

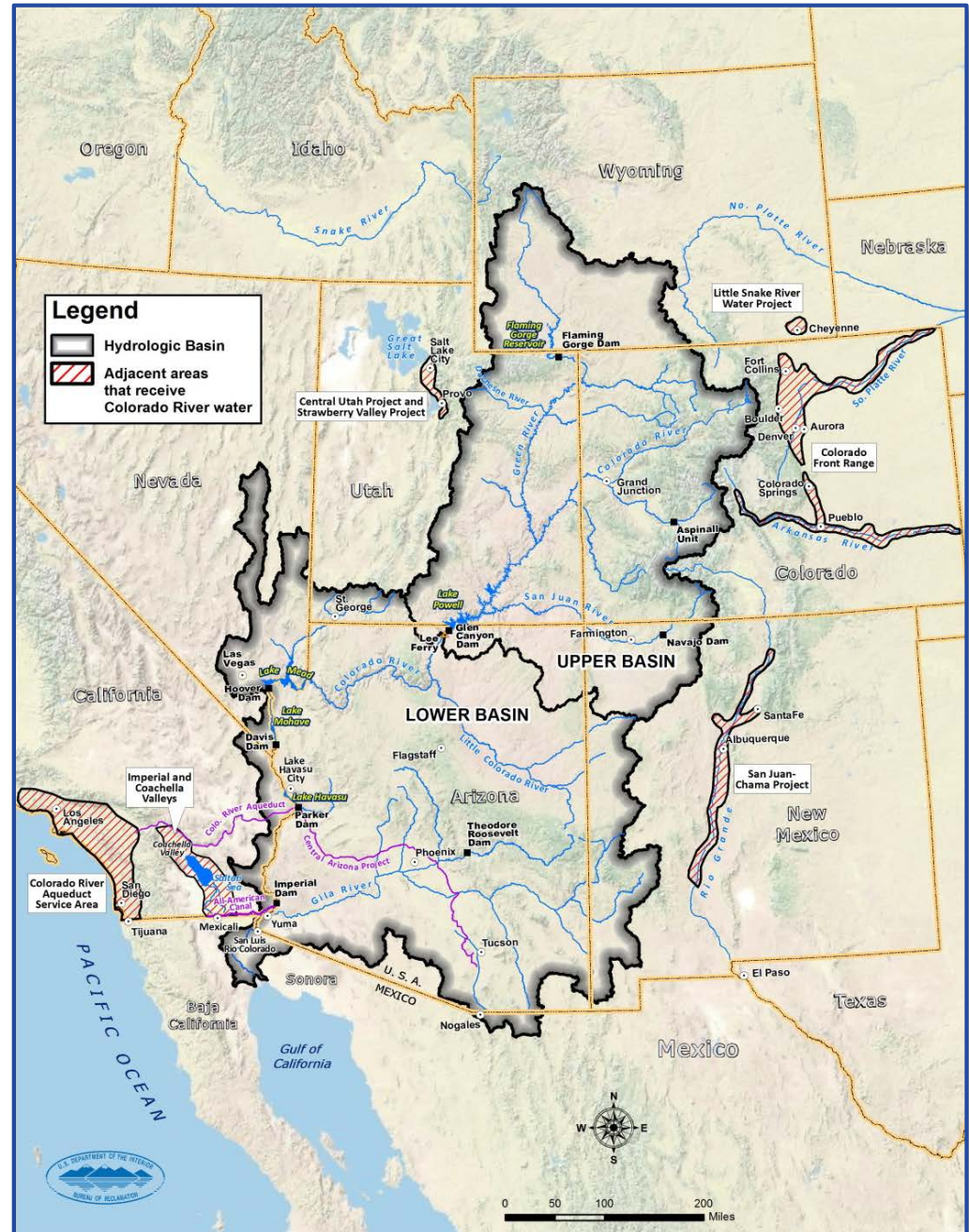
Modeling to Support Minute 323 and Transboundary Cooperative Measures for Management of the Colorado River

