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*Managing Water in the West*

## Bureau of Reclamation Lower Colorado River Update

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**WESTCAS, 2016 Fall Conference**  
**October 26, 2016**



U.S. Department of the Interior  
Bureau of Reclamation



# Topics

- Overview of the Colorado River Basin
- Lower Colorado River Operations
- Colorado River Drought
- Drought Response Activities
- Summary

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# Overview of the Colorado River System

- 16.5 million acre-feet (maf) allocated annually
  - 7.5 maf each to Upper and Lower Basins
  - 1.5 maf to Mexico
- About 16 maf average annual “natural flow” (based on historical record)
  - 14.8 maf in the Upper Basin and 1.3 maf in the Lower Basin
- Inflows are highly variable year to year
- 60 maf of storage (nearly 4-times the annual inflow)
- Operations and water deliveries governed by the “Law of the River”



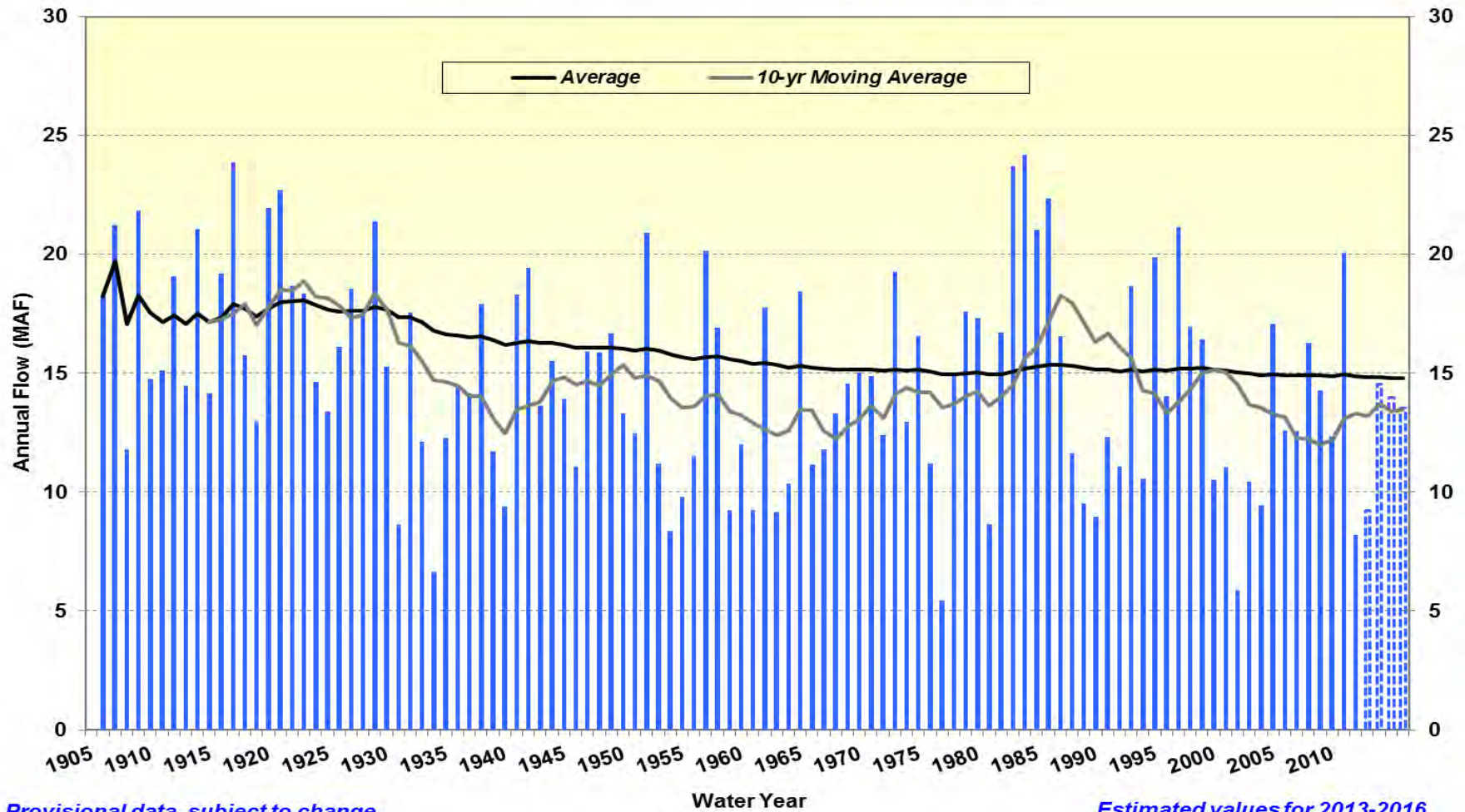
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# Natural Flow

## Colorado River at Lees Ferry Gaging Station, Arizona

### Water Year 1906 to 2016

Colorado River at Lees Ferry, AZ - Natural Flow



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# Lower Colorado River Operations

