Southwest Ag Summit

The Colorado River Water Shortage: Agricultural Perspectives

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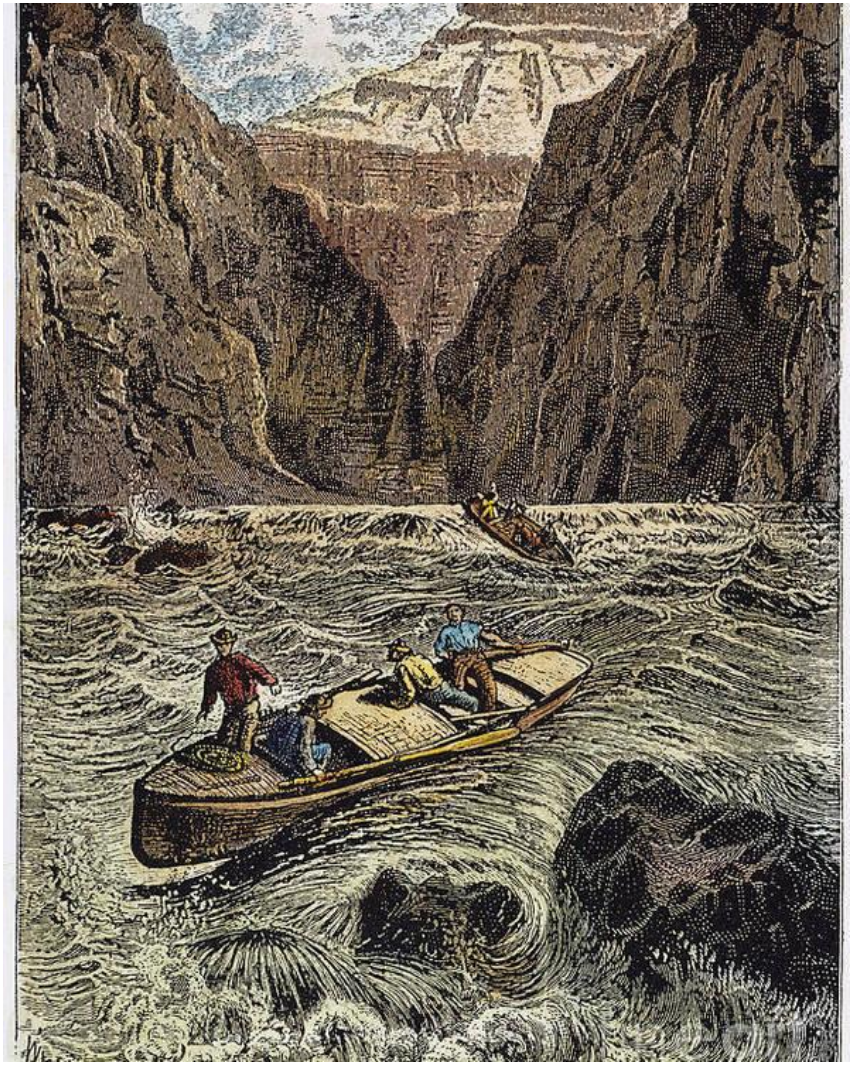
COOPERATIVE EXTENSION

