Glen Canyon Dam Technical Work Group
Agenda Item Information
August 27, 2014

Agenda Item

Basin Hydrology, Operations and 2015 Hydrograph

Action Requested

- ✓ Motion requested. The attached motion is recommended by TWG. However, no motion is officially made unless and until an AMWG member makes the motion in accordance with the AMWG Operating Procedures.

Presenter

Katrina Grantz, Hydraulic Engineer, Bureau of Reclamation, Upper Colorado Region
John Jordan, TWG Chair

Previous Action Taken

- ✓ By AMWG: At the August 2013 meeting, the AMWG passed a motion to recommend to the Secretary of the Interior her approval of the DOI-DOE Proposed Hydrograph for Water Year 2014. Previous year hydrographs (water years 2012 and 2013) were also reviewed by the TWG, and the AMWG and approved by the Secretary of the Interior.

Relevant Science

The TWG and AMWG have been presented with sediment and financial results from the DOI-DOE analysis of operational scenarios for the 2012, 2013, and 2014 Hydrographs. These analyses were based upon the USGS sand retention model and Western's GTMax power/financial model. In May 2014, the AMWG was presented with a range of possible operational scenarios for a potential water year 2015 hydrograph. The anticipated range of conditions and objectives for 2015 remain similar to the previous years; therefore, the targeted approach adopted as the 2012, 2013 and 2014 Hydrographs is recommended again for the 2015 Hydrograph.

Background Information

The first portion of 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 2014 and provide an outlook for 2015.

The second portion of the presentation will cover the potential range of annual release volumes from Lake Powell in water year 2015 and the proposed 2015 Hydrograph. John Jordan, TWG Chair, will provide a brief summary of the TWG deliberation and motion.

Motion Requested: TWG recommends the AMWG recommend to the Secretary of the Interior her approval of the DOI-DOE Proposed Hydrograph for Water Year 2015 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 kaf

- 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

Upper Basin Hydrology and Projected Operations Water Years 2014 and 2015

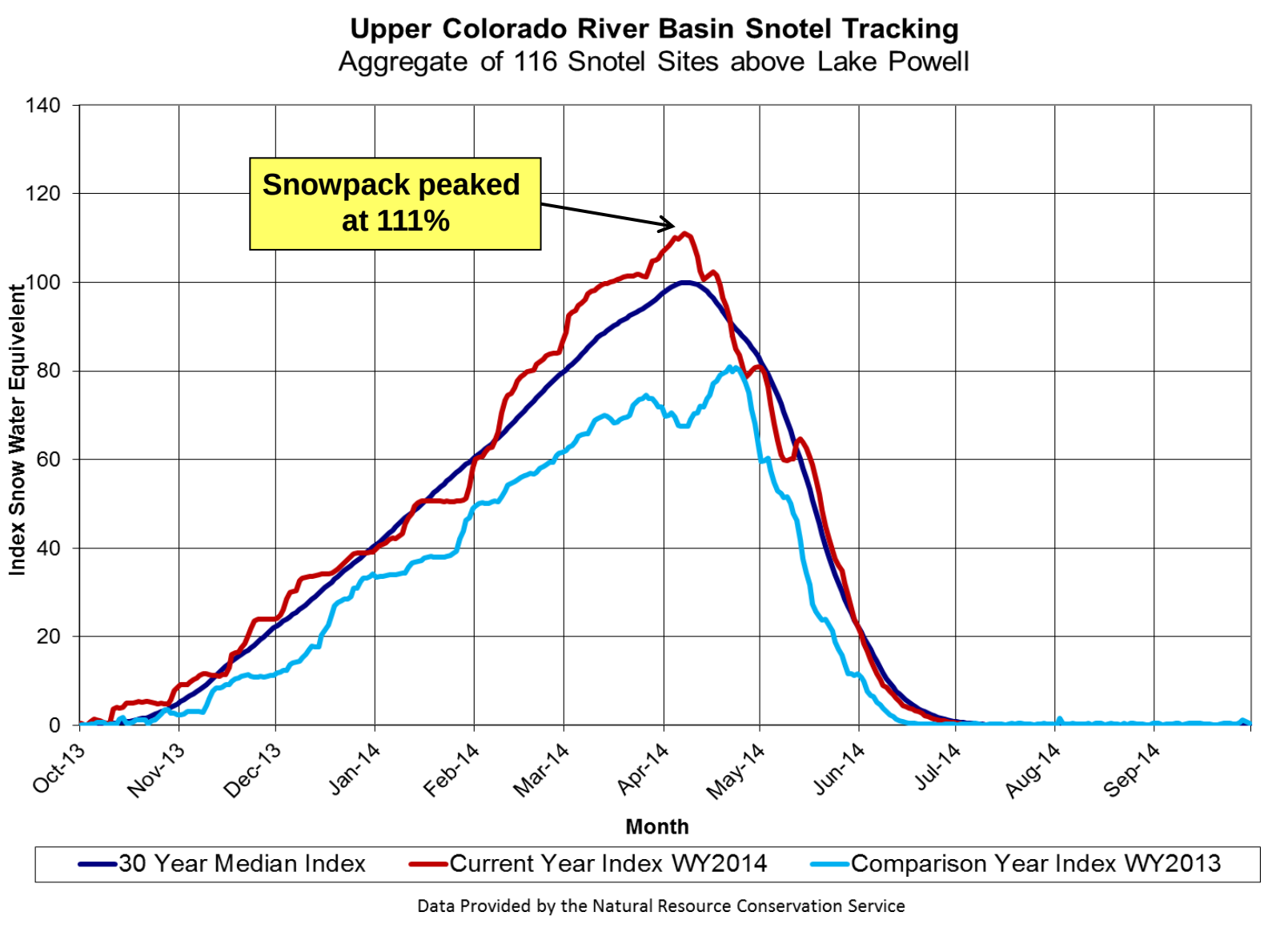
Adaptive Management Work Group
August 27-28, 2014

