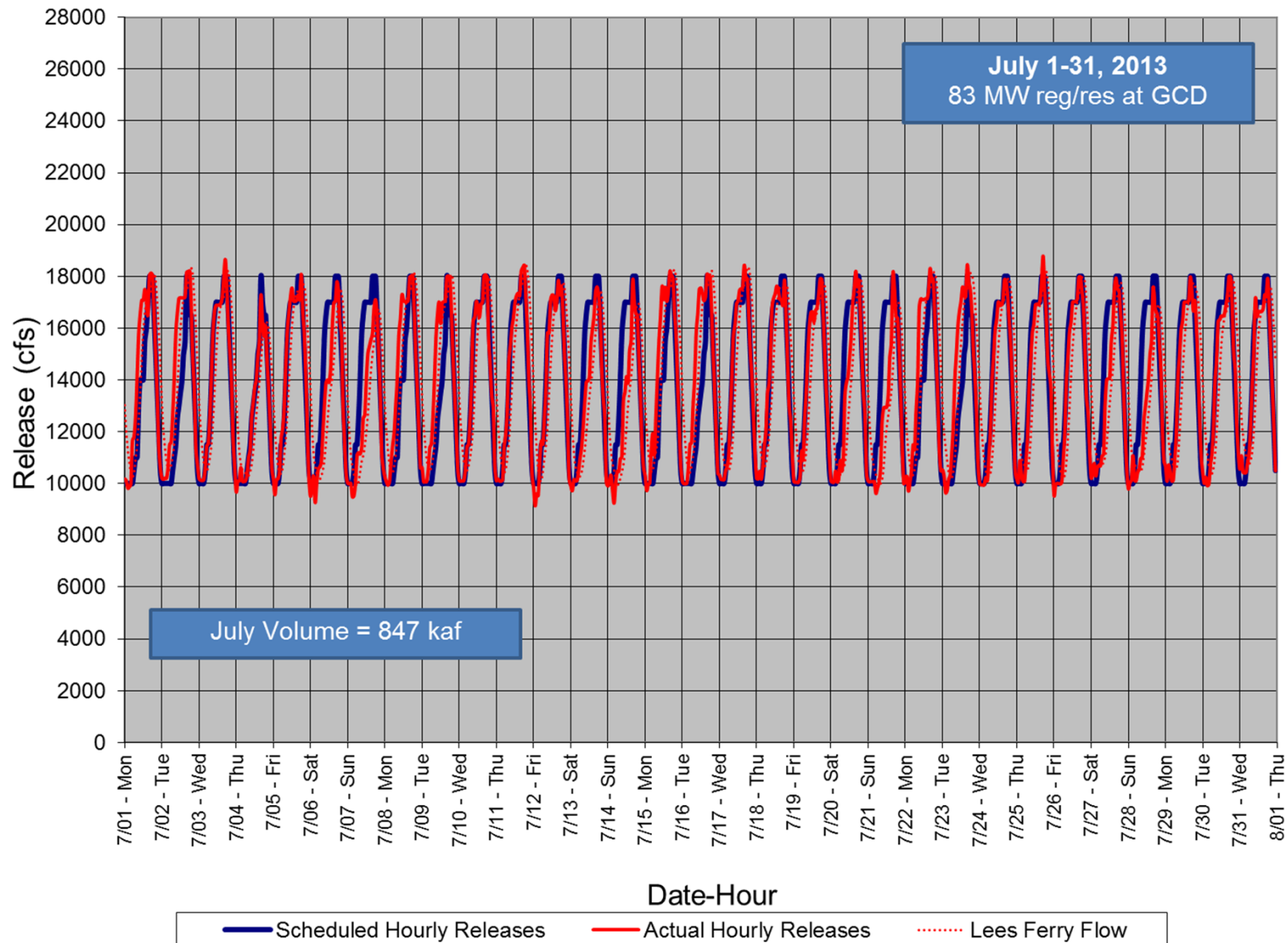
# Lake Mead End of Month Elevations

Projections from April and July 2013 24-Month Study Inflow Scenarios



