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*Managing Water in the West*

## **The Colorado River Basin: Current Reservoir Conditions**

**Upper Colorado River Basin Water Forum  
November 6, 2014**



U.S. Department of the Interior  
Bureau of Reclamation

# The Colorado River Basin: Current Reservoir Conditions

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- Lower Colorado River Basin – Shana Tighi



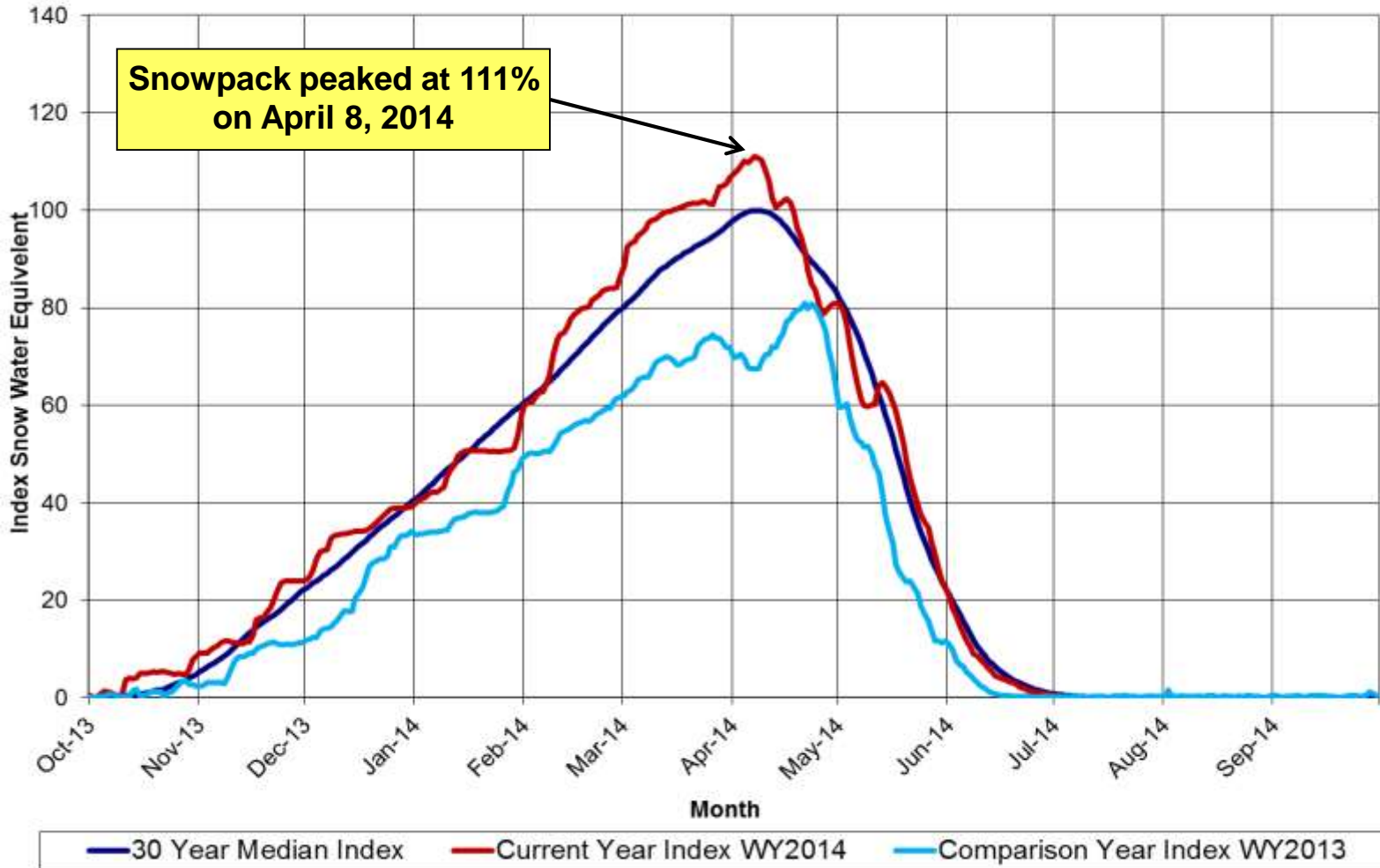
# Upper Colorado River Basin Hydrology and Operations

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# Upper Basin Hydrology

Upper Colorado River Basin Snotel Tracking  
Aggregate of 116 Snotel Sites above Lake Powell



Data Provided by the Natural Resource Conservation Service

[http://www.usbr.gov/uc/water/notice/Graphs/Upper\\_Colorado.html](http://www.usbr.gov/uc/water/notice/Graphs/Upper_Colorado.html)

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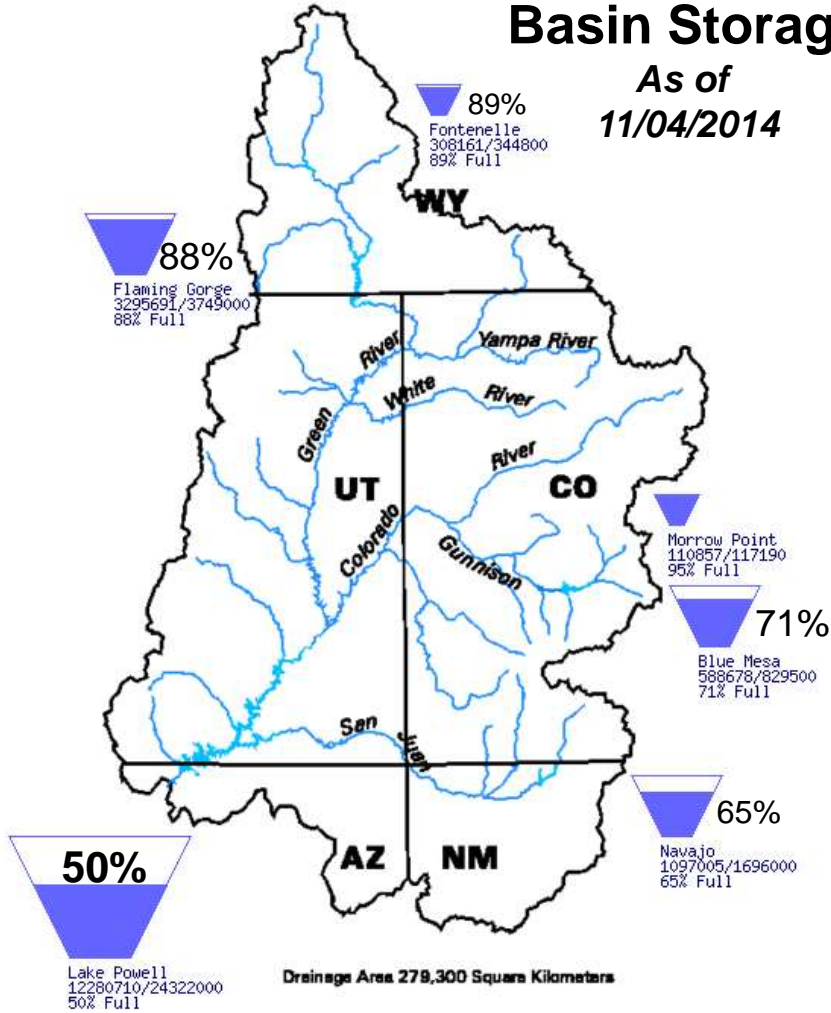
# Upper Basin Storage