U.S. Department of the Interior
Bureau of Reclamation

Presentation Overview

- Hydrology and upper basin reservoirs status
- August inflow forecasts
  - Water years 2014 and 2015
- August modeling projections
  - releases and reservoir elevations
  - long-term modeling projections
- Scheduled Glen Canyon powerplant maintenance
- Drought contingency planning

Upper Basin Hydrology

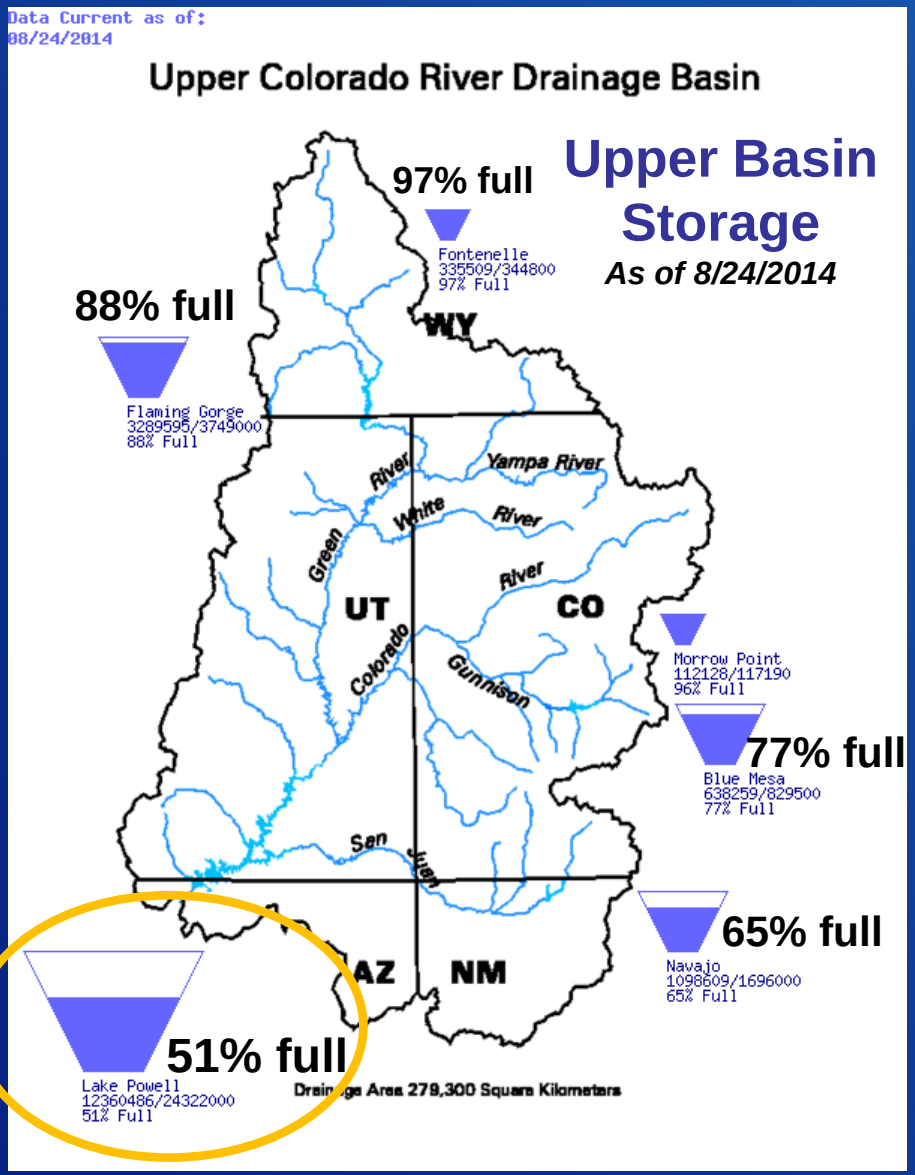


http://www.usbr.gov/uc/water/notice/Graphs/Upper_Colorado.html

RECLAMATION

Colorado River Basin

Upper Basin Storage



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

2014 April – July Observed Unregulated Inflow

Reservoir	A-J Inflow (KAF)	Percent of Average[1]
Fontenelle	1,020	141%
Flaming Gorge	1,159	118%
Blue Mesa	849	126%
Navajo	428	58%
Powell	6,923	97%