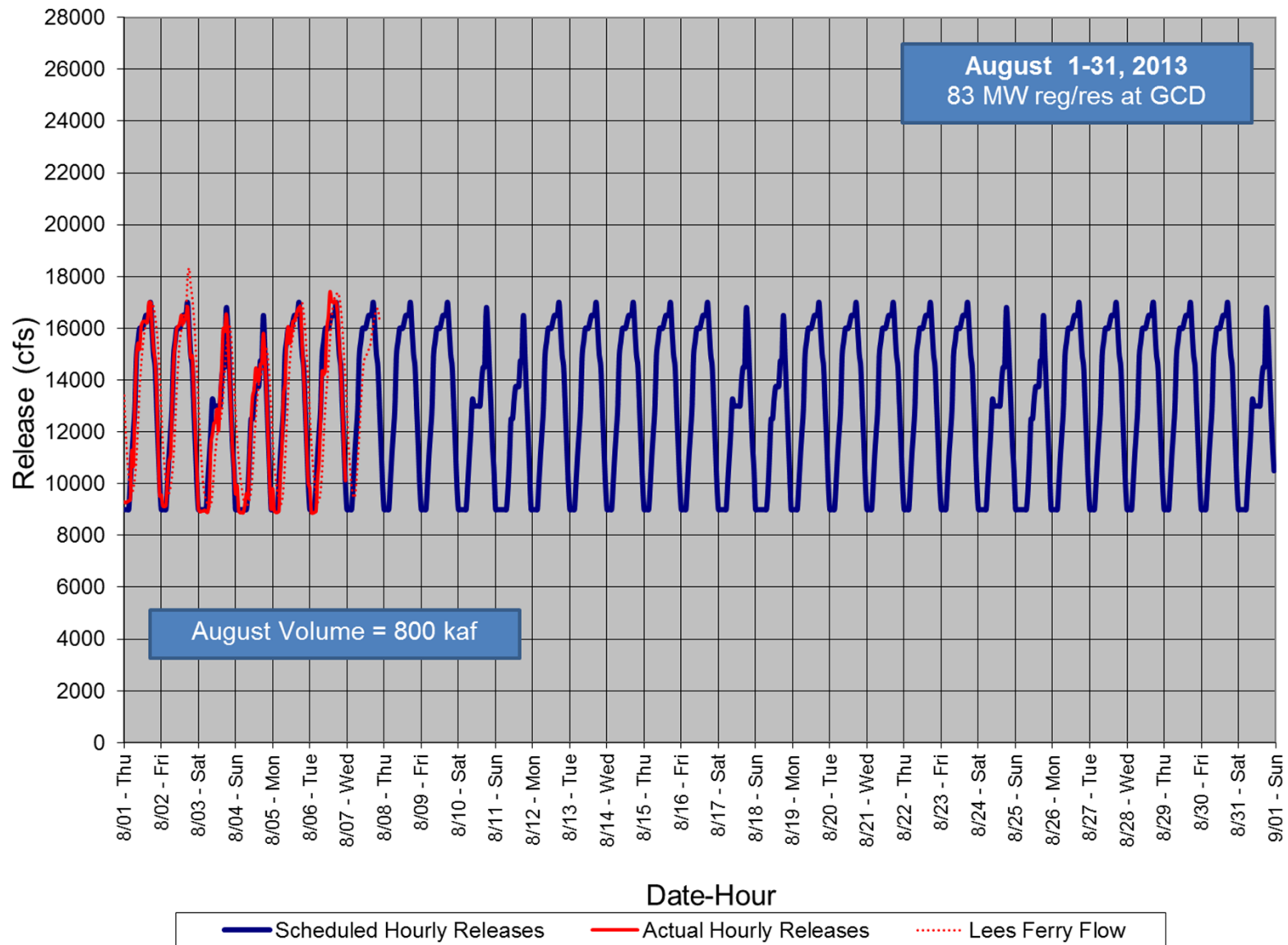
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## Glen Canyon Dam Hourly Release Pattern JULY 2013



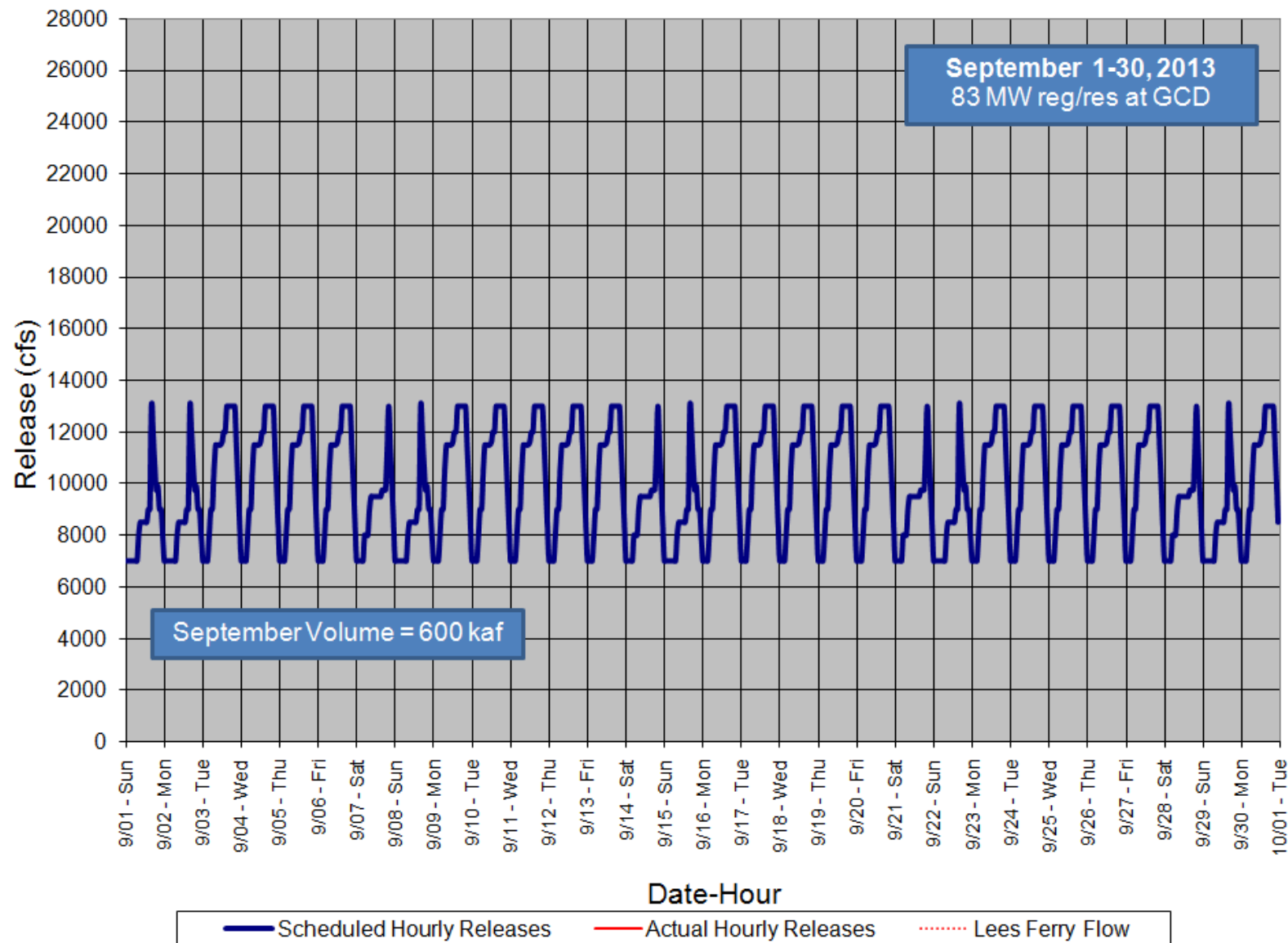