Data Current as of:  
11/04/2014

## Upper Colorado River Drainage Basin

### Basin Storage

As of  
11/04/2014



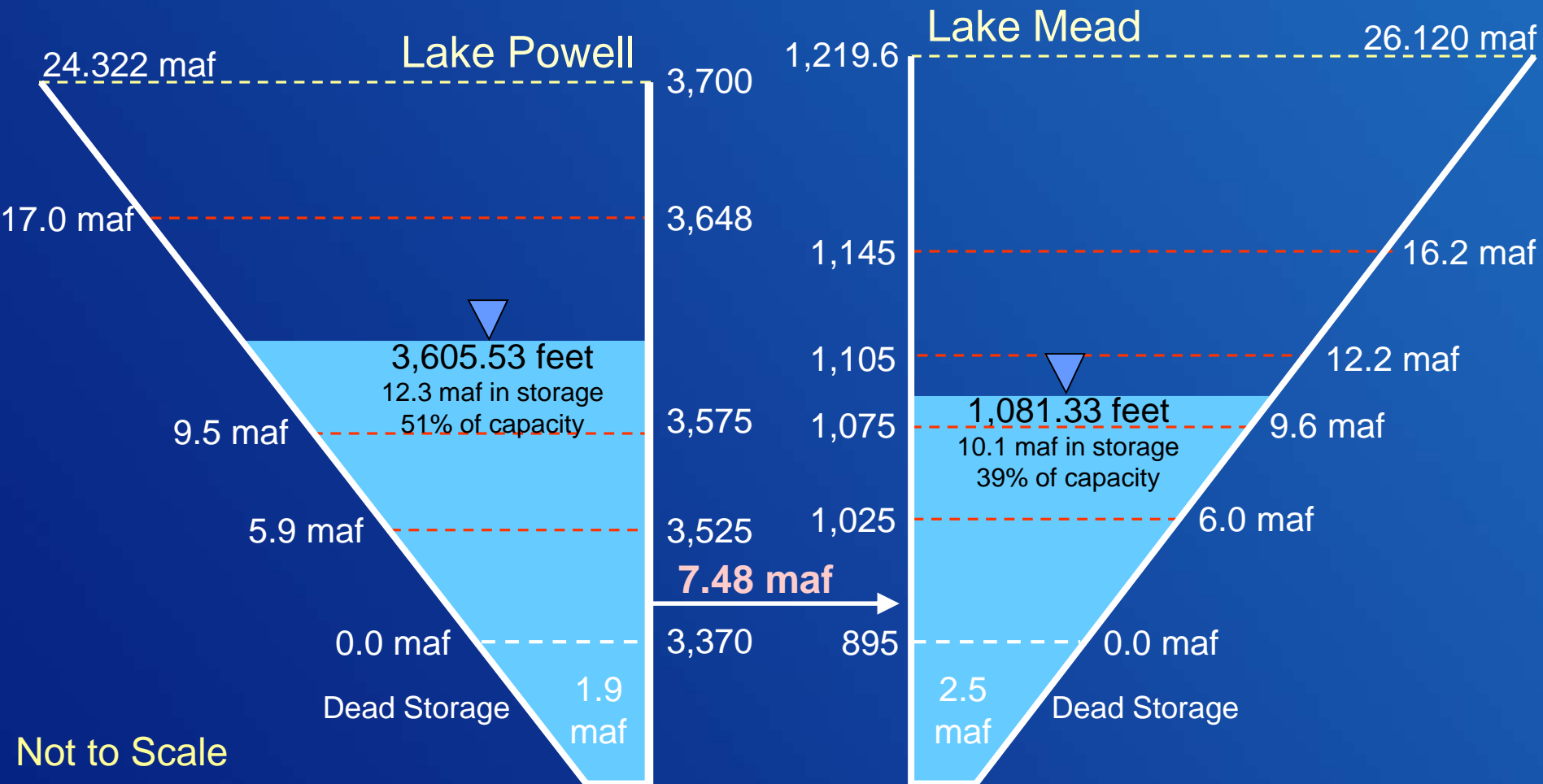
## Water Year 2014 Observed Unregulated Inflow

Reservoir	WY 2014 Inflow (KAF)	Percent of Average <sup>1</sup>
Fontenelle	1,424	132%
Flaming Gorge	1,689	116%
Blue Mesa	1,145	120%
Navajo	696	65%
Powell	10,381	96%

<sup>1</sup> 1981-2010 period

# End of Water Year 2014 Conditions

Observed Unregulated Inflow into Powell<sup>1</sup> = 10.38 maf (96% of average)