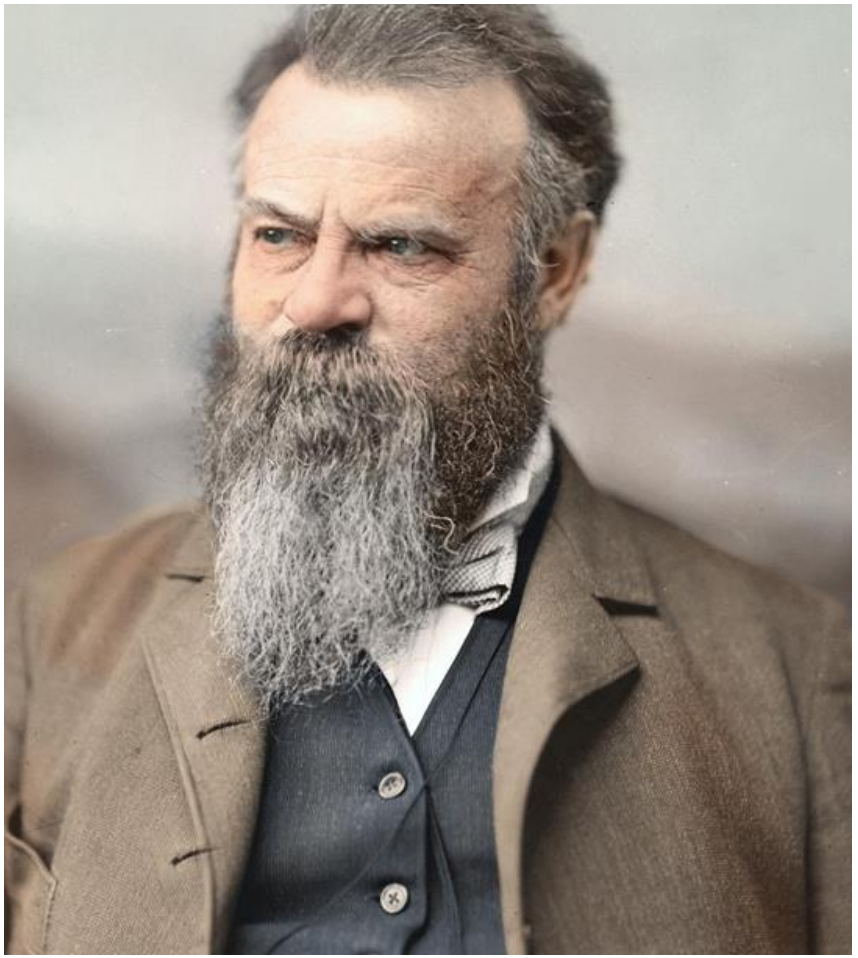
Powell Geographic Expeditions of 1869 and 1871



John Wesley Powell

“All the great values of this territory have ultimately to be measured to you in acre feet”.

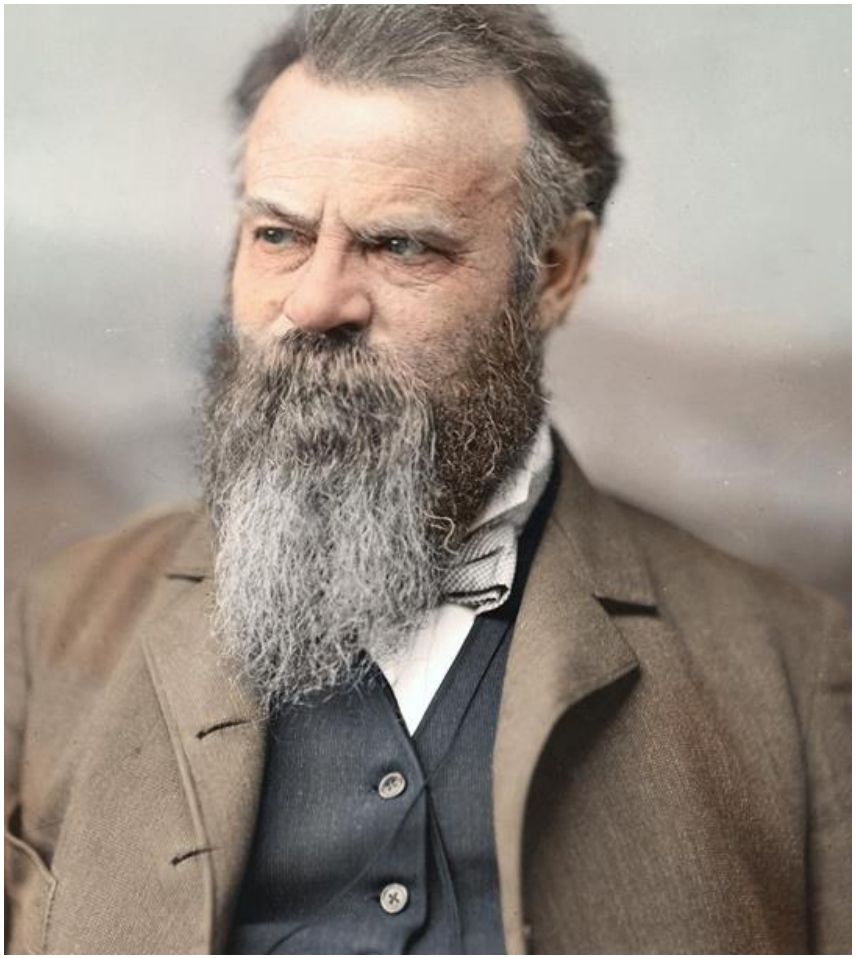
John Wesley Powell, Montana Constitutional Convention, 1889.