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## Glen Canyon Dam Hourly Release Pattern AUG 2013



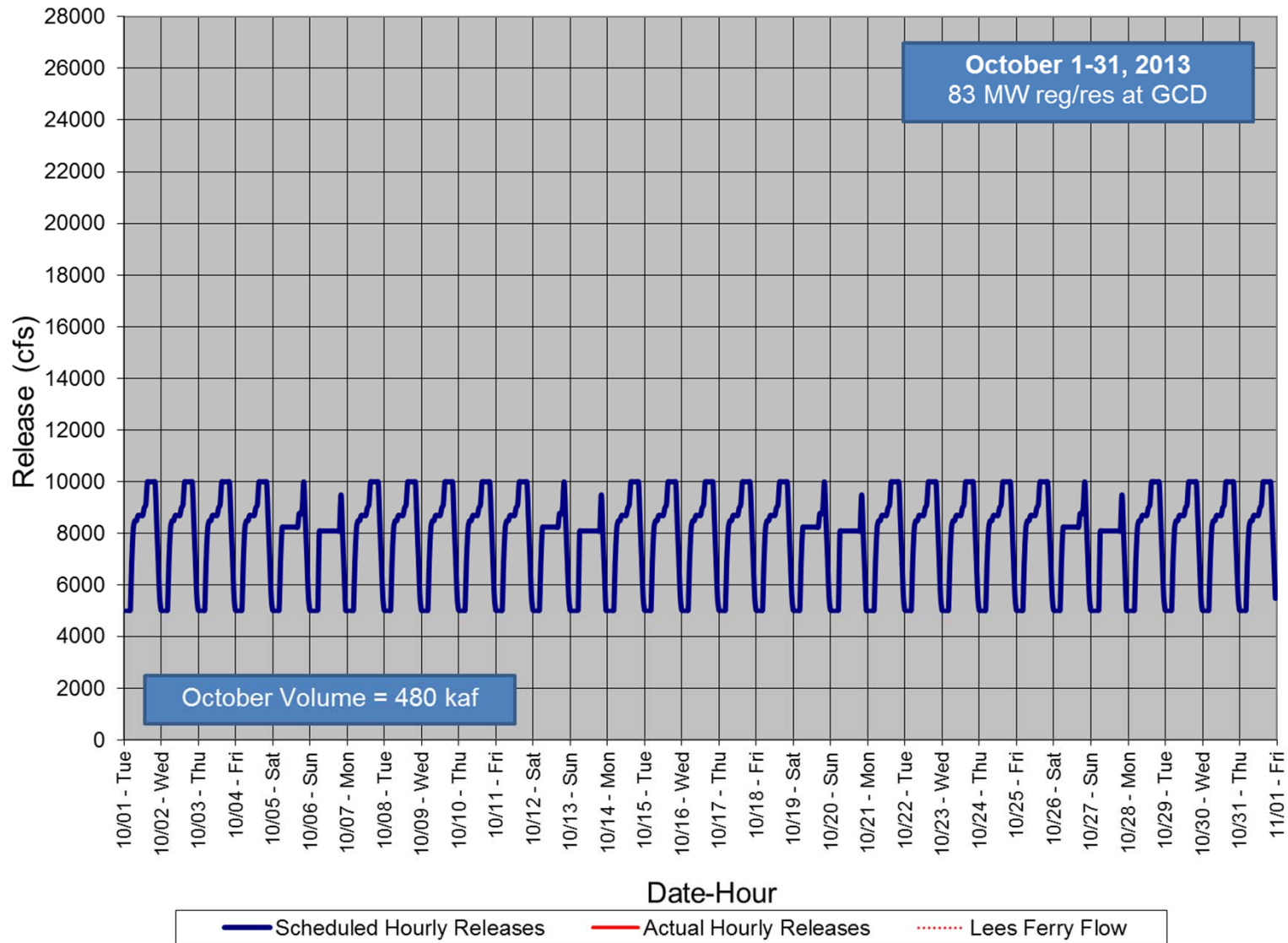