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# Lower Colorado Region

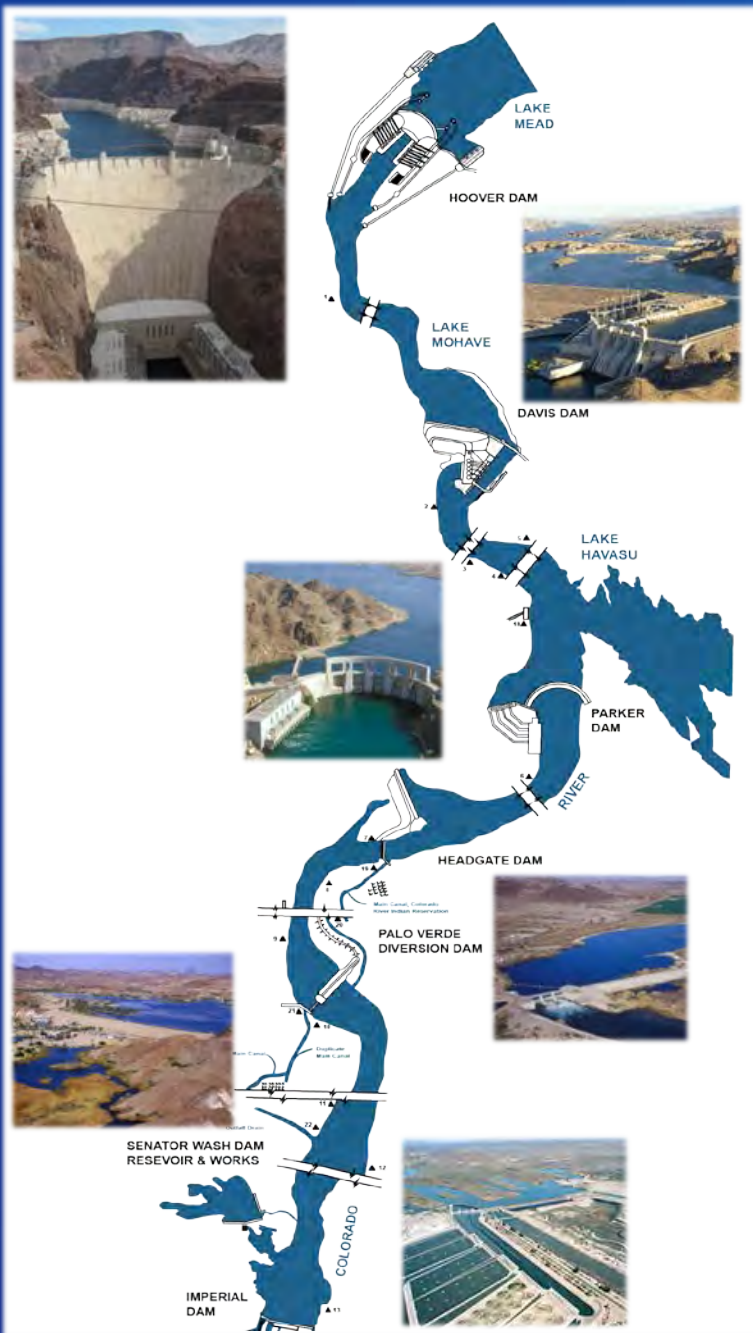


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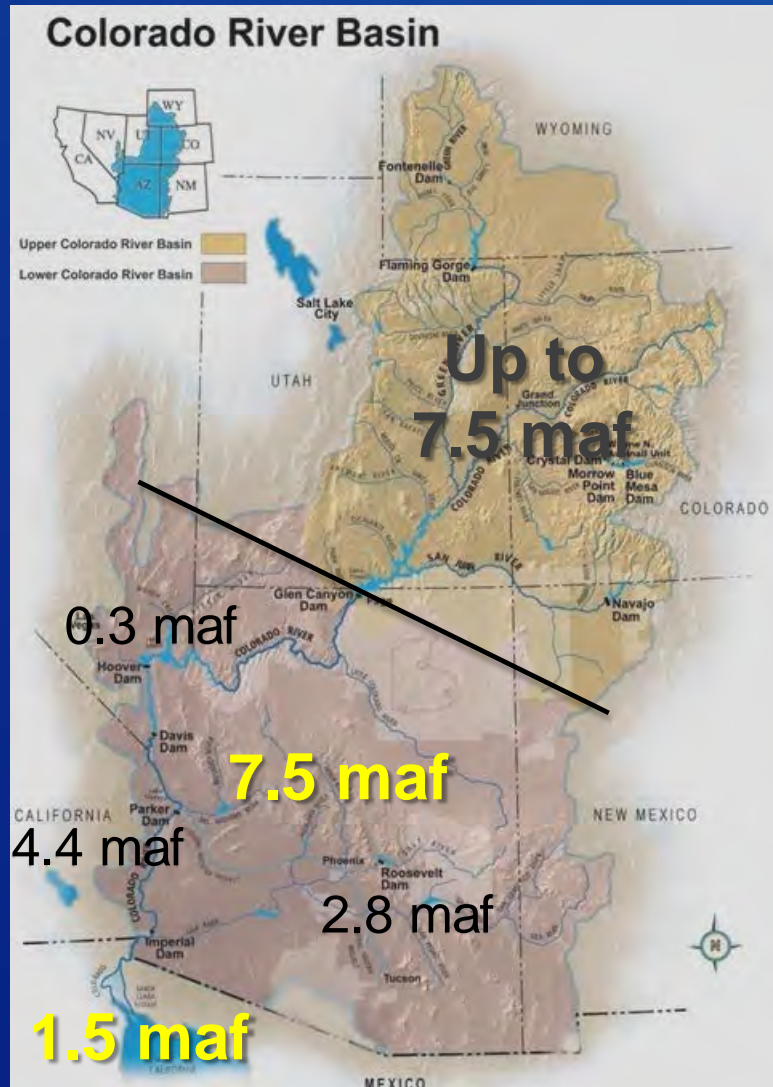
# Lower Colorado River Management Objectives

- Provide flood control and river regulation
- Meet water orders
- Generate hydropower
- Implement LCR Multi-Species Conservation Program
- Support recreational opportunities

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# Annual Water Allocations



- Lower Basin States under the BCPA
  - California 4.4 maf (5,430 mcm)
  - Arizona 2.8 maf (3,450 mcm)
  - Nevada 0.3 maf (370 mcm)
- 1944 Water Treaty
  - Mexico 1.5 maf (1,850 mcm)

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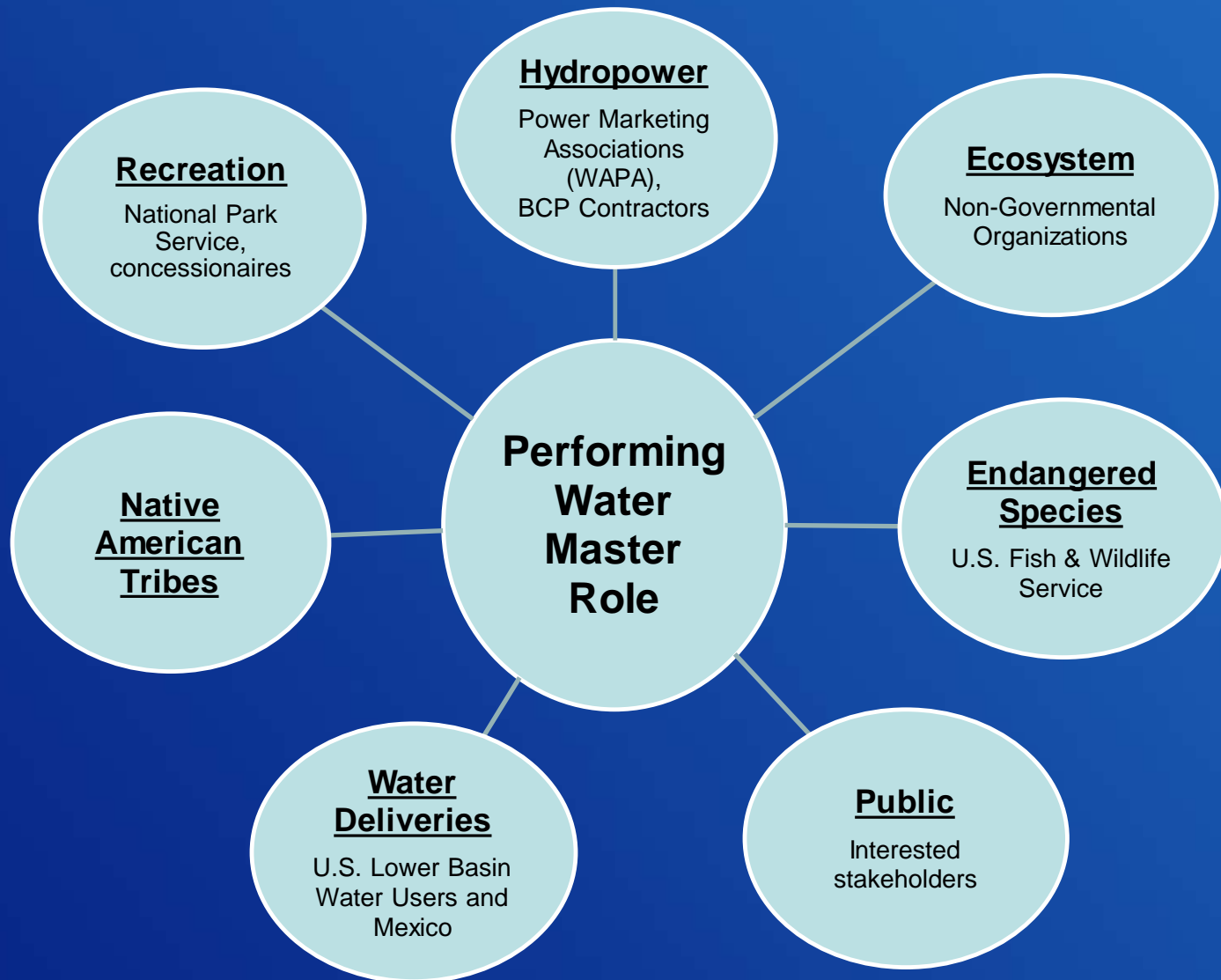
# Lower Colorado River Water Master Role

- Boulder Canyon Project Act of 1928 established the Secretary of the Interior as Water Master of the Lower Colorado River
  - Develop Annual Operating Plan for Colorado River Reservoirs
  - Administer water contracts
  - Approve U.S. water orders
  - Schedule water releases from Hoover, Davis, and Parker Dams
  - Account for all water use