Not to Scale

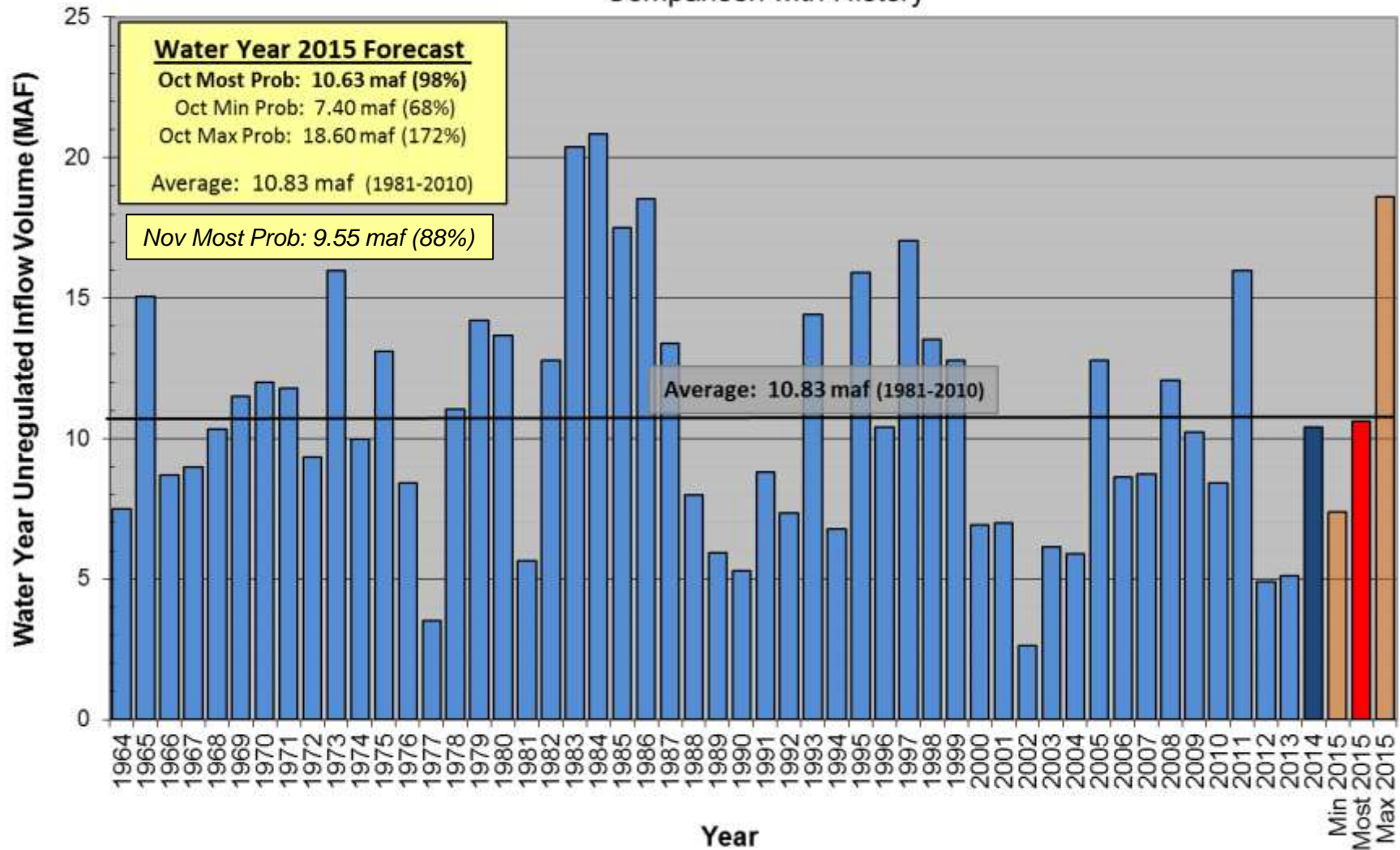
<sup>1</sup> Percent of average inflow is based on the 30-year period of record from 1981-2010 .