John Wesley Powell

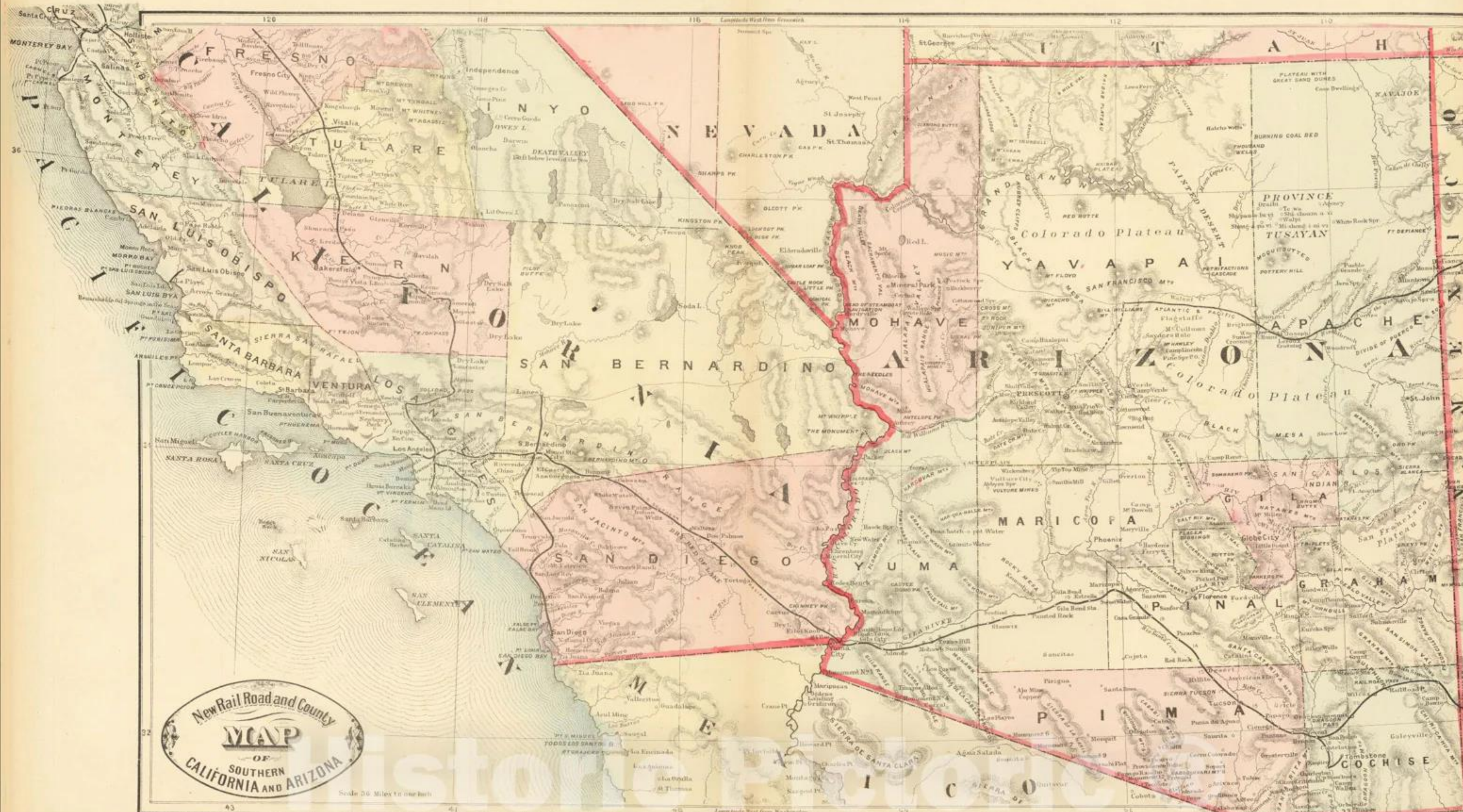
- “**I tell you, gentlemen, you are piling up a heritage of conflict and litigation over water rights, for there is not sufficient water to supply these lands**.”

To the1893 irrigation congress in Los Angeles



Watersheds of the U.S.

Colorado River Watershed



Water is Life

Photo Credit: Jon Dinsmore

Water












Critical Limiting Factors in Desert Crop Production Systems

- **Water**
  - **–(Irrigation Management)**
- Nitrogen
- Plant Genetics

Colorado River Watershed

- 1,450 mile river channel
- 244,000 sq. mile drainage
- greatest elevation drop in North America
- budgeted volume = **16.5 million acre-ft/year**
  - Columbia River: 192 million acre-ft/year
  - Mississippi River: 400 million acre-ft/year
- covers portions of **7 states** and **2 nations**
- **40M people w/ 30 American Indian Tribes**
- **~ 6.0M acres of farmland**

The Law of the River

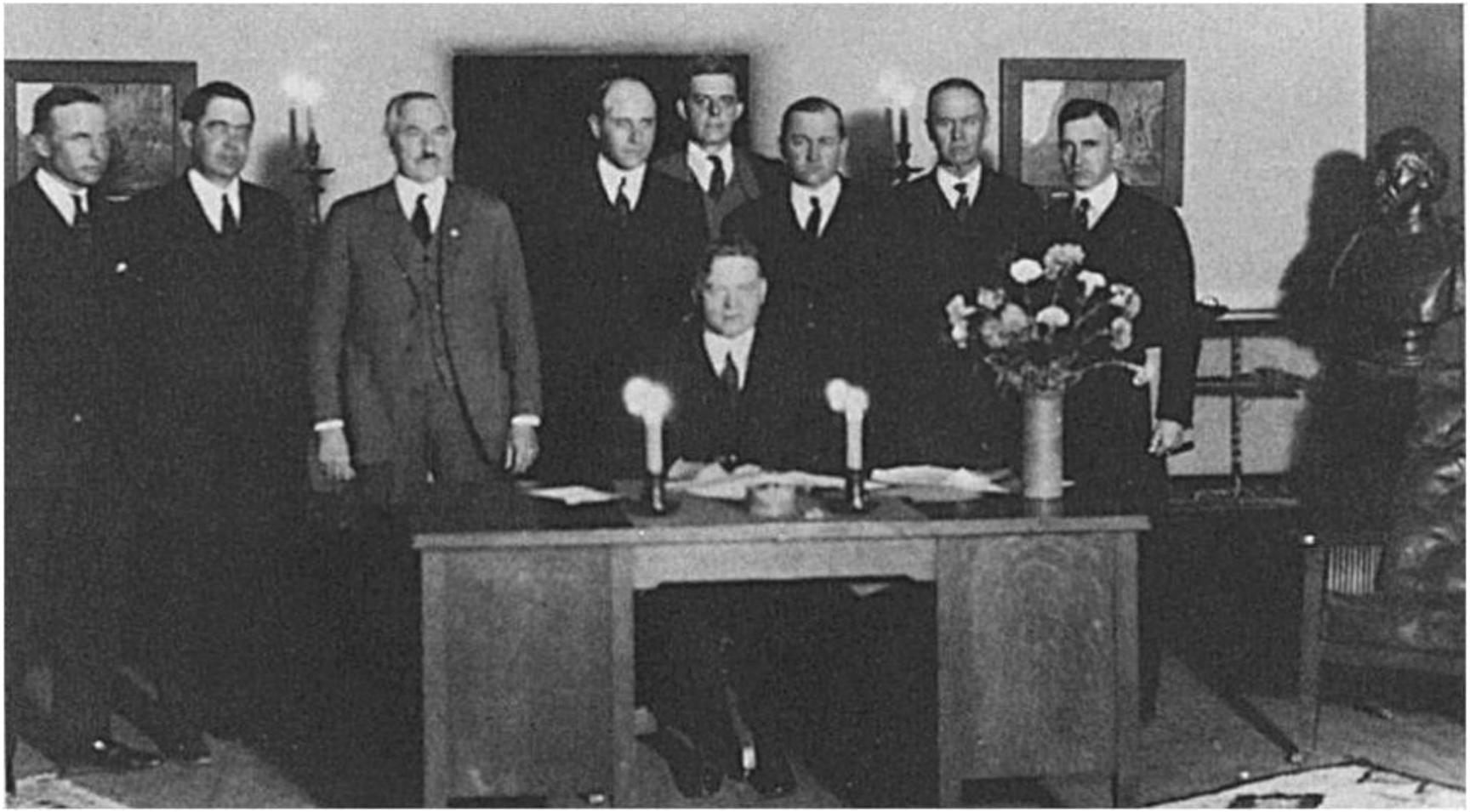
Colorado River Compact

- Created in 1922 to Divide the Water of the Colorado River

  – At The Bishop's Lodge in Santa Fe, N.M. with Secretary Herbert Hoover to negotiate an agreement to divide the Colorado River

  – signed 24 November 1922

Colorado River Compact Signed 24 November 1922

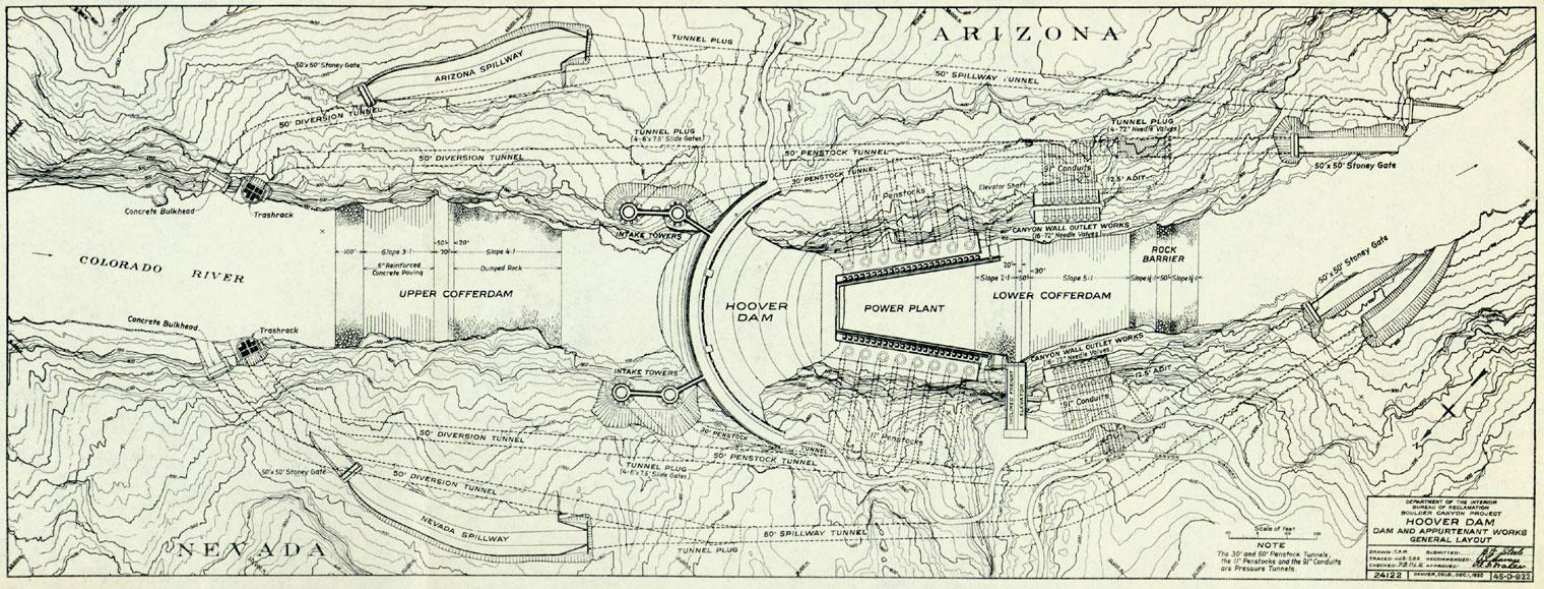


Boulder Canyon Project Act 1928

- Legislation for Creation of Hoover Dam
- Also Created All-American Canal (CA Project)
- Purposes for Hoover
  - River Regulation, Improvement of Navigation, and Flood Control;
  - Delivery of Stored Water for Irrigation and other Domestic Uses;

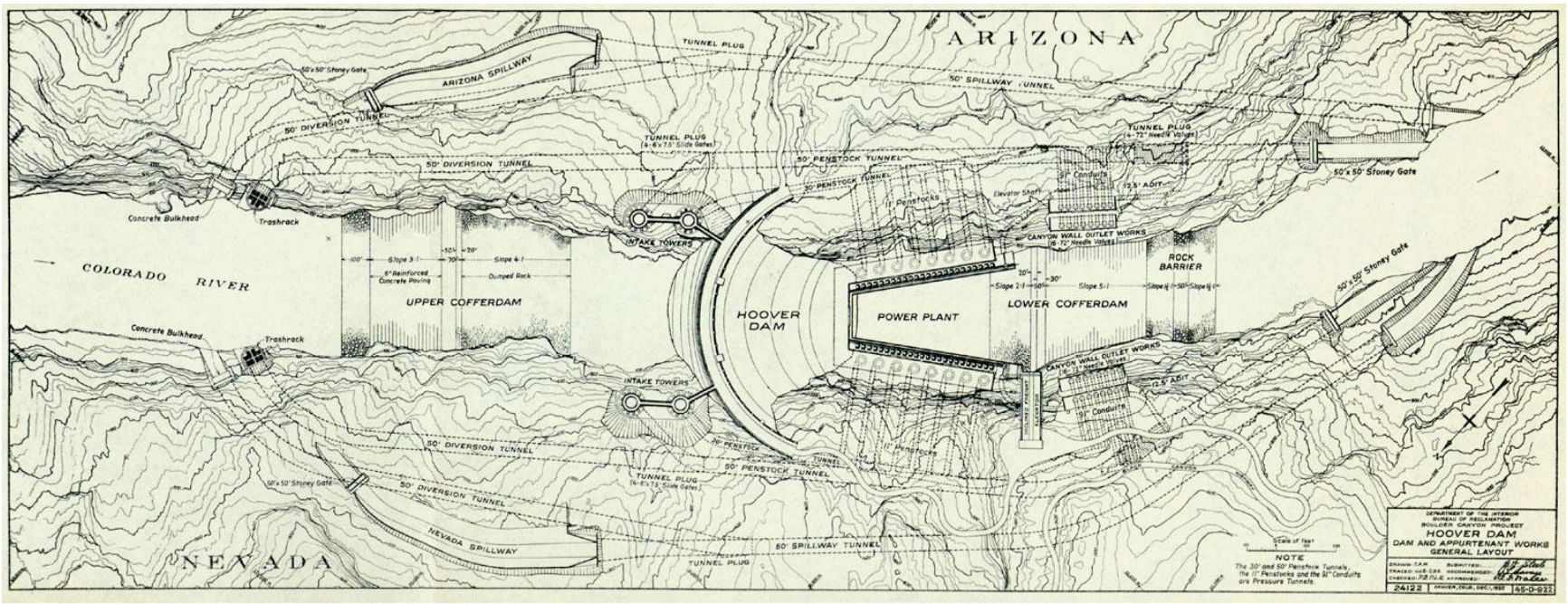
Boulder Canyon Project Act 1928

- Power Generation: 2,048 MW
- When Hoover was First Contemplated, Power wasn't in the Initial Design



Boulder Canyon Project Act 1928

Began 7 July 1930 & Completed 29 May 1935




LAS VEGAS WASH
LAKE MEAD
COLORADO RIVER
Las Vegas
Hoover Dam
LAKE MOHAVE
Davis Dam
Flagstaff
CALIFORNIA
LAKE HAVASU
ARIZONA
COLORADO RIVER AQUEDUCT
Parker Dam
Los Angeles
Headgate Rock Dam
CENTRAL ARIZONA PROJECT
Torrez Martinez Reservation
COACHELLA CANAL
Palo Verde Diversion Dam
Phoenix
SALTON SEA
El Centro
San Diego
Imperial Dam
ALL-AMERICAN CANAL
Yuma
Morelos Dam (Mexico)
COLORADO RIVER
Tucson
MEXICO

Imperial Dam
All-American Canal

- Construction of the All-American Canal **began in 1934**,
- The construction of Imperial Dam and Desilting Works began in January 1936
  - completed July 1938.
- The first irrigation water was delivered in 1940.

Parker Dam 1934

- Arizona Gov. Benjamin Baker Moeur,
  - Unhappy that a federally approved interstate compact had awarded California more water from the Colorado than he thought it deserved,
  - dispatched a squad of National Guard troops to the river on a ferryboat to block the new dam's construction.
    - The Arizona Navy!

127-A

127-A "Julia B" on Colorado River near Parker, Arizona.

Parker Dam 1934
California & Arizona

- The ferryboat Julia B. promptly ran aground on a sandbar.

- Interior Secretary Harold Ickes imposed a truce between the two states,
  - the guardsmen returned home from the war zone to be hailed as “conquering heroes.”

Davis Dam, 1953

- Near Bullhead City, AZ and Laughlin, NV
- Re-regulate Hoover Dam releases
  - including the annual delivery of 1.5 million acre-feet of water to Mexico.
- Hydroelectric energy,
  - generating 1-2 B kilowatt-hours annually.
- Completed in 1953.

Colorado River Storage Project Act - 1956

- Dam in Glen Canyon Studied