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# Stakeholder Collaboration



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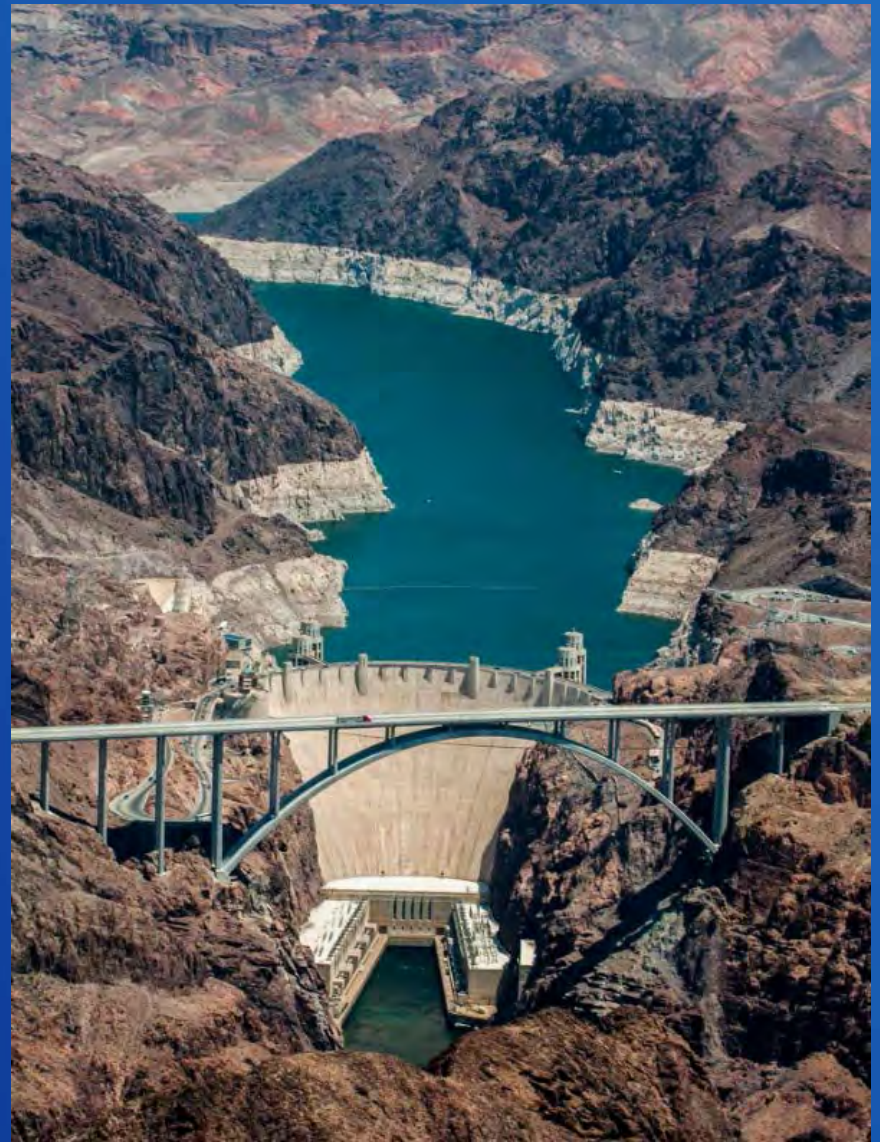
# Colorado River Drought

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Lake Mead near Hoover Dam in 2000