# Lake Powell Unregulated Inflow

## Water Year 2015 Forecast *(issued Oct 1)*

### Comparison with History

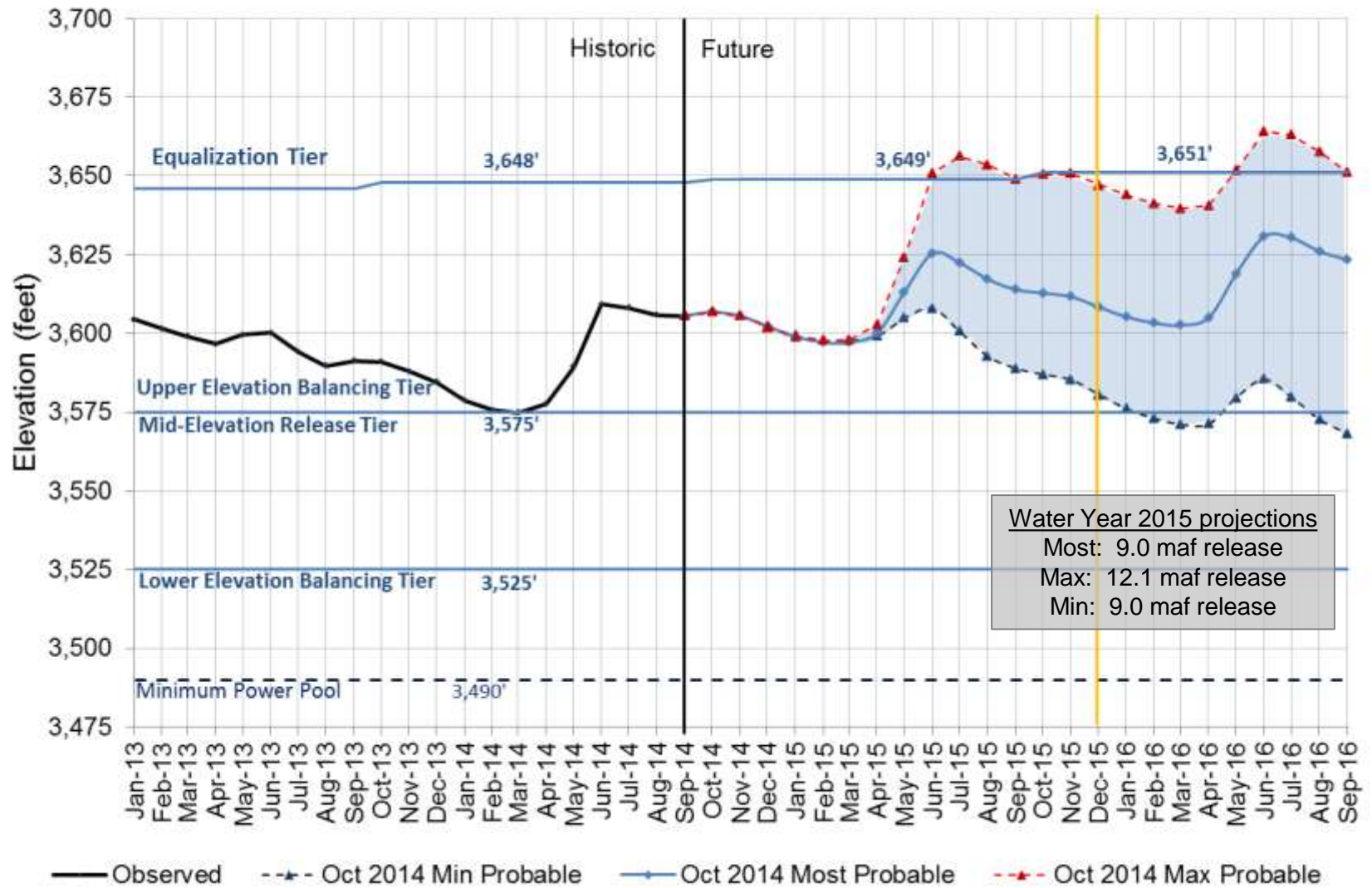


Observed Water Year 2014: 10.38 maf (96%)



# Lake Powell End of Month Elevations

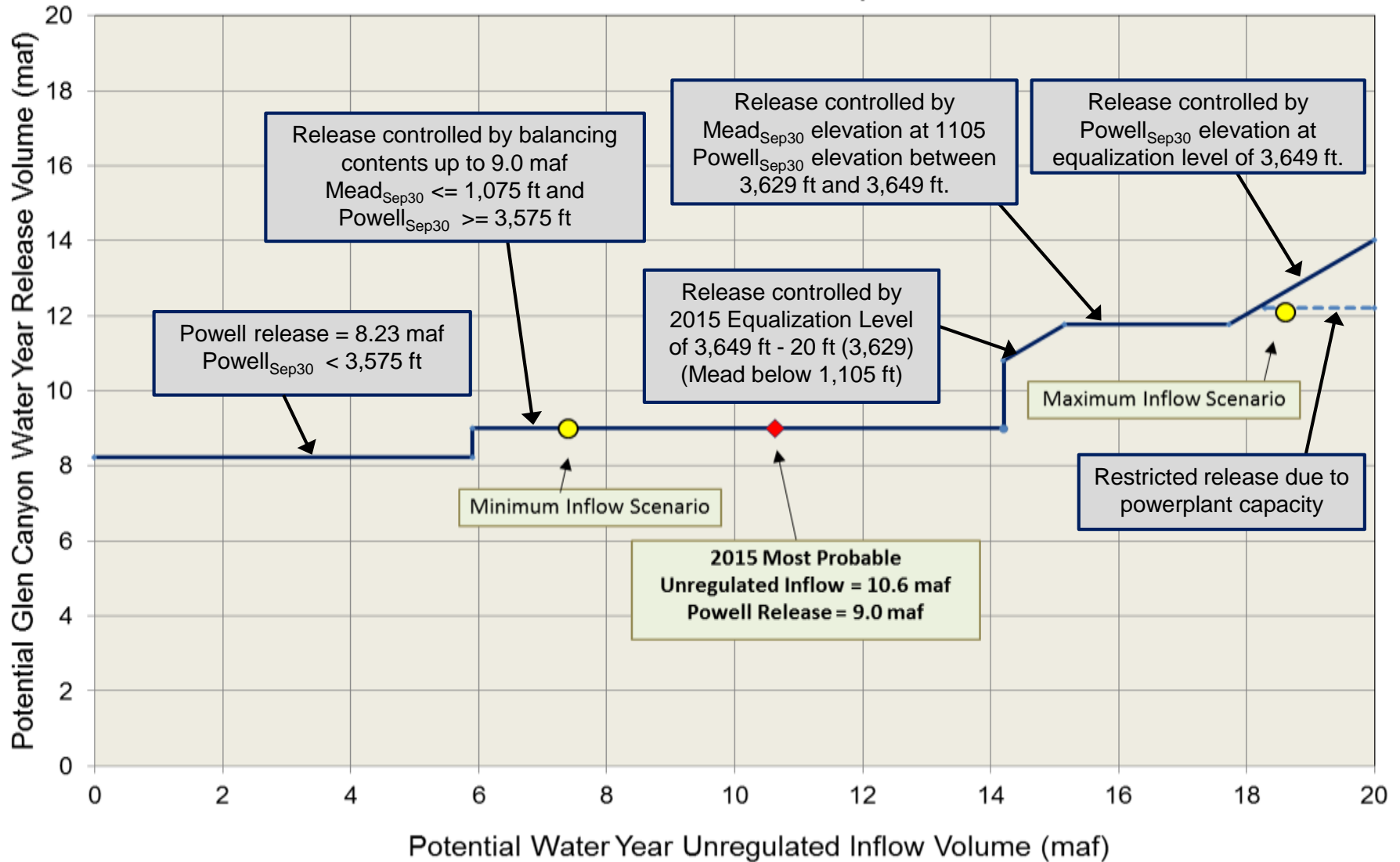
Historic and projected based on October 2014 modeling



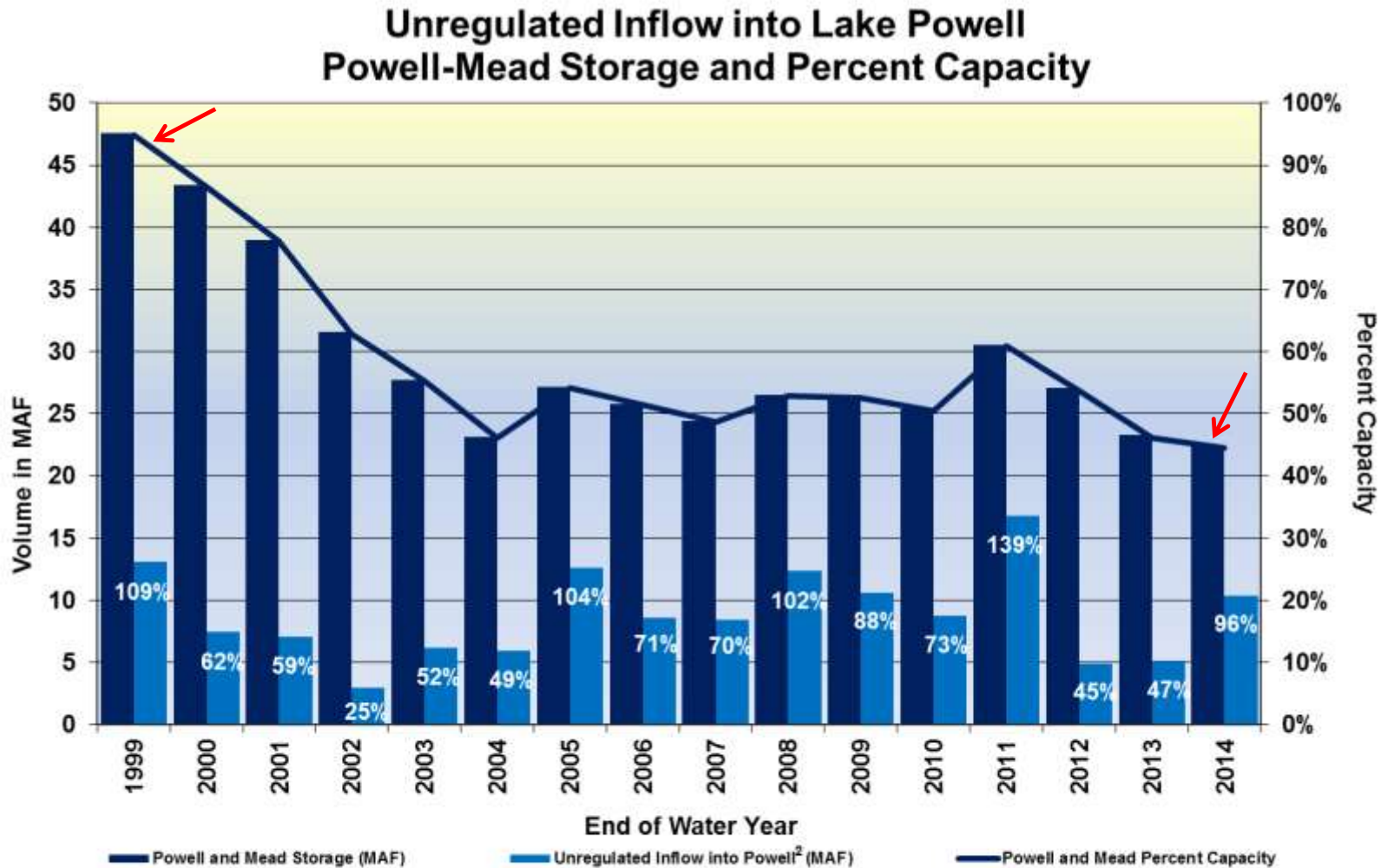


# Potential Lake Powell Release Scenarios

Water Year 2015 Release Volume as a Function of Unregulated Inflow Volume  
based on October 2014 24-Month Study Conditions



# State of the System (Water Years 1999-2014)<sup>1</sup>



<sup>1</sup>Percentages at the top of the light blue bars represent percent of average unregulated inflow into Lake Powell for a given water year. Water years 1999-2011 are based on the 30-year average from 1971 to 2000. Water years 2012-2014 are based on the 30-year average from 1981-2010.

# Colorado River Drought

- 2000-2014 was the driest 15-year period in over 100 years of historical records (2011-2014 are estimated)
- Tree-ring reconstructions show more severe droughts have occurred over the past 1200 years (e.g., drought in the mid 1100s)
- The observed 2014 WY Lake Powell inflow was 96% of average<sup>1</sup>
- Not unusual to have a few years of above average inflow during longer-term droughts (e.g., the 1950s)

# Percent of Traces with Event or System Condition

## Results from October 2014 CRSS<sup>1,2,3</sup> (values in percent)

	Event or System Condition	2015	2016	2017	2018	2019
<b>Upper Basin – Lake Powell</b>	<b>Equalization Tier</b>	8	23	25	26	30
	<i>Equalization – annual release &gt; 8.23 maf</i>	8	23	25	26	29
	<i>Equalization – annual release = 8.23 maf</i>	0	0	0	0	1
	<b>Upper Elevation Balancing Tier</b> ( <i>Powell &lt; Eq level and ≥ 3,575 ft</i> )	92	59	55	54	45
	<i>Upper Elevation Balancing – annual release &gt; 8.23 maf</i>	49	47	43	41	33
	<i>Upper Elevation Balancing – annual release = 8.23 maf</i>	43	10	11	10	12
	<i>Upper Elevation Balancing – annual release &lt; 8.23 maf</i>	0	2	1	3	0
	<b>Mid-Elevation Release Tier</b> ( <i>Powell &lt; 3,575 and ≥ 3,525 ft</i> )	0	18	18	11	17
	<i>Mid-Elevation Release – annual release = 8.23 maf</i>	0	0	0	1	3
	<i>Mid-Elevation Release – annual release = 7.48 maf</i>	0	18	18	10	14
<b>Lower Elevation Balancing Tier</b> ( <i>Powell ≤ 3,525 ft</i> )	0	0	2	9	8	
<b>Powell below Minimum Power Pool</b> ( <i>Powell &lt; 3,490 ft</i> )	0	0	0	4	6	
<b>Lower Basin – Lake Mead</b>	<b>Shortage Condition – any amount</b> ( <b>Mead ≤ 1,075 ft</b> )	0	25	53	62	61
	<i>Shortage – 1<sup>st</sup> level (Mead ≤ 1,075 and ≥ 1,050)</i>	0	25	40	44	37
	<i>Shortage – 2<sup>nd</sup> level (Mead &lt; 1,050 and ≥ 1,025)</i>	0	0	13	14	14
	<i>Shortage – 3<sup>rd</sup> level (Mead &lt; 1,025)</i>	0	0	0	4	10
	<b>Surplus Condition – any amount</b> ( <b>Mead ≥ 1,145 ft</b> )	0	0	6	9	15
	<i>Surplus – Flood Control</i>	0	0	0	1	2
	<b>Normal or ICS Surplus Condition</b>	100	75	41	29	24

<sup>1</sup> Reservoir initial conditions based on the most probable October 24-month Study projected levels for December 31, 2014.

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

<sup>3</sup> Percentages shown may not be representative of the full range of future possibilities that could occur with different modeling assumptions.

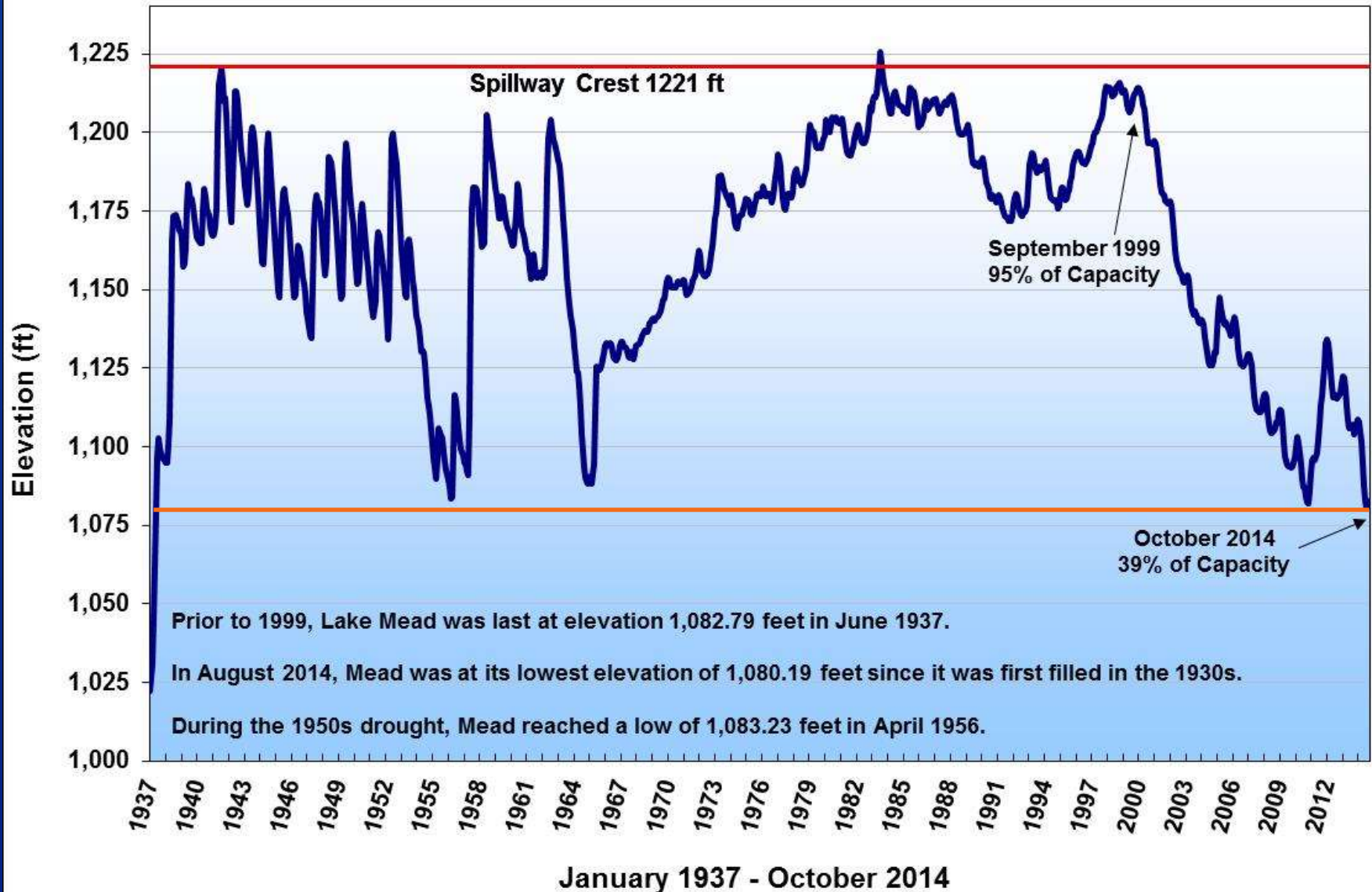


# Lower Colorado River Basin Hydrology and Operations



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# Lake Mead End of Month Elevation





# Overview of the 2007 Interim Guidelines<sup>1</sup>

- In place for an interim period (through 2026) to gain valuable operational experience
- Operations specified through the full range of operation for Lake Powell and Lake Mead
- Strategy for shortages in the Lower Basin, including a provision for additional shortages if warranted<sup>2</sup>
- Encourage efficient and flexible use and management of Colorado River water through the ICS mechanism

<sup>1</sup> Issued in Record of Decision, dated December 13, 2007; available at: <http://www.usbr.gov/lc/region/programs/strategies.html>

<sup>2</sup> Mexico water deliveries are not directly affected by these guidelines

# Lake Powell & Lake Mead Operational Table

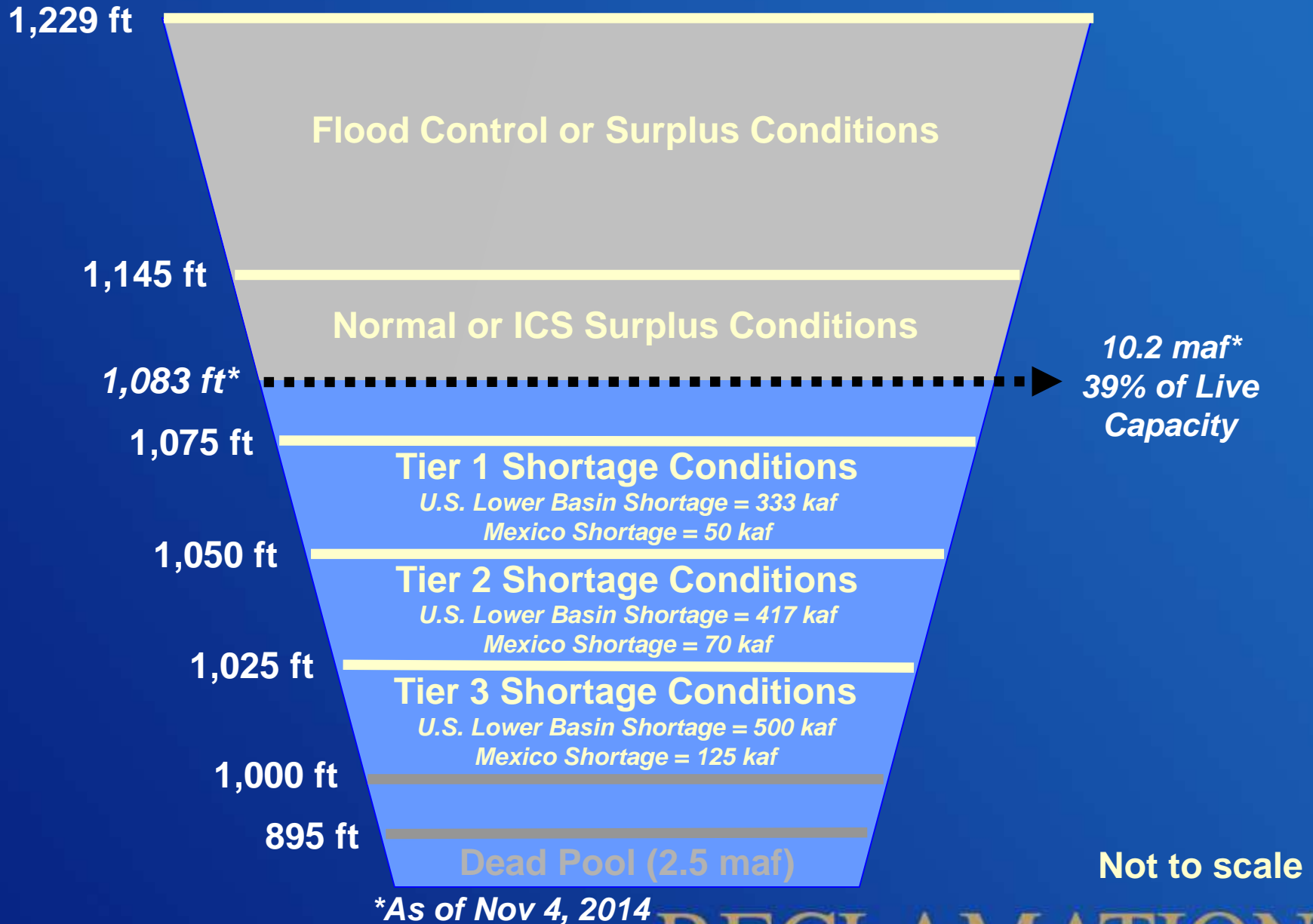
Operational Tiers for Water/Calendar Year 2015 determined with the August 2014 24-Month Study

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	<b>Equalization Tier</b> Equalize, avoid spills or release 8.23 maf	24.3	1,220	<b>Flood Control Surplus or Quantified Surplus Condition</b> Deliver > 7.5 maf	25.9	
3,636 - 3,666 (2008-2026)	<b>Upper Elevation Balancing Tier<sup>2</sup></b> 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.) <sup>2</sup>	<b>Domestic Surplus or ICS Surplus Condition</b> Deliver > 7.5 maf	22.9 (approx.) <sup>2</sup>	
			1,145			
	<b>3,596.62 ft</b> <b>Jan 1, 2015 Projection</b>		1,105	<b>Normal or ICS Surplus Condition</b> Deliver ≥ 7.5 maf	11.9	
3,575	<b>Mid-Elevation Release Tier</b> Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.5		<b>1,083.37 ft</b> <b>Jan 1, 2015 Projection</b>		
					1,075	<b>Shortage Condition</b> Deliver 7.167 <sup>5</sup> maf
3,525	<b>Lower Elevation Balancing Tier</b> Balance contents with a min/max release of 7.0 and 9.5 maf	5.9	1,050	<b>Shortage Condition</b> Deliver 7.083 <sup>5</sup> maf	7.5	
3,490			1,025		<b>Shortage Condition</b> Deliver 7.0 <sup>6</sup> maf Further measures may be undertaken <sup>7</sup>	5.8
3,370			1,000			4.3
		0	895		0	

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.



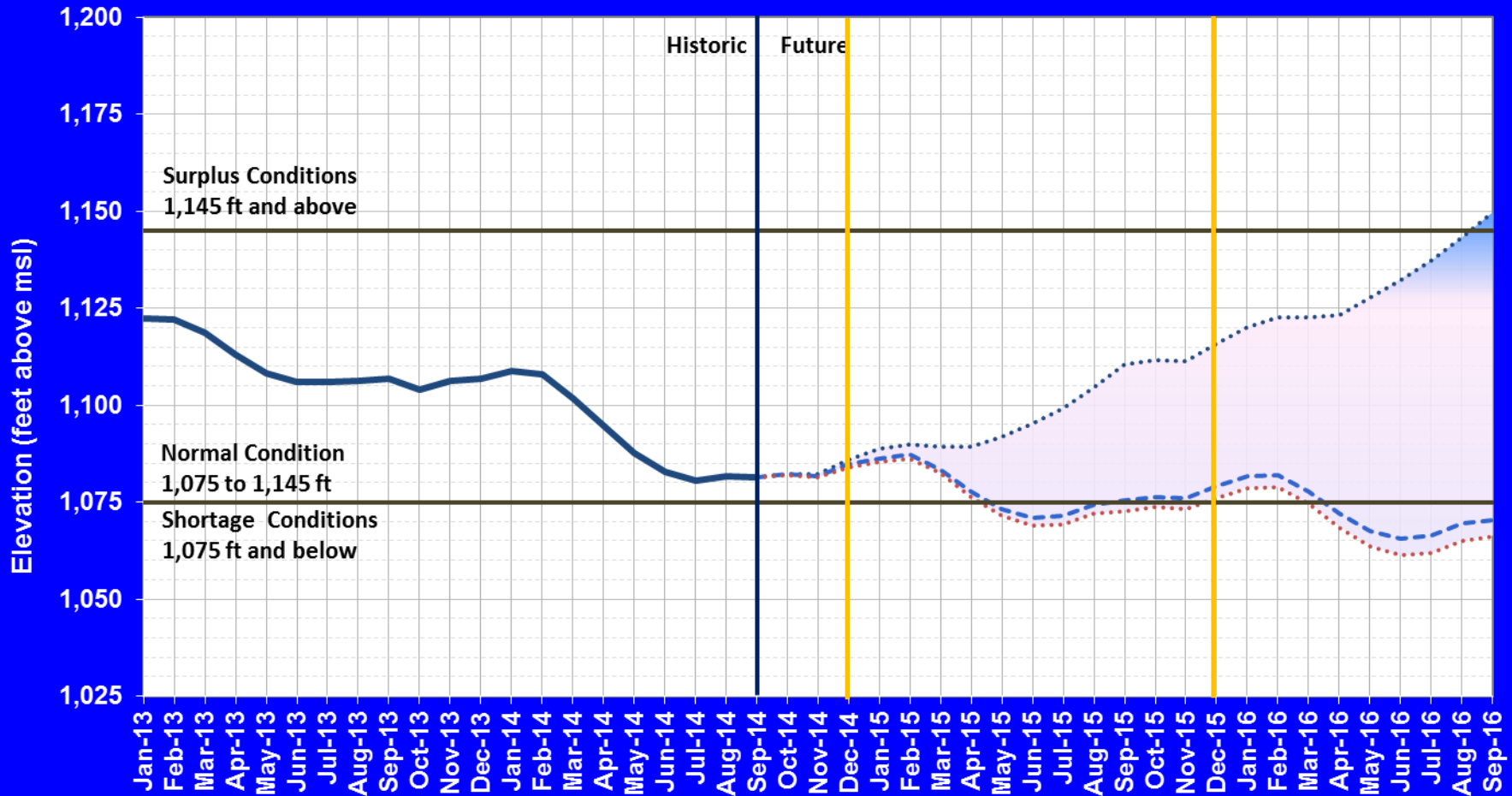
# Lake Mead – Key Elevations<sup>1</sup>



<sup>1</sup> U.S. Lower Basin shortage volumes based on the 2007 Interim Guidelines; Mexico shortage volumes based on IBWC Minute 319.

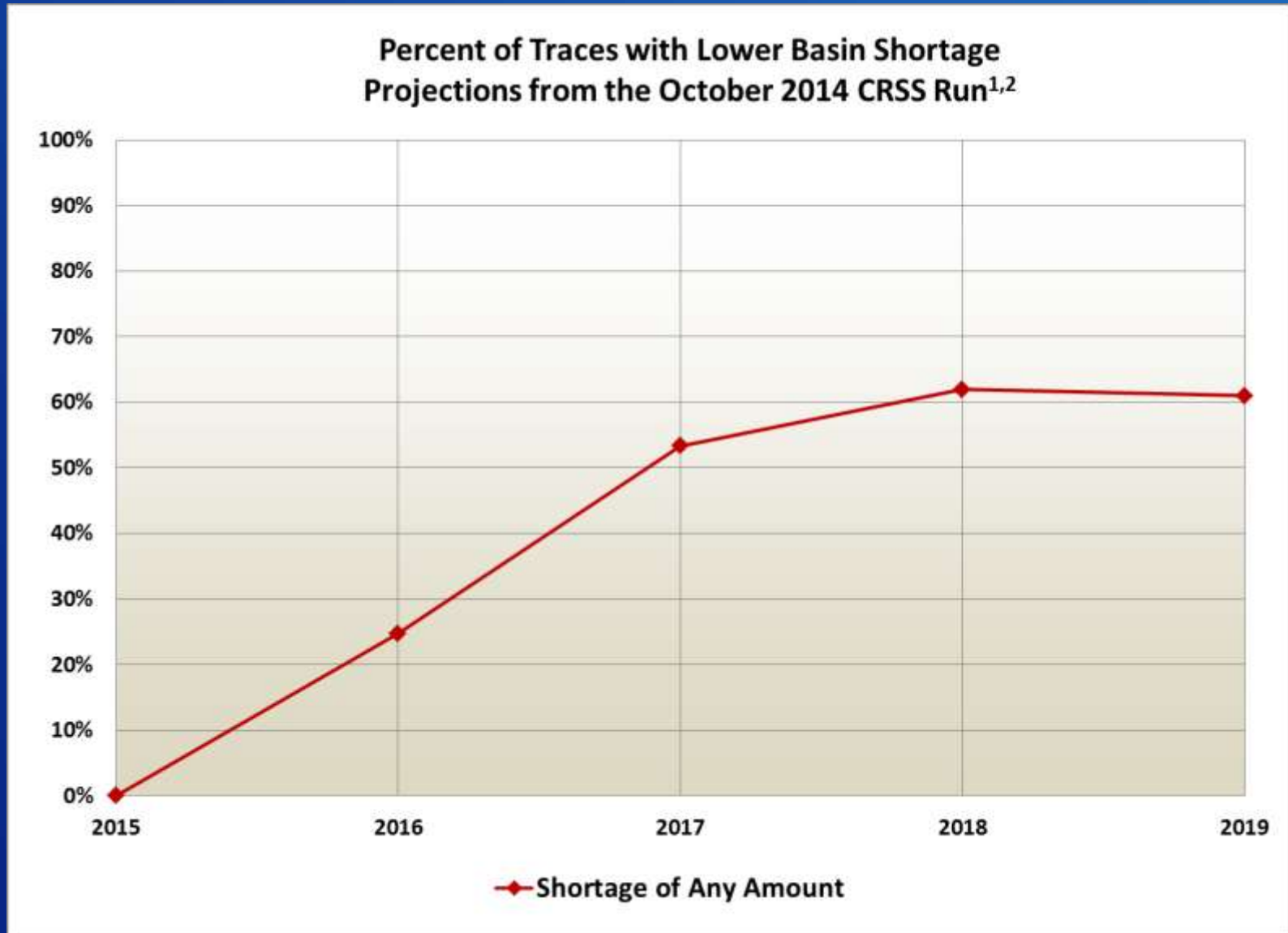
# Lake Mead End of Month Elevations

## Projections from October 2014 24-Month Study Inflow Scenarios



- ..... October 2014 Probable Maximum Inflow with Lake Powell Release of 12.06 maf Water Year 2015 and 13.60 maf in Water Year 2016
- - - - - October 2014 Most Probable Inflow with Lake Powell Release of 9.00 maf in Water Year 2015 and Water Year 2016
- ..... October 2014 Probable Minimum Inflow with Lake Powell Release of 9.00 maf in Water Year 2015 and Water Year 2016
- Historical Elevations

# Lower Basin Shortage through 2019



<sup>1</sup> Reservoir initial conditions based on the most probable October 24-month Study projected levels for December 31, 2014.

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

# Closing Thoughts

- The period from 2000-2014 was the driest 15-year period in over 100 years of record keeping
- Fortunate to start the drought in 2000 with nearly full system conditions
- The system is working exactly as designed; Reclamation has been able to meet its delivery obligations during the drought
- However, a future hydrology that includes continued drought may lead us to new operational challenges, and the need for innovative, collaborative solutions



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# Questions/Discussion



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