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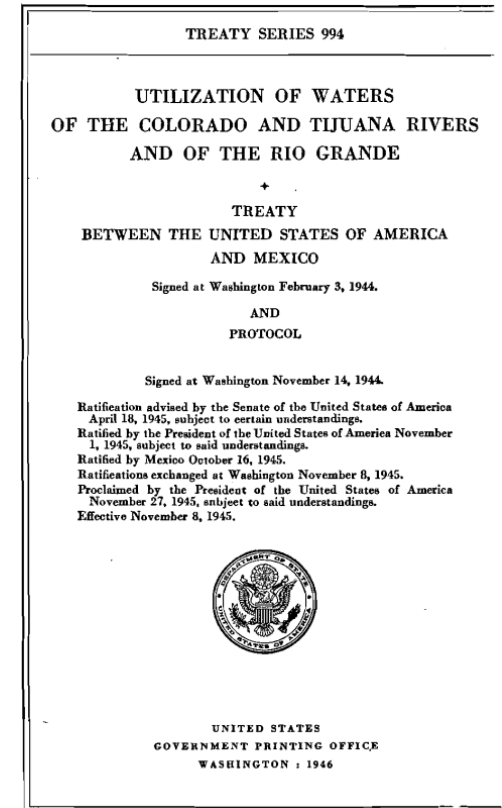
Outline

- Background
- Minute 323
- Modeling to support Minute 323 negotiations



1944 Water Treaty – Colorado River

- Apportions 1,500,000 acre-feet annually to Mexico
 - No express provision re: “carryover storage”
- Addresses surpluses & reductions
 - Surplus – in excess of amounts necessary to satisfy U.S. and Mexican uses
 - Shortage – reduction due to “extraordinary drought” – (Note: term is not defined)
- U.S. has never delivered less than the 1.5 MAF
- Administered by the International Boundary and Water Commission



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 shortage conditions in the Lower Basin
- Does not include provisions for Mexico

Summary: U.S./Mexico – 1997-2012

- Litigation 1997, 2001, 2005
 - NGO focus on the Colorado River Delta
 - US/MX tension on All-American Canal
- Post 2007
 - Dialogue
 - Cooperative process (Minute 317)
 - Humanitarian response (Minute 318 in 2010)
- 2012 - Minute 319



Minute 319 Overview

- Signed on November 20, 2012
- Cooperative 5-year agreement
- In place for an interim period from 2013 through 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



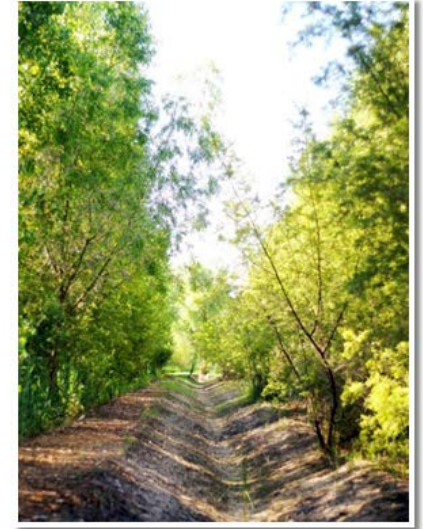
One mile north of SIB before pulse flow



One mile north of SIB during pulse flow

Minute 323 Overview

- Entered into force on September 27, 2017; remains in effect through 2026
- Provides certainty for water operations in both countries by extending proactive, cooperative reservoir management strategies (e.g., surplus and shortage sharing, water storage in Lake Mead)
- Provides for investment by U.S. entities (Federal and non-Federal) in water infrastructure and environmental projects in Mexico
- Implements a “water scarcity contingency plan” (in effect when U.S. implements Lower Basin Drought Contingency Plan) for additional actions to reduce the risk of reaching critical reservoir elevations at Lake Mead



Environmental Enhancement –
Laguna Grande Site 2017



Conservation Projects

Modeling to Support Minute 323

- Focus on shortage/surplus sharing and Binational Water Scarcity Contingency Plan
- Key metrics were performance, i.e., protects Lake Mead, parity, and alignment

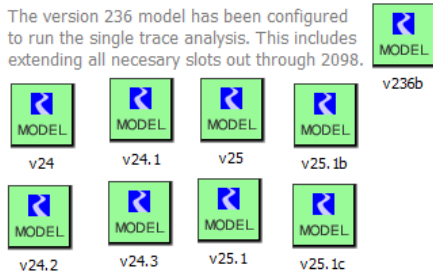
Lake Mead Elevation (feet)	U.S. Shortage (kaf)	U.S. Shortage (percent of apportionment)	MX Reductions (kaf)	MX Reductions (percent of apportionment)
<= 1,075 and >=1,050	313	4.44%	50	3.33%
< 1,050 and >= 1,025	417	5.56%	70	4.67%
<= 1,025	500	6.67%	125	8.33%