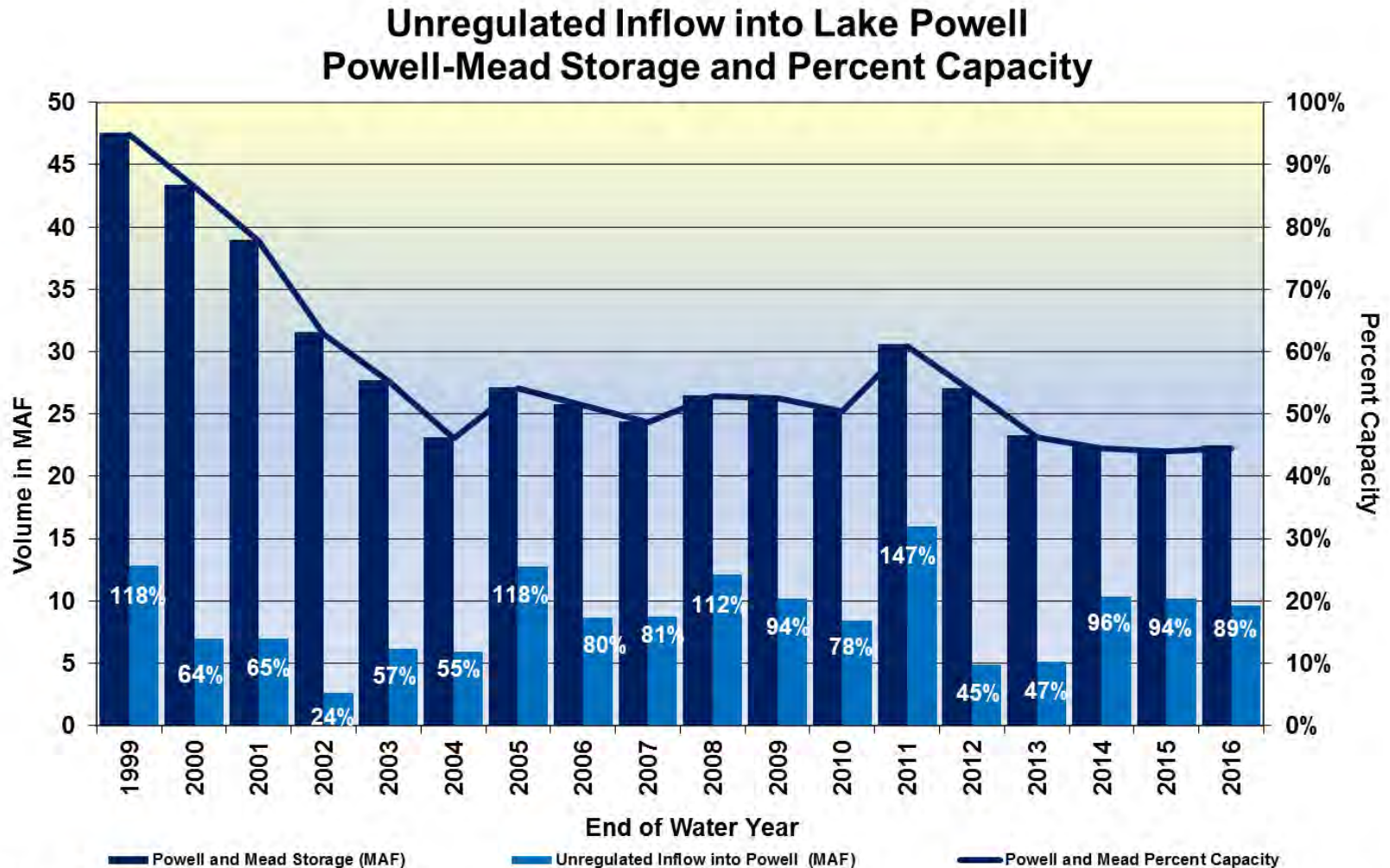


Lake Mead near Hoover Dam in 2016

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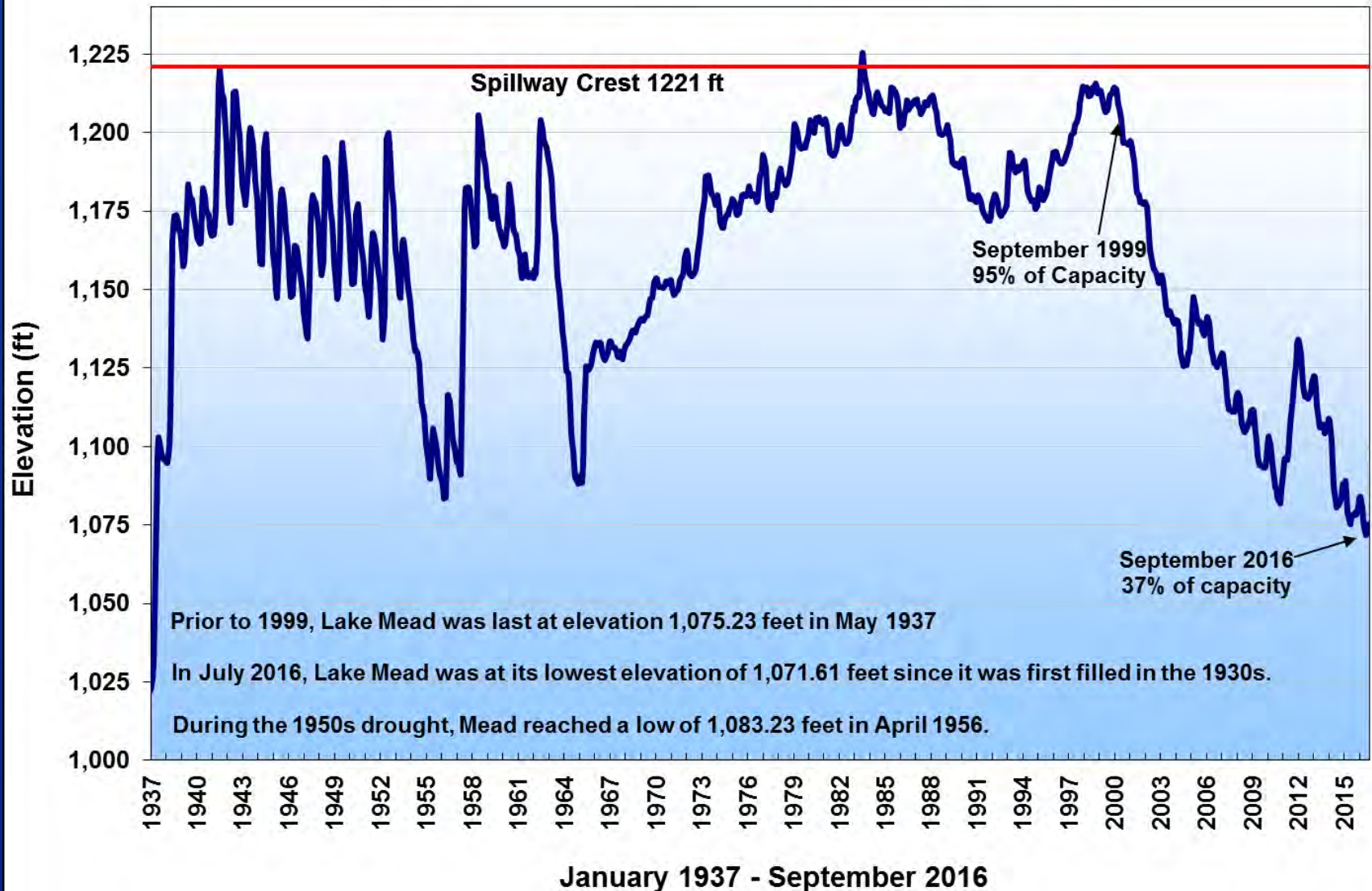


# State of the System (Water Years 1999-2016)<sup>1</sup>



<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. The percent of average is based on the period of record from 1981-2010.

## Lake Mead End of Month Elevation



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# Water Budget at Lake Mead

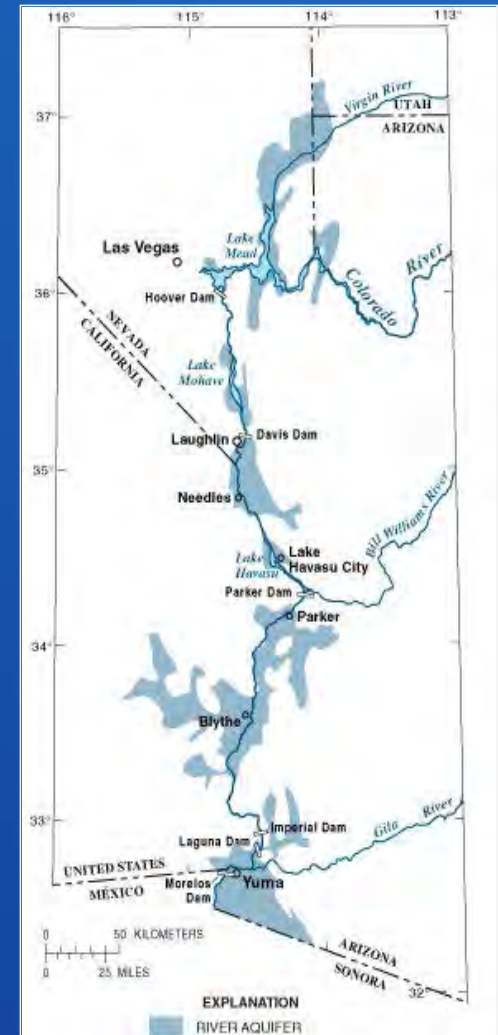
Given current water demands in the Lower Basin and Mexico, and a minimum objective release from Lake Powell (8.23 maf), Lake Mead storage declines by about 1.2 maf annually (equivalent to about 12 feet in elevation).

Inflow 9.0 maf  
(Powell release + side inflows above Mead)

Outflow -9.6 maf  
(Lower Division State apportionments and Mexico Treaty Allocation, plus balance of downstream regulation, gains, and losses)

Mead evaporation loss -0.6 maf

Balance -1.2 maf

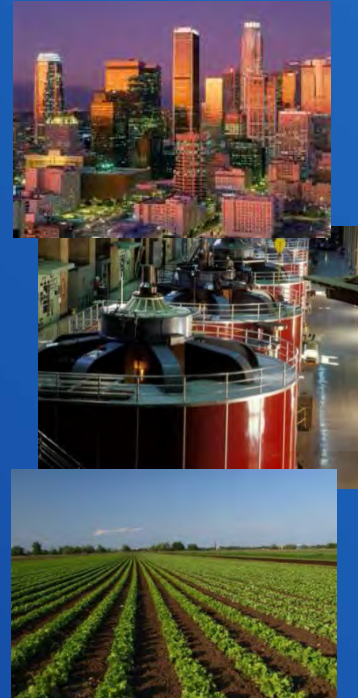


Source: USGS, 1994

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# Impacts of Low Lake Mead Levels and Storage

- Water Supply
  - Potential for Lower Basin shortage determination
  - At 1,025 feet, 6.0 maf (23% of capacity) in storage
  - At 1,000 feet, 4.5 maf (17% of capacity) in storage
- Power Generation
  - Reduced operational efficiency
  - Each 10-ft decline in Lake Mead elevation reduces Hoover's generating capacity by about 50 MW
- Recreation
  - Impacts to the National Park Service and its concessions
  - Reduced access to boat ramps and other recreational facilities



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# Drought Response Activities

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# 2007 Interim Guidelines



- In place for an interim period (2007 through 2026)
- Provide for coordinated operations of Lake Powell and Lake Mead to minimize Lower Basin shortages and Upper Basin curtailments
- Encourage efficient use and management of Colorado River water through the Intentionally Create Surplus (ICS) mechanism
- Establish guidelines for determining shortages in the Lower Basin
- Does not include provisions for Mexico

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# 1944 U.S.-Mexico Water Treaty