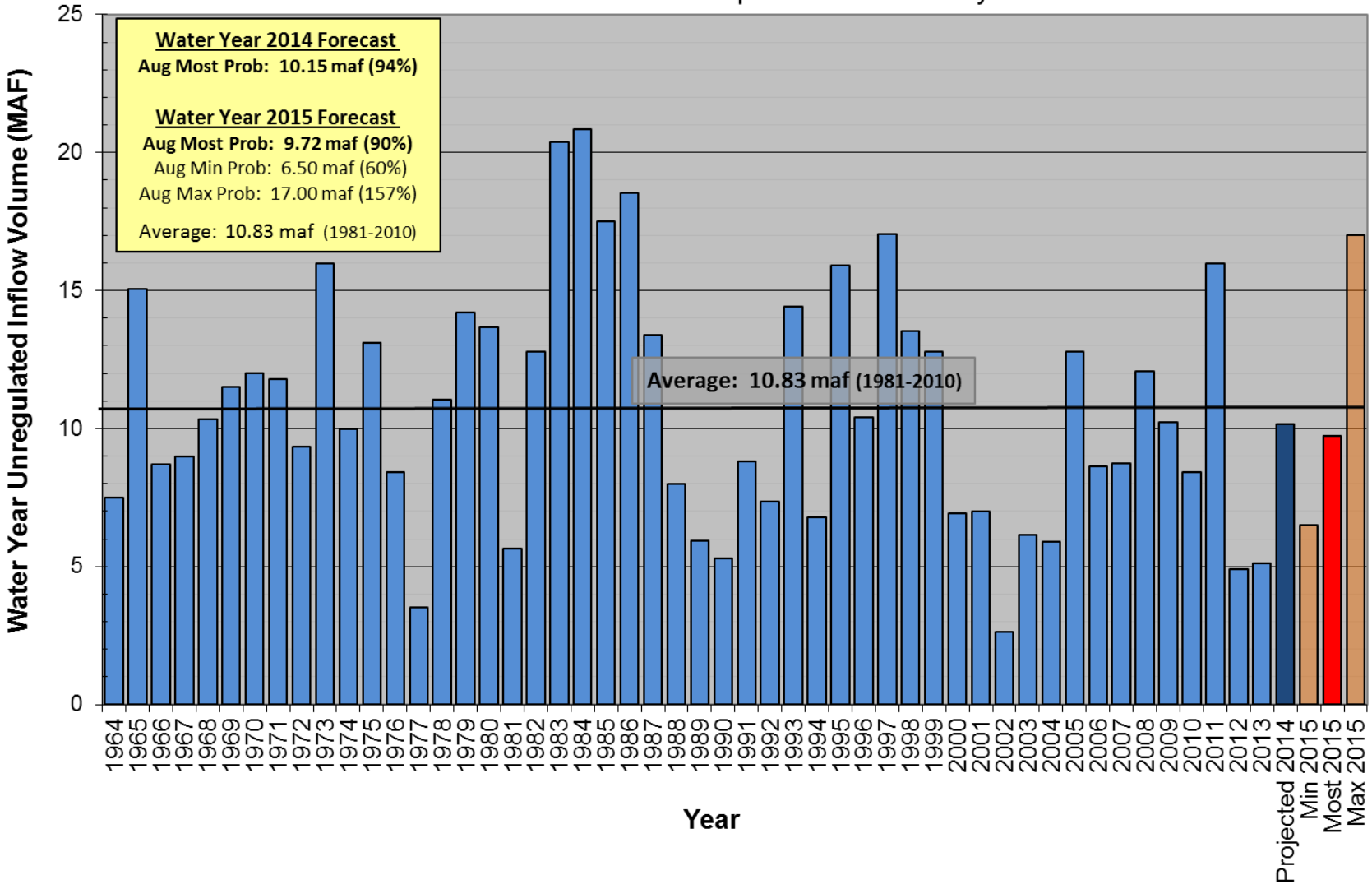
[1] Percentages and percent of average based on period of record from 1981-2010.

RECLAMATION

Lake Powell Unregulated Inflow

Water Years 2014 and 2015 Forecast *(issued Aug 1)*

Comparison with History



Observed April-July 2014: 6.92 maf (97%)

RECLAMATION

Lake Powell & Lake Mead Operational Table

Operational Tiers for 2015 determined with the August 2014 24-Month Study

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)		15.5 - 19.3 (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	
	3,597 ft Jan 1 projection	
3,575		9.5
	Mid-Elevation Release Tier Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	
3,525		5.9
	Lower Elevation Balancing Tier Balance contents with a min/max release of 7.0 and 9.5 maf	
3,490		4.0
3,370		0

Lake Mead

Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf)[1]
1,220	**Flood Control Surplus or Quantified Surplus Condition** Deliver > 7.5 maf	25.9
1,200 (approx.)[2]		22.9 (approx.)[2]
	Domestic Surplus or ICS Surplus Condition Deliver > 7.5 maf	
1,145		15.9
1,105	**Normal or ICS Surplus Condition** Deliver ≥ 7.5 maf	11.9
1,075		9.4
	Shortage Condition Deliver 7.167[4] maf	
1,050		7.5
	Shortage Condition Deliver 7.083[5] maf	
1,025		5.8
1,000	**Shortage Condition** Deliver 7.0[6] maf Further measures may be undertaken[7]	4.3
895		0

Diagram not to scale

[1] Acronym for million acre-feet

[2] 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.

[3] Subject to April adjustments which may result in a release according to the Equalization Tier

[4] Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

[5] Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

[6] Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

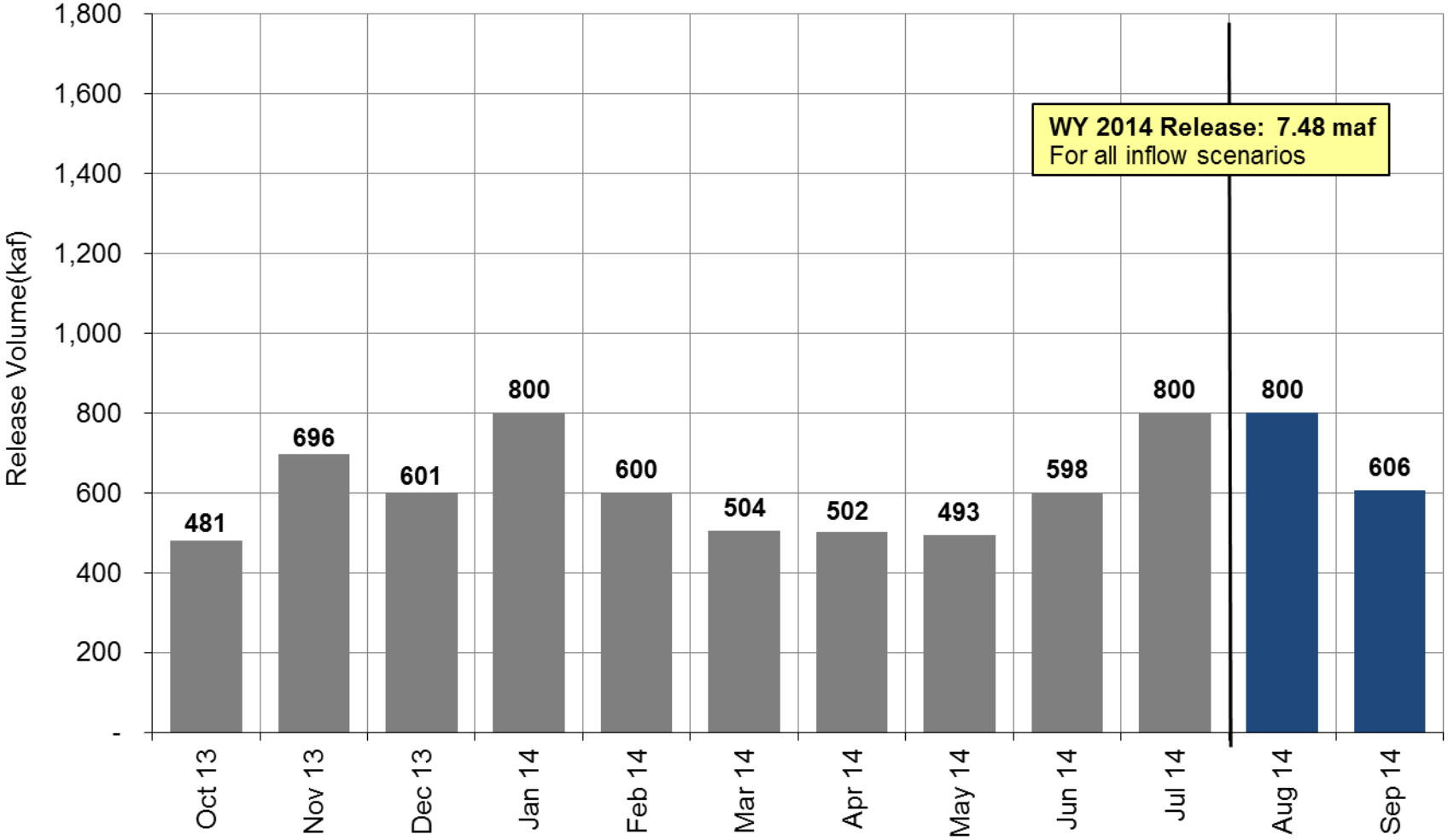
[7] Whenever Lake Mead is below elevation 1,025 feet, the Secretary shall consider whether hydrologic conditions together with anticipated deliveries to the Lower Division States and Mexico is likely to cause the elevation at Lake Mead to fall below 1,000 feet. Such consideration, in consultation with the Basin States, may result in the undertaking of further measures, consistent with applicable Federal law.

RECLAMATION

Projected Lake Powell Monthly Release Volume Distribution

August 2014 Release Projections

Water Year 2014

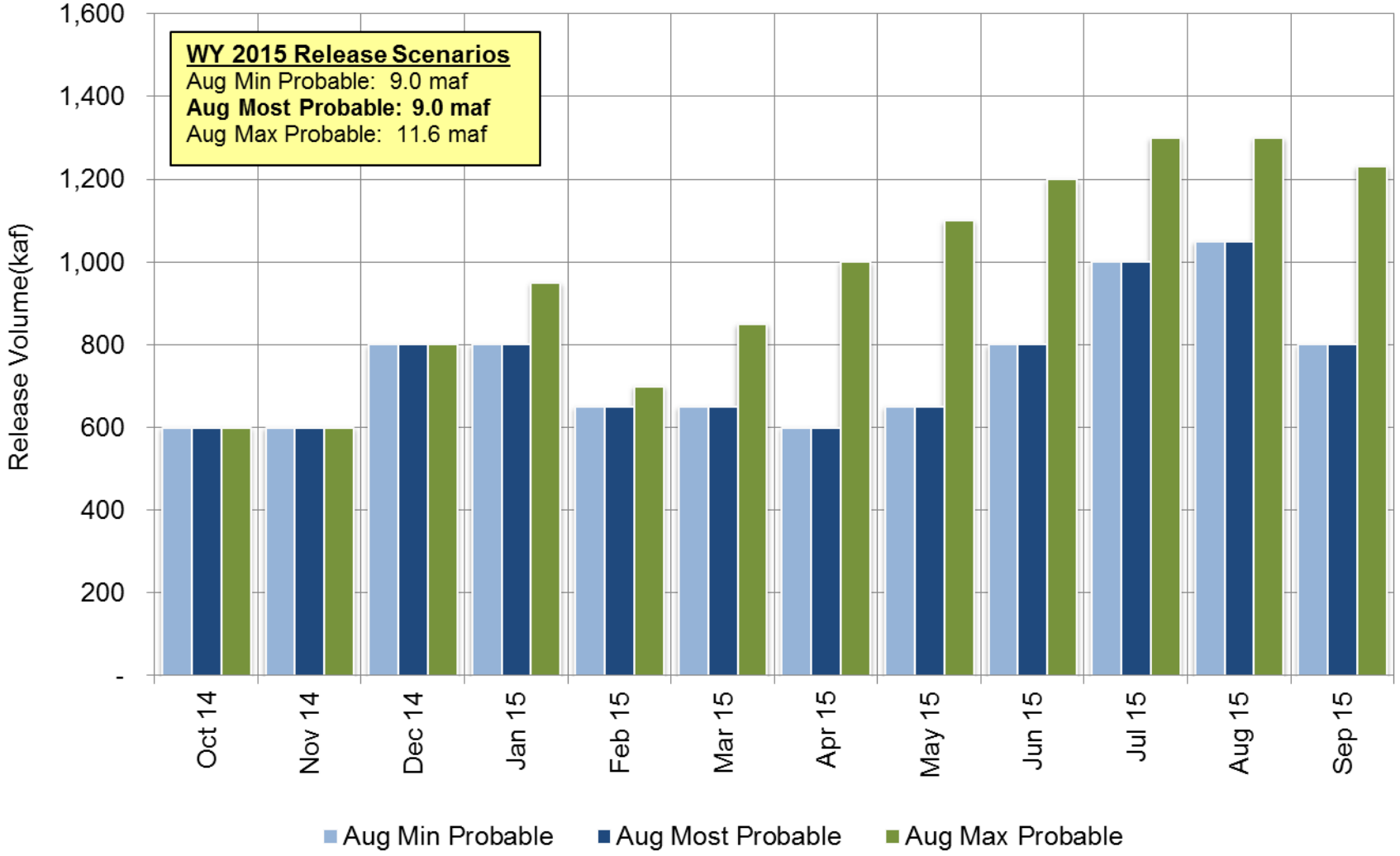


RECLAMATION

Projected Lake Powell Monthly Release Volume Distribution

Release Scenarios from August 2014 24-Month Study

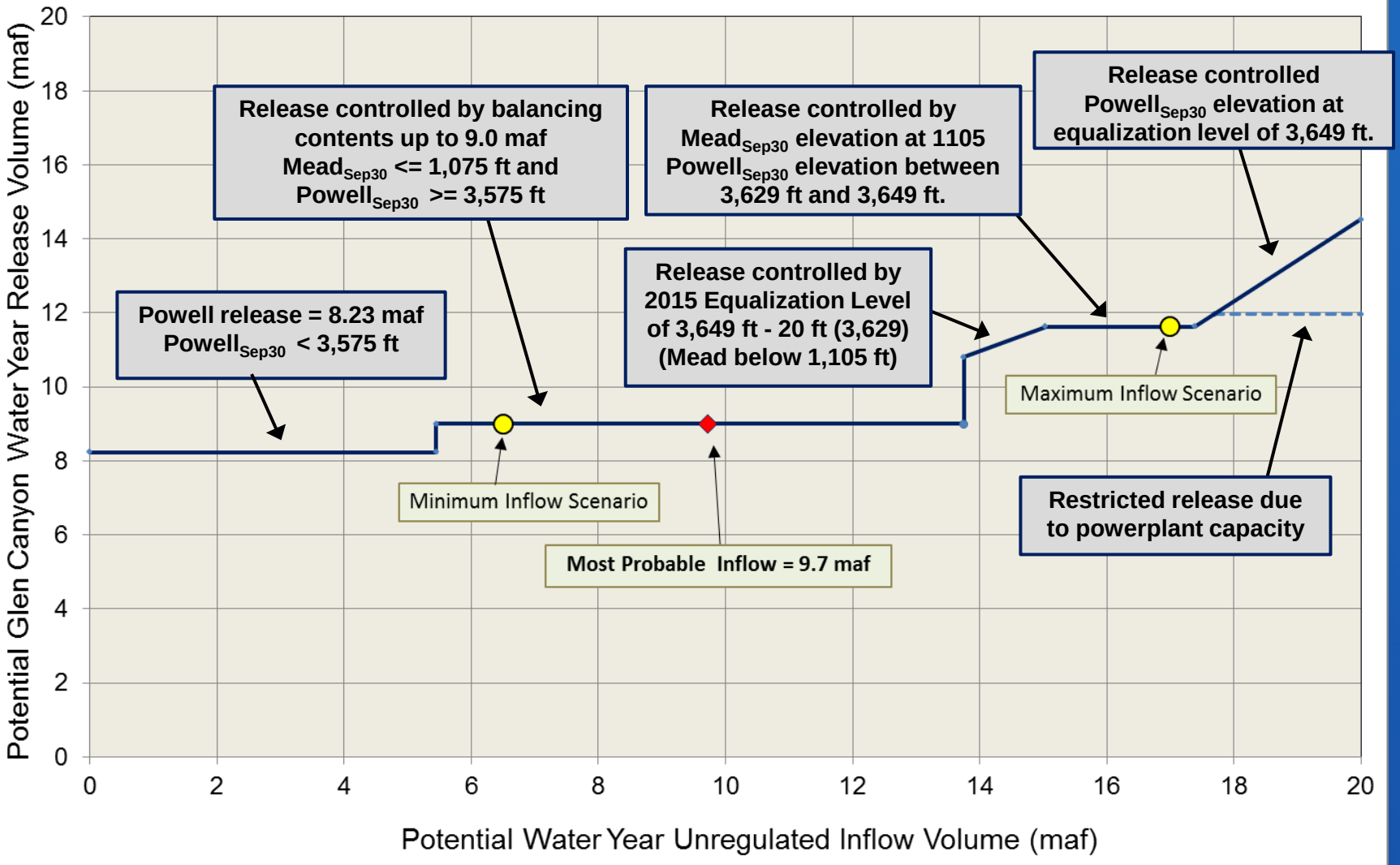
Water Year 2015



RECLAMATION

Lake Powell Release under Coordinated Operations

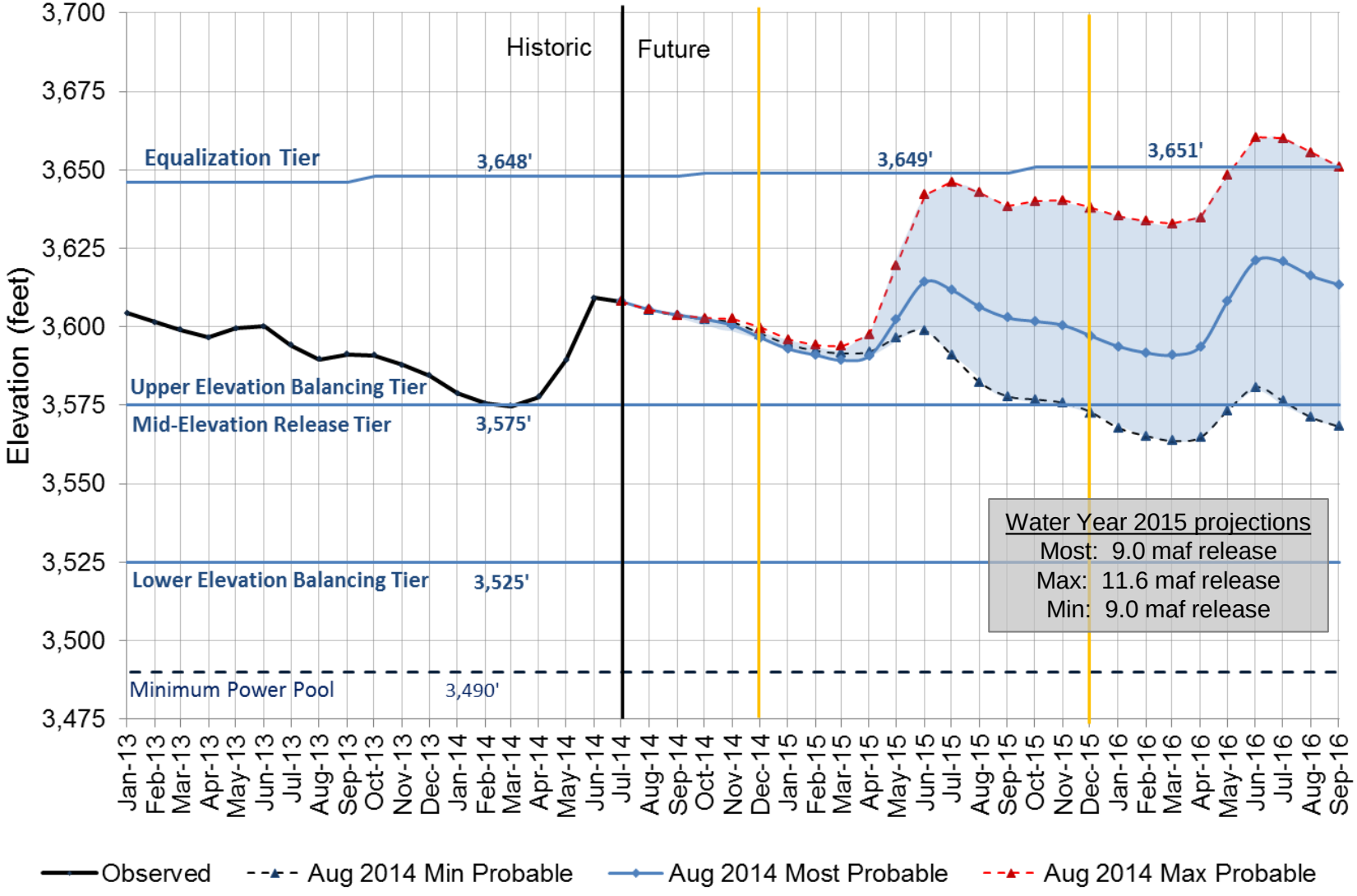
Water Year 2015 Release Volume as a Function of Unregulated Inflow Volume
based on August 2014 24-Month Study Conditions



RECLAMATION

Lake Powell End of Month Elevations

Historic and projected based on August 2014 modeling



RECLAMATION

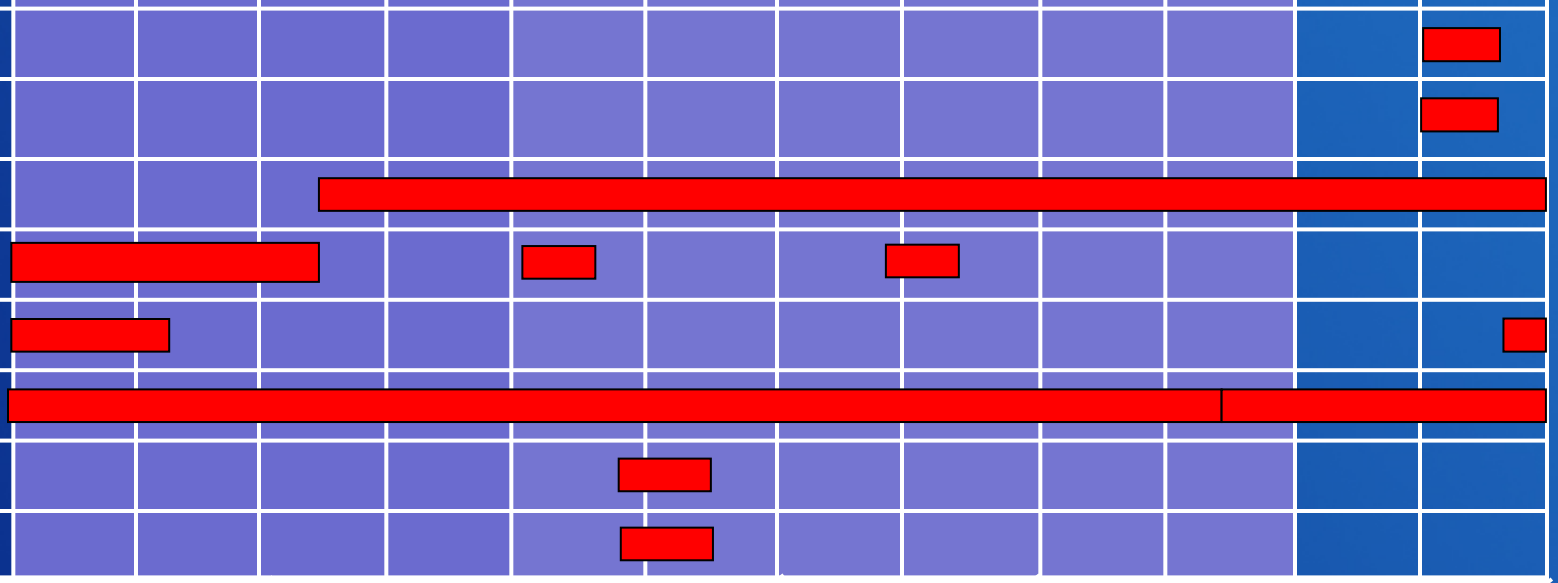
Percent of Traces with Event or System Condition

Results from August 2014 CRSS[1,2,3] (values in percent)

	Event or System Condition	2015	2016	2017	2018	2019
Upper Basin – Lake Powell	**Equalization Tier**	**5**	**20**	**24**	**24**	**32**
	Equalization – annual release > 8.23 maf	*5*	*20*	*24*	*24*	*31*
	Equalization – annual release = 8.23 maf	*0*	*0*	*0*	*0*	*1*
	Upper Elevation Balancing Tier	**95**	**51**	**53**	**53**	**43**
	Upper Elevation Balancing – annual release > 8.23 maf	*58*	*43*	*41*	*41*	*34*
	Upper Elevation Balancing – annual release = 8.23 maf	*37*	*7*	*11*	*12*	*9*
	Upper Elevation Balancing – annual release < 8.23 maf	*0*	*1*	*1*	*0*	*0*
	Mid-Elevation Release Tier	**0**	**29**	**19**	**14**	**15**
	Mid-Elevation Release – annual release = 8.23 maf	*0*	*0*	*0*	*1*	*2*
	Mid-Elevation Release – annual release = 7.48 maf	*0*	*29*	*19*	*13*	*13*
	Lower Elevation Balancing Tier	**0**	**0**	**4**	**9**	**10**
	Powell *≤ 3,490 ft*	**0**	**0**	**0**	**6**	**7**
Lower Basin – Lake Mead	**Shortage Condition – any amount (Mead ≤ 1,075 ft)**	**0**	**36**	**58**	**68**	**61**
	Shortage – 1st level (Mead ≤ 1,075 and ≥ 1,050)	*0*	*36*	*43*	*46*	*34*
	Shortage – 2nd level (Mead < 1,050 and ≥ 1,025)	*0*	*0*	*15*	*18*	*17*
	Shortage – 3rd level (Mead < 1,025)	*0*	*0*	*0*	*4*	*10*
	Surplus Condition – any amount (Mead ≥ 1,145 ft)	**0**	**0**	**5**	**7**	**14**
	Surplus – Flood Control	*0*	*0*	*0*	*1*	*2*
	Normal or ICS Surplus Condition	**100**	**64**	**37**	**25**	**25**

[1] Reservoir initial conditions based on the most probable August 24-month Study projected levels for December 31, 2014.
[2] Hydrologic inflow traces based on resampling of the observed natural flow record from 1906-2010.
[3] Percentages shown may not be representative of the full range of future possibilities that could occur with different modeling assumptions.

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
Units Available	5	6 / 5	6	6	5 / 4	4 / 6	6	5 / 6	6	6	6	4 / 5
Capacity (cfs)	14,200	20,000 / 14,300	18,000	17,900	13,600 / 10,300	10,300 / 16,600	16,600	13,800 / 17,000	17,000	17,000	17,000	10,400 / 13,800
Capacity (kaf/month)	900	1040	1120	1100	750	850	950	950	1010	1050	1050	710
Max (kaf) [1]	--	--	--	--	--	--	--	--	--	--	800	606
Most (kaf) [2]	481	696	601	800	599	504	502	493	598	800	800	606
Min (kaf) [1]	--	--	--	--	--	--	--	--	--	--	800	606

7.48

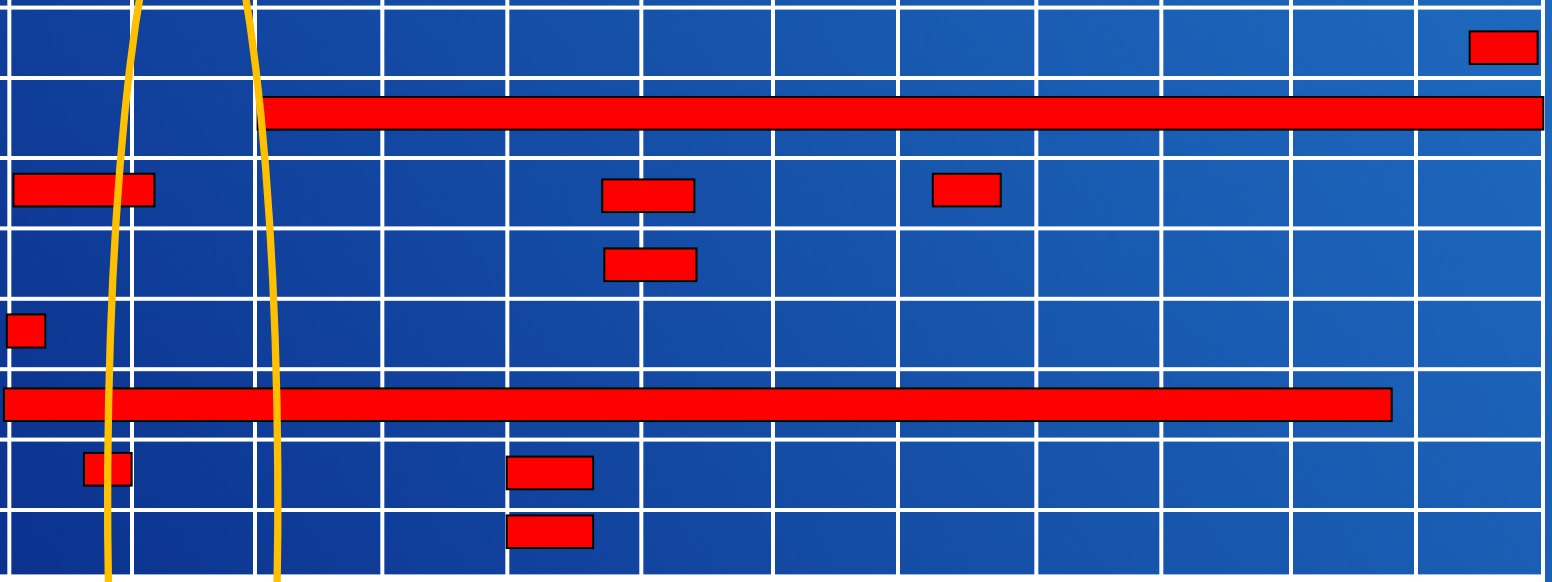
(updated 8-19-2014)

1 Projected release, based on August 2014 Min and Max Probable Inflow Projections and 24-Month Study model runs

2 Projected release, based on August 2014 Most Probable Inflow Projections and 24-Month Study model runs

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	4 / 6	6	6 / 5	6	6	6	6	
Capacity (cfs)	13,800	**20,600**	**17,200**	**17,200**	10,700	10,400 / 17,200	**17,200**	17,200 / 13,600	**17,200**	**17,200**	**17,200**	**17,400**	
Capacity (kaf/month)	870	1180	1060	1060	630	880	1020	930	1020	1060	1130	1120	
Max (kaf) [1]	600	600	800	950	700	850	1000	1100	1200	1300	1300	1232	**11.6**
Most (kaf) [2]	600	600	800	800	650	650	600	650	800	1000	1050	800	**9.0**
Min (kaf) [1]	600	600	800	800	650	650	600	650	800	1000	1050	800	**9.0**

(updated 8-19-2014)

1 **Projected release, based on August 2014 Min and Max Probable Inflow Projections and 24-Month Study model runs**

2 **Projected release, based on August 2014 Most Probable Inflow Projections and 24-Month Study model runs**

RECLAMATION

Drought Contingency Planning

- Ongoing coordination with Colorado River Basin stakeholders
- Upper Basin planning considerations
  1. Weather modification (cloud seeding)
  2. Upper Basin Reservoirs extended operations
  3. Upper Basin voluntary demand management
- Bob Snow to discuss in more detail tomorrow

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Resource Management Division

Water Resources Group

RECLAMATION