CRSS Configuration

- Colorado River Simulation System (CRSS)
 - Implemented in RiverWare
 - Comprehensive, basin-scale planning model for the Colorado River Basin
 - Monthly timestep
 - Excels at comparative analyses
- Configuration for Minute 323 modeling
 - Used 82 hydrologic inflow traces
 - Resampled 1931-2012
 - December 31, 2016 reservoir levels as initial conditions (projected by May 2016 24-month study)
 - RiverSMART
 - Analyzed 25+ different scenarios

RiverSMART Setup

The version 236 model has been configured to run the single trace analysis. This includes extending all necessary slots out through 2098.



Configured to use the Basin Study Current Projected Demand scenario; 2061-2098 are assumed the same as 2060 levels

Configured to use Basin Study Current Projected demands constant at 2017 levels

Configured to use Basin Study Current Projected demands constant at 2017 levels.

All demand scenarios also use a modified version of the equalization line that is analogous to the assumed demand levels. Ex: the C2017 demands fix the equalization line at the 2017 value.

Demand



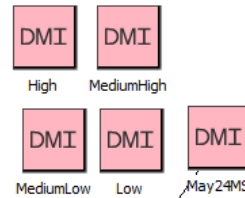
Model



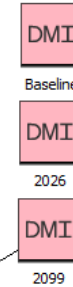
Policy



Initial Conditions



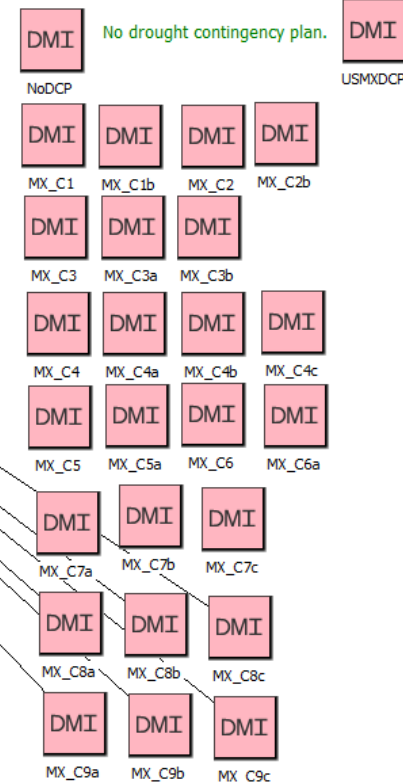
Minute 32x Expires



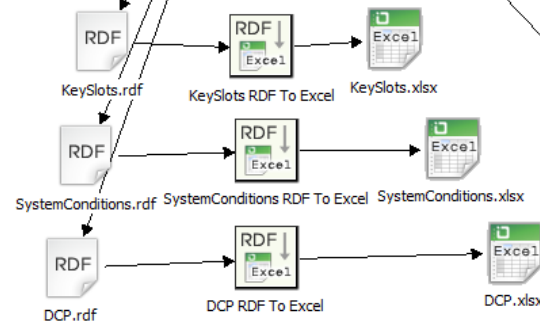
The baseline assumes Mexico shares in shortage at 16.67% the total Lower Basin shortage volume in 2018 - 2037.

This assumes the provisions of Minute 319 are extended through 2026.

Drought Contingency Plan



Supply



Scenario Configuration

MXDCP.xlsx - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW

Paste Font Alignment Number Conditional Formatting Format as Table Cell Styles

E7

	A	B	C
1		MXDCP.ScenarioNumber	MXDCP.nYear
2	12/2016	1	10
3	1/2017	1	10
4	2/2017	1	10
5	3/2017	1	10

MX Input Table NoMXDCP MXDCP MX_C1 ...