- IBWC Minute 319 – November 2012
  - Cooperative 5-year agreement
  - In place for an interim period from 2013 to 2017
  - Provides for storage of Mexican conserved water in Lake Mead
  - Shortage and surplus sharing with U.S. water users at high and low reservoir conditions
  - Improved infrastructure for conservation
  - Environmental projects including riparian restoration sites in the Colorado River Delta
  - A new agreement is being discussed



Damage to canal in Mexico from earthquake, April 2010



View of riparian area in Colorado River Delta

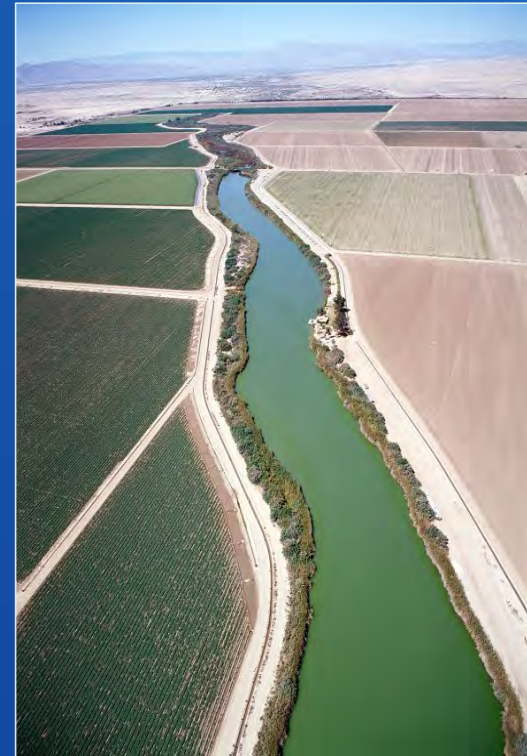
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# Drought Response Activities

## Basin-wide Pilot System Conservation Program

- Funders include Reclamation, three municipal water agencies in the Lower Basin, and one municipal water agency in the Upper Basin
- Provided over \$20 million of funding for voluntary pilot projects to create system water to benefit storage in Lake Mead and Lake Powell
- To-date, the program will conserve approximately 98 kaf of water in the Lower Basin and 11 kaf of water in the Upper Basin



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# Drought Response Activities

## Lower Basin MOU for Pilot Drought Response Actions

- Agreement among Reclamation, three municipal water agencies (SNWA, CAWCD, and MWD), and the Lower Basin States
- 2014-2017 goal to generate 740,000 acre-feet of water to benefit Lake Mead storage through voluntary actions
- Total goal from 2014-2019 to generate 1.5 to 3.0 maf of water in total to benefit Lake Mead storage
- Commitment to continue to discuss operational flexibility and long-term sustainability in the Lower Basin



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# Summary of Drought Response Activities

- Four conservation programs have resulted in an additional 10 feet in Lake Mead elevation through 2016
- Approximately 5 feet of water in Lake Mead from:
  - U.S. Intentionally Created Surplus
  - Mexican water deferred under IBWC Minute 319
- Another 5 feet of water in Lake Mead since 2014 from:
  - Lower Basin Drought MOU voluntary protection volumes
  - Pilot System Conservation Program
- Lower Basin Drought Contingency Planning
  - Goal is to reduce the risk of reaching critical Lake Mead elevations through voluntary actions

# Colorado River Basin Storage (as of August 16, 2016)

Reservoir	Percent Full		Elevation (Feet)
Lake Powell	53%		3,616
Lake Mead	37%		1,074
Total System Storage*	50%		NA

\*Total system storage was 31.19 maf or 52% this time last year

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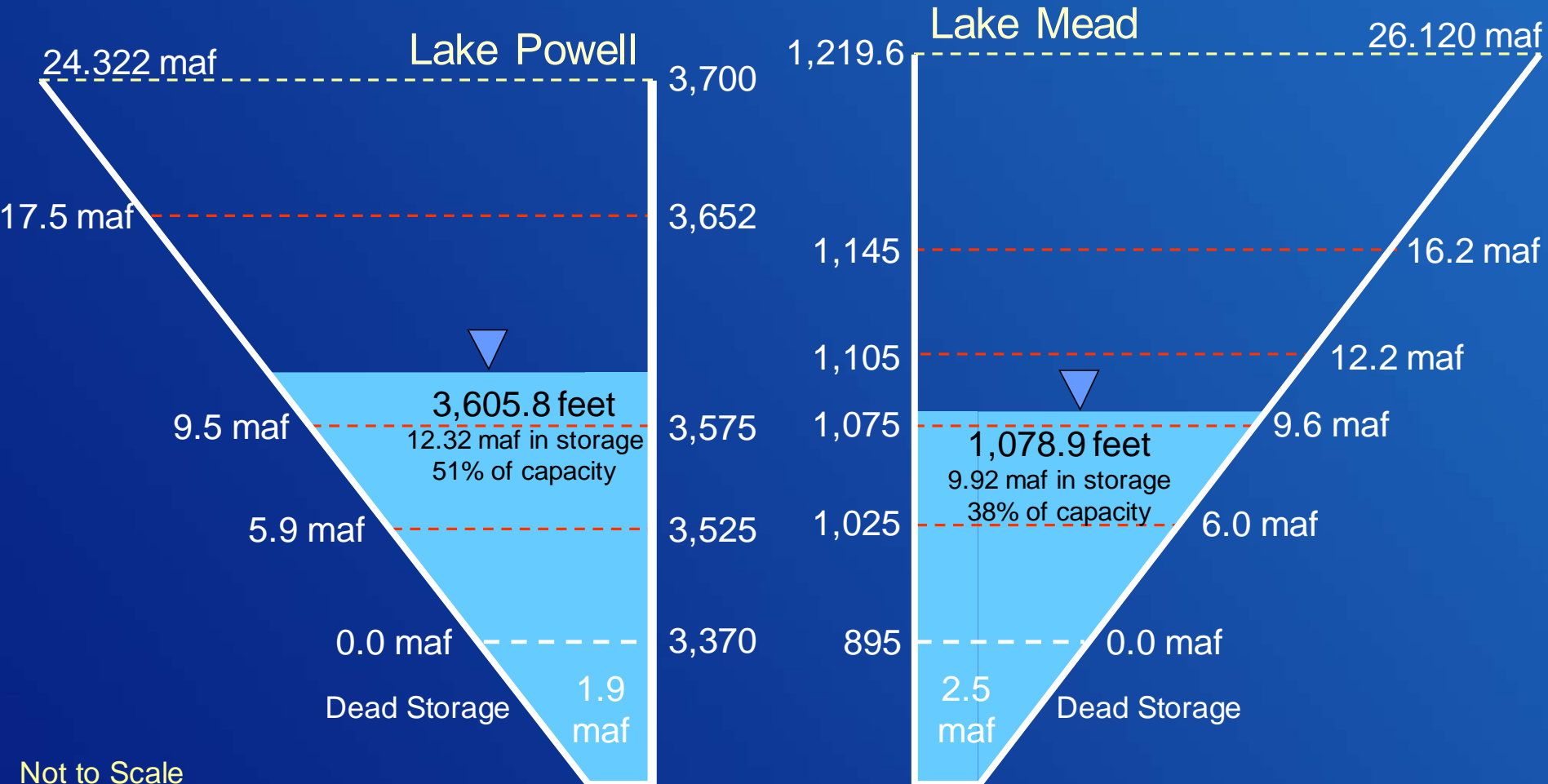
# Timing of Operational Decisions

- August 24-Month Study projections of January 1 elevations sets the operating tiers for Lake Powell and Lake Mead for the upcoming year
- When Lake Powell is operating in Upper Elevation Balancing Tier, April 24-Month Study projections of September 30 elevations may result in an adjustment to Powell's operations