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## Glen Canyon Dam Hourly Release Pattern SEP 2013



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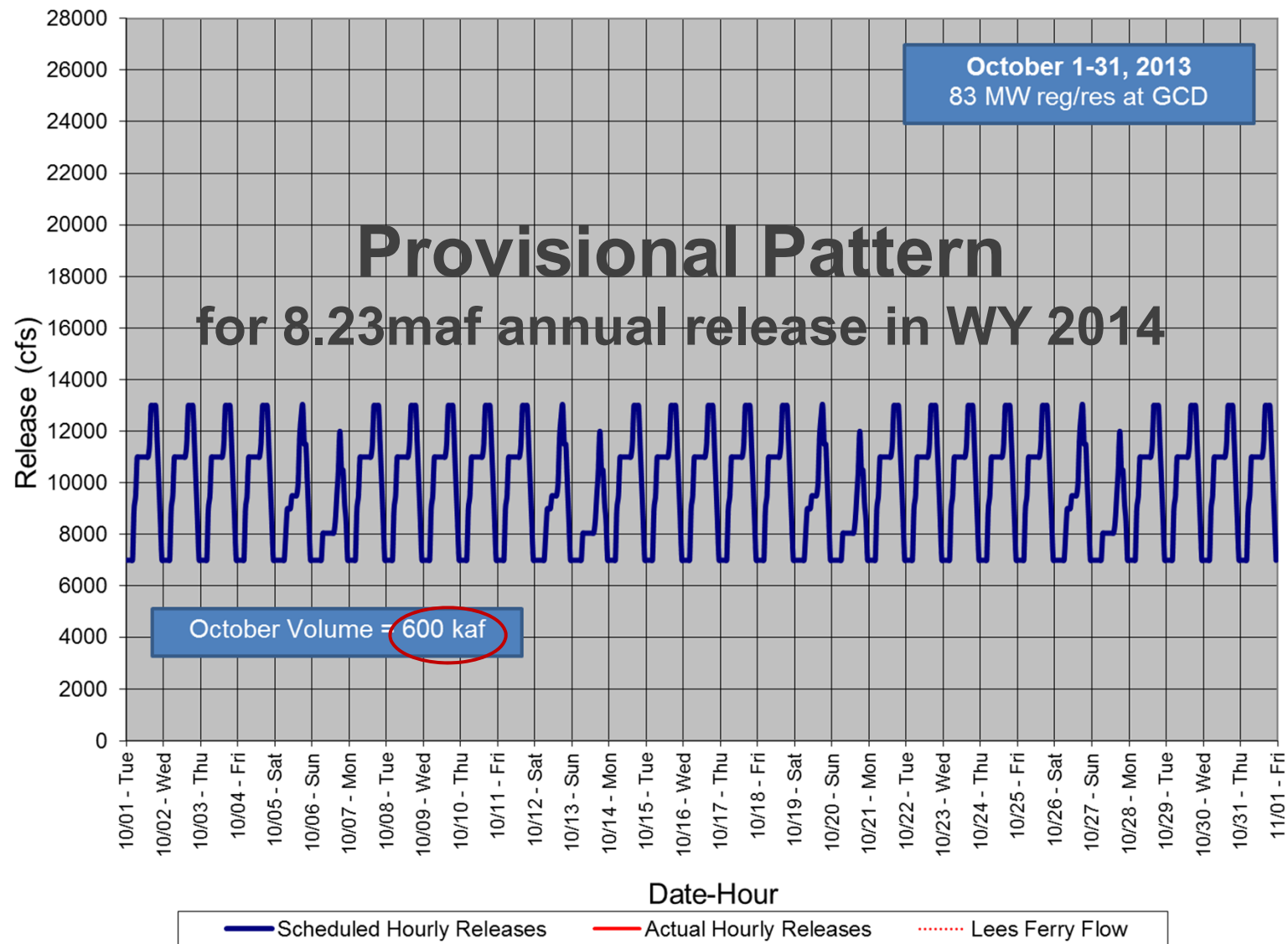
## Glen Canyon Dam Hourly Release Pattern OCT 2013



# RECLAMATION



## Glen Canyon Dam Hourly Release Pattern OCT 2013



# RECLAMATION