Object Viewer

MXDCP

Object: MXDCP

Slots Methods Accounts Accounting Methods Attributes Description

December, 2016

Slot Name	Value	Units
MakeSavingsContributions5		C
TakeReductions5		C
MakeSavingsContributions6		C
TakeReductions6		C
MakeSavingsContributions7		C
TakeReductions7		C
MakeSavingsContributions8		C
TakeReductions8		C
MakeSavingsContributions9		C
TakeReductions9		C
MakeSavingsContributions10		C
TakeReductions10		C
MakeSavingsContributions11		C
TakeReductions11		C
MakeSavingsContributions12		C
TakeReductions12		C
MakeSavingsContributions13		C
TakeReductions13		C
MakeSavingsContributions14		C
TakeReductions14		C

Order: Custom for this Object

MXDCP.ScenarioNumber

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ScenarioNumber

Value: 23 NONE

Dec 2016

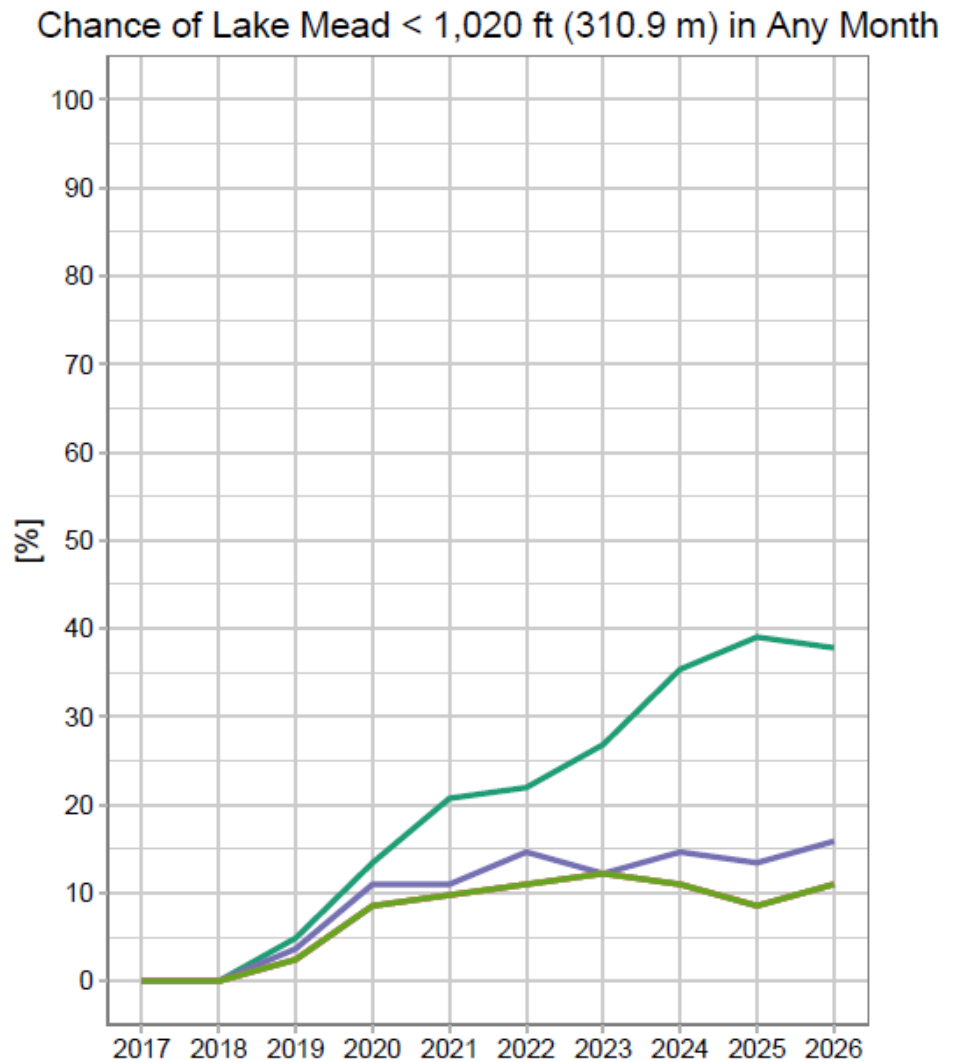
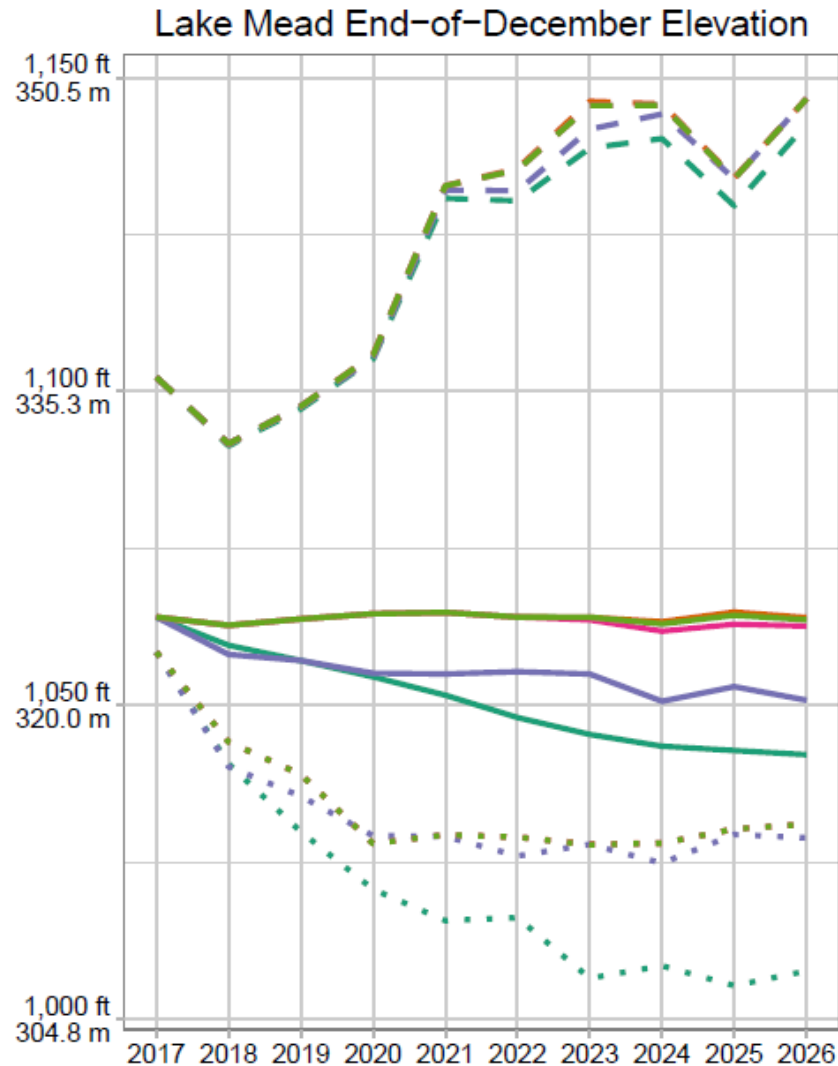
	NONE
12-2018	23.00 I
01-2019	23.00 I
02-2019	23.00 I