# End of Calendar Year 2016 Projections

August 2016 24-Month Study Most Probable Inflow Scenario<sup>1</sup>

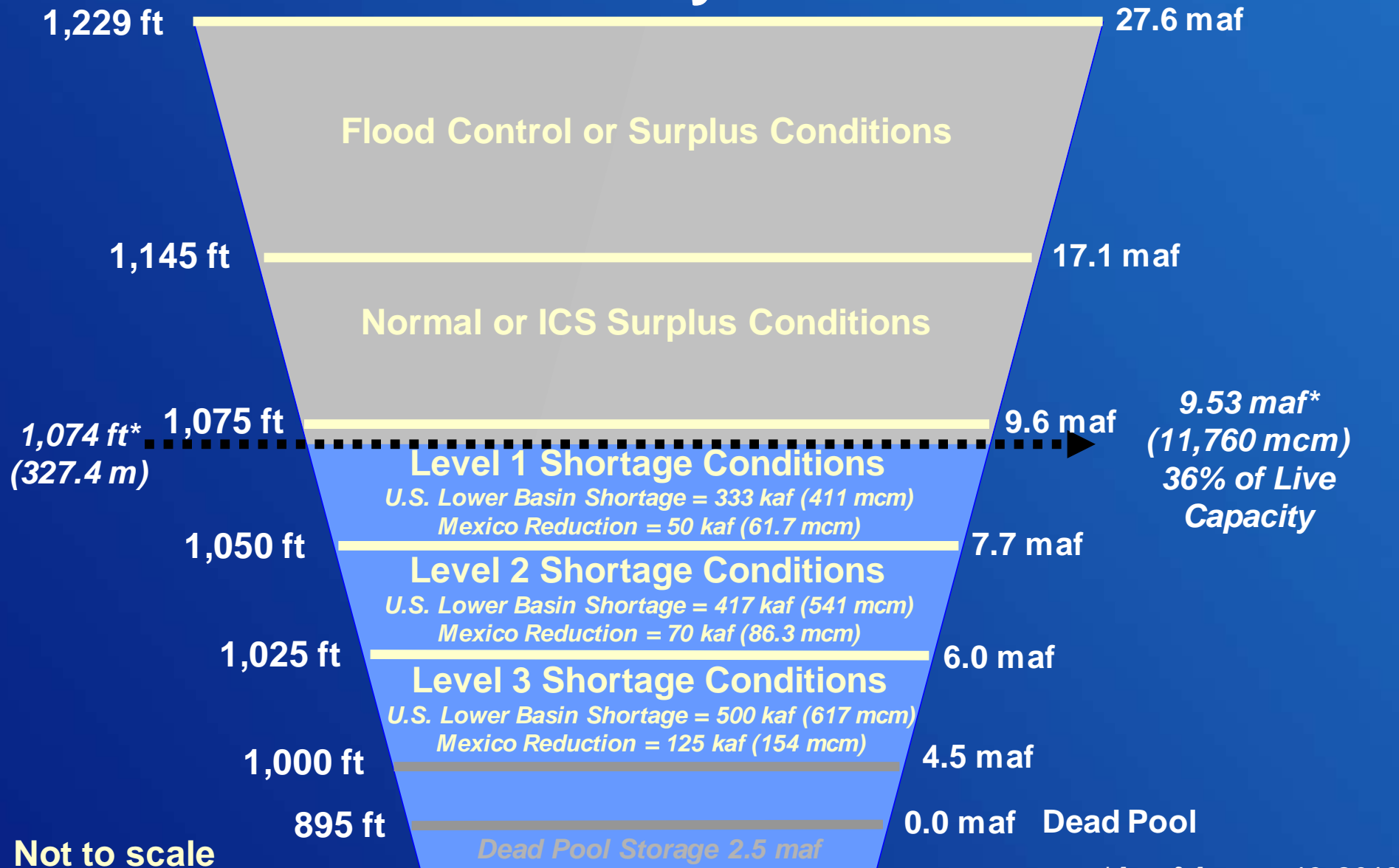
Based on a 9.00 maf release pattern from Lake Powell in Water Year 2017



<sup>1</sup> WY 2016 unregulated inflow into Lake Powell is based on the CBRFC forecast dated 8/1/16.

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



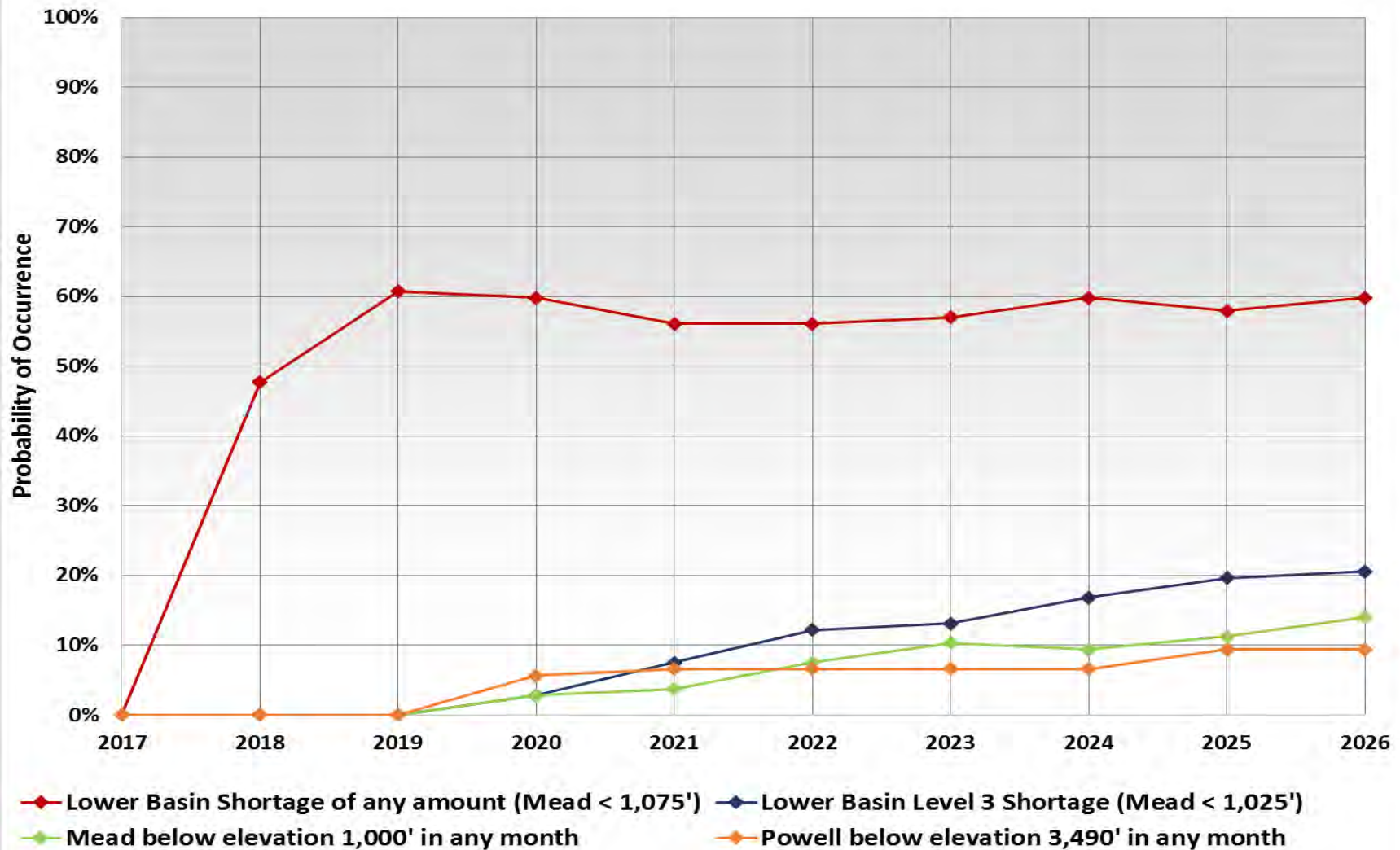
<sup>1</sup> Lake Mead operational condition and U.S. Lower Basin shortage volumes based on the 2007 Interim Guidelines; Mexico reductions based on Minute 319.

*\*As of August 16, 2016*

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# Lake Powell and Lake Mead Projections<sup>1,2</sup>

## August 2016 CRSS run for period from 2017 to 2026

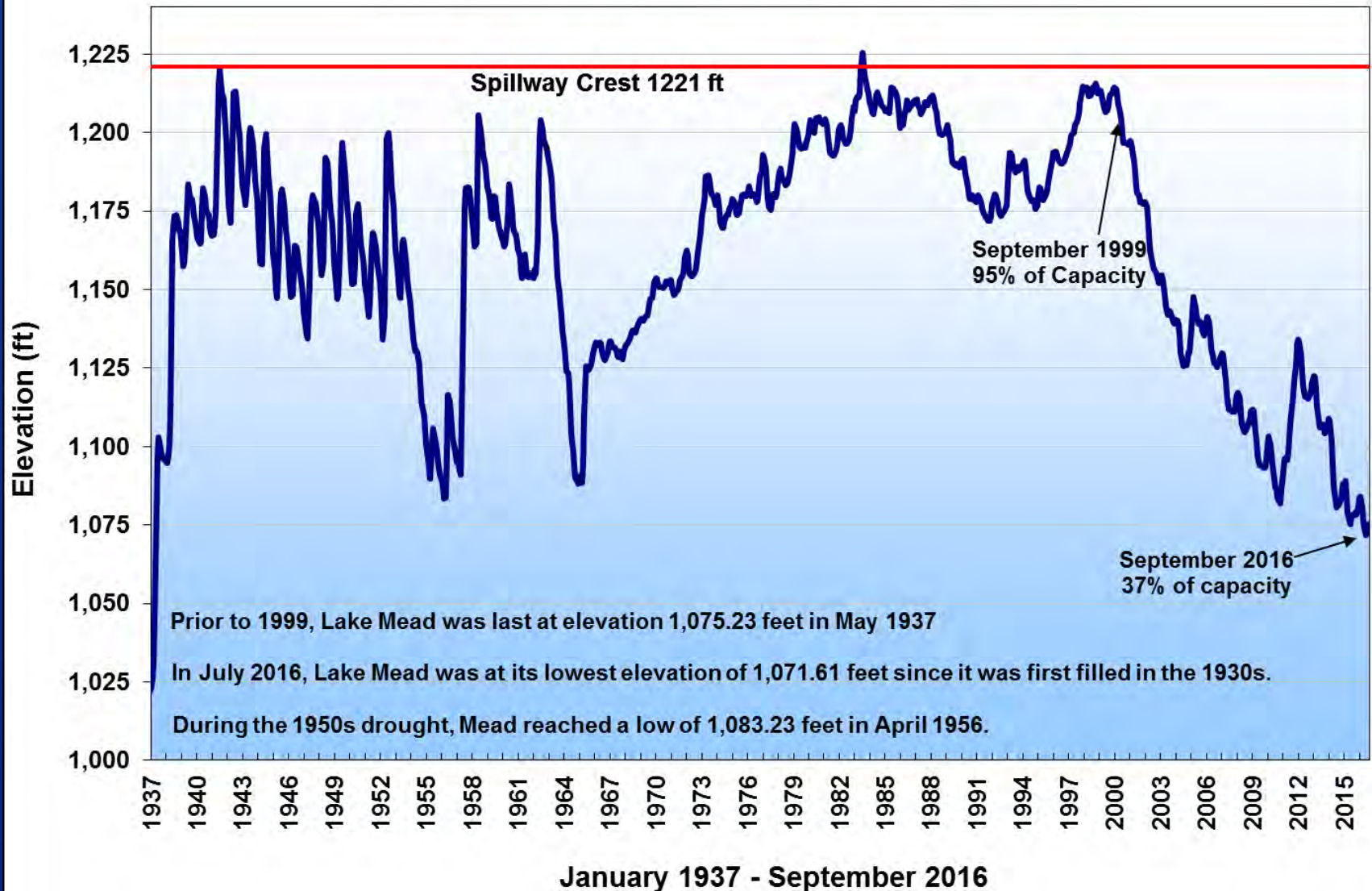


<sup>1</sup> Reservoir initial conditions based on projected December 31, 2016 conditions from the August 2016 24-Month Study.

<sup>2</sup> Hydrologic inflow traces based on resampling of the observed natural flow record from 1906-2012.



## Lake Mead End of Month Elevation



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# Installation of Wide-Head Turbines at Hoover



Existing turbine



New wide-head turbine

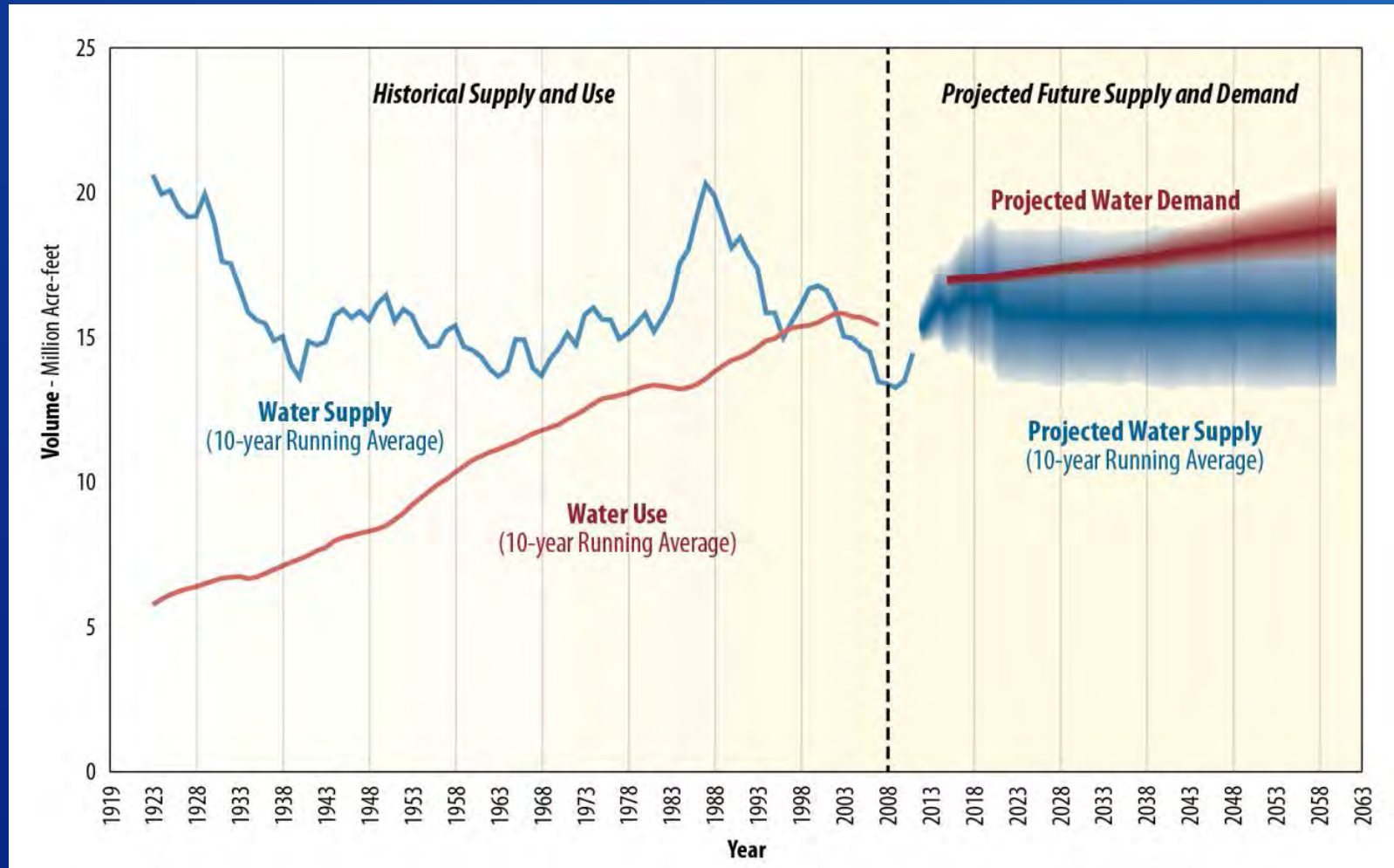
- Boulder Canyon Project contractors funded the installation of five wide-head turbines to replace existing turbines
- Increases operational efficiency across a wider range of reservoir levels, including lower lake levels
  - Four wide-head turbines are already in operation
  - A fifth will be installed in 2017

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# WaterSMART – Basin Study

## Colorado River Basin Water Supply and Demand



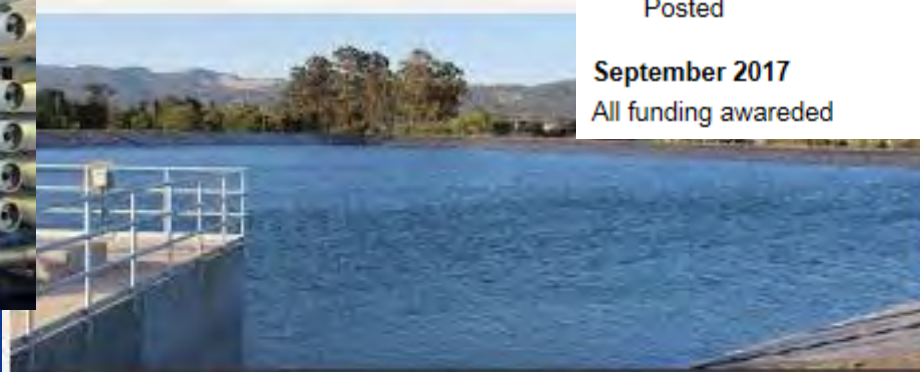
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# WaterSMART – Title XVI

Title XVI of P.L. 102-575, as amended (Title XVI), provides authority for Reclamation's water recycling and reuse program, titled "Title XVI." Through the Title XVI program, Reclamation identifies and investigates opportunities to reclaim and reuse wastewaters and naturally impaired ground and surface water in the 17 Western States and Hawaii. Title XVI includes funding for the planning, design, and construction of water recycling and reuse projects, on a project specific basis, in partnership with local government entities.

Since 1992, approximately \$639 million in Federal cost-share has been leveraged with more than \$2.4 billion in non-Federal funding to design and construct water recycling projects. In 2014, an estimated 378,000 acre-feet of water was recycled through Title XVI projects.



## PROPOSED CALENDAR

### November 2016

- Title XVI Water Reclamation and Reuse Program: Feasibility Studies Funding Opportunity Announcement Posted
- Title XVI Water Reclamation and Reuse Program: Water Reclamation Research Funding Opportunity Announcement Posted
- Title XVI Water Reclamation and Reuse Program: Title XVI Authorized Projects Funding Opportunity Announcement Posted

### September 2017

All funding awarded

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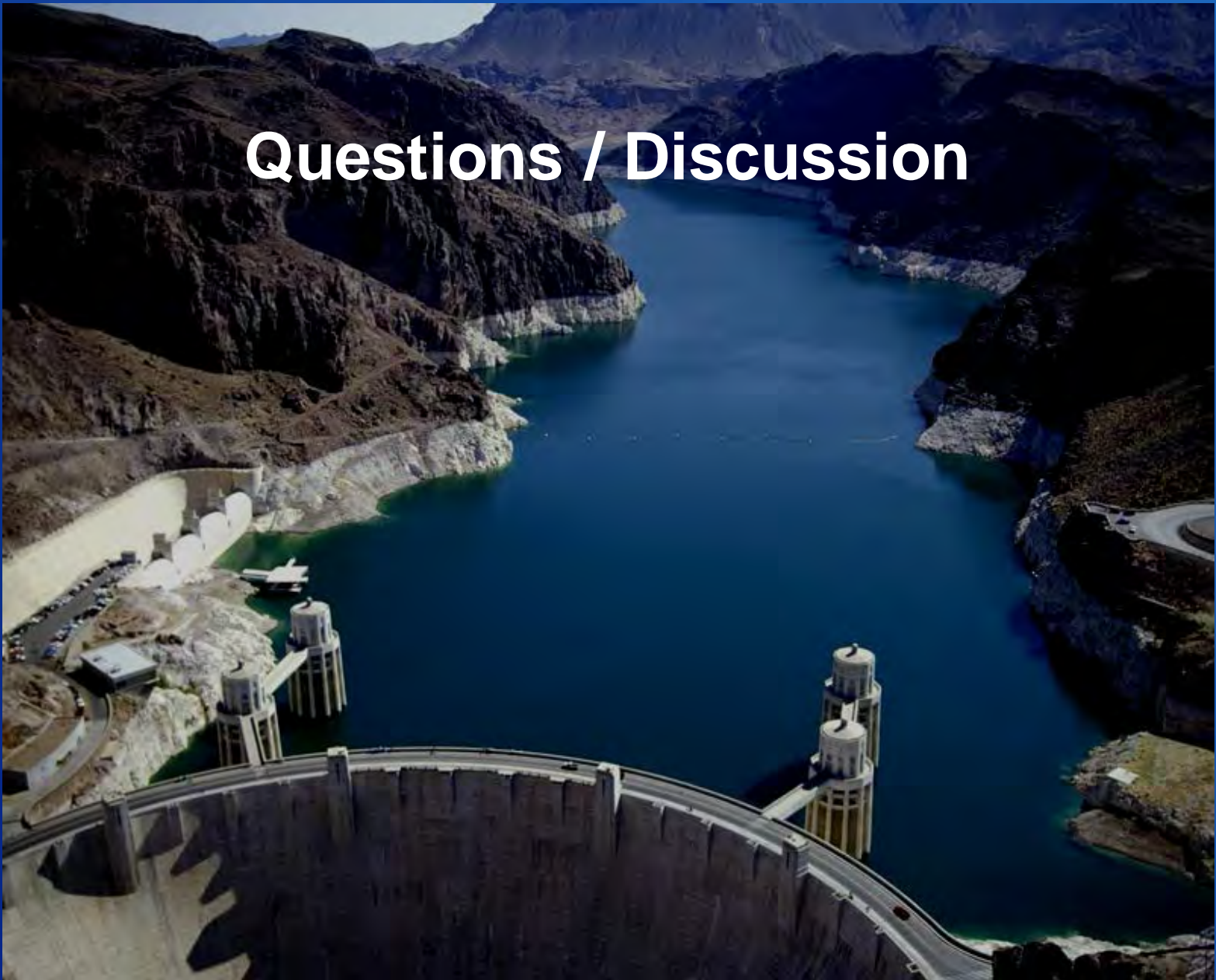
# Summary

- The Colorado River Basin is experiencing an unprecedented drought
- The chance of reaching critical reservoir elevations at Lake Mead continues to increase
- Safeguarding our shared water supply is critical to all of us
- Cooperation and collaboration will be the key to finding sustainable solutions and addressing current and future challenges



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# Questions / Discussion



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