Show: ☐ Description

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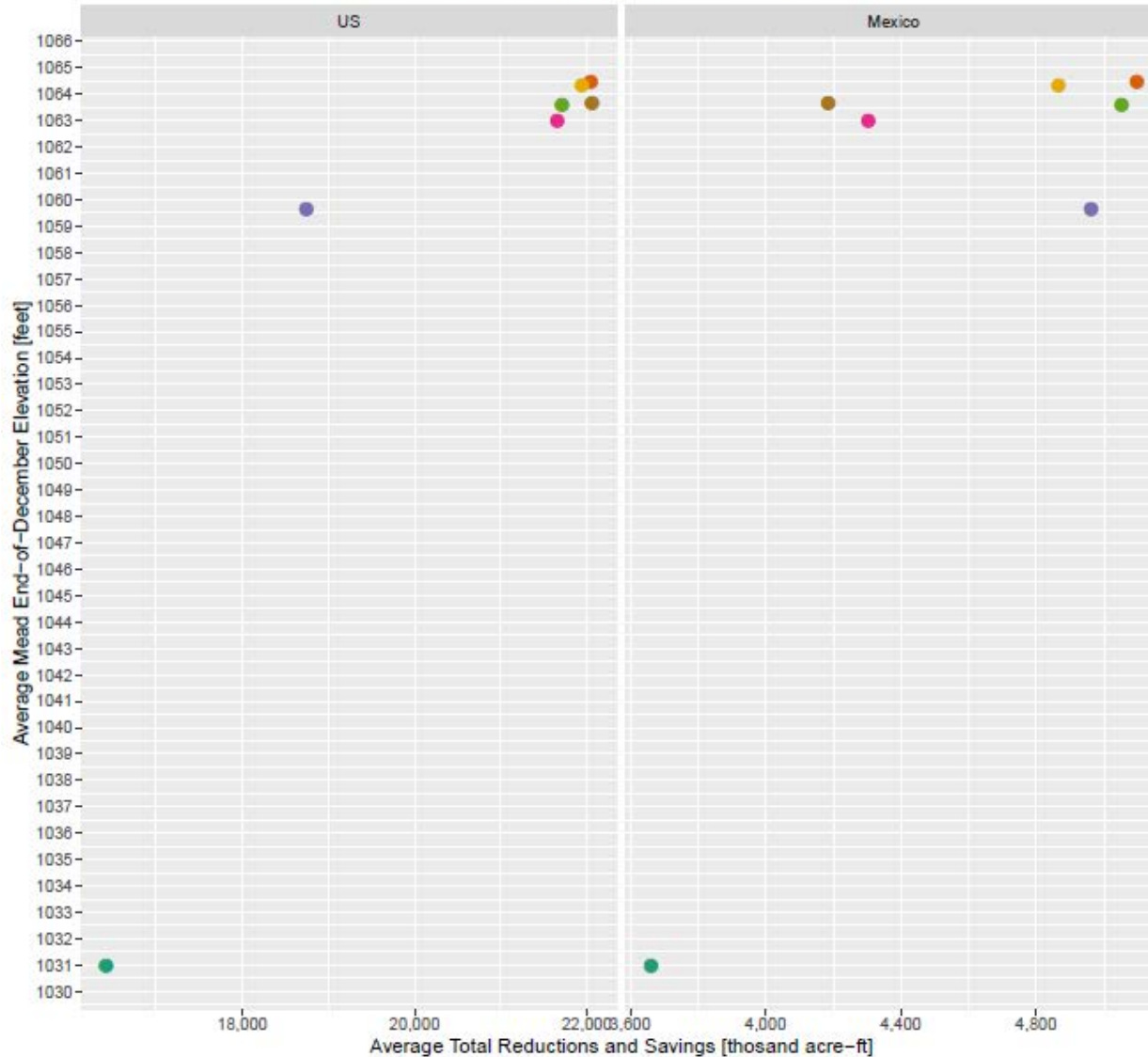
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Output and Analysis - Performance



Output and Analysis – Parity and Alignment

2017–2060 Average Performance of Policy Scenarios
Results Computed Across 82 Traces



2017–2060 Statistics 10 Years Page 1

Policy Scenario	Average Mead Elevation (feet)	Total Reductions and Savings (a-f)	Percent of Total Construction (%)
No Action	1059.5	18,500	100
Moderate	1063.5	21,500	85.5
Aggressive	1064.5	22,000	81.8

2017–2060 Statistics 10 Years Page 2

Policy Scenario	Average Mead Elevation (feet)	Average Number of Years with Shortages	Average Number of Years with Surpluses
No Action	1059.5	2.4	2.4
Moderate	1063.5	2.4	2.4
Aggressive	1064.5	2.4	2.4

2017–2060 Statistics 10 Years Page 3

Policy Scenario	Average Mead Elevation (feet)	Average Annual Consumption (a-f)	Average Annual Consumption (a-f) as Percent of Demand (%)
No Action	1059.5	2,800.0	100
Moderate	1063.5	2,800.0	100
Aggressive	1064.5	2,800.0	100

Summary and Conclusion

- Entered into force on September 27, 2017; remains in effect through 2026
- Binational water scarcity contingency plan will be in alignment with LB DCP (if implemented)

Projected January 1 Lake Mead Elevation (ft msl)	Mexico's Savings that Contribute to the Binational Water Scarcity Contingency Plan
At or below 1,090 and above 1,075	41,000 acre-feet (51 mcm)
At or below 1,075 and above 1,050	30,000 acre-feet (37 mcm)
At or below 1,050 and above 1,045	34,000 acre-feet (42 mcm)
At or below 1,045 and above 1,040	76,000 acre-feet (94 mcm)
At or below 1,040 and above 1,035	84,000 acre-feet (104 mcm)
At or below 1,035 and above 1,030	92,000 acre-feet (113 mcm)
At or below 1,030 and above 1,025	101,000 acre-feet (125 mcm)
At or below 1,025	150,000 acre-feet (185 mcm)

Mexico's water scarcity contingency plan savings volumes from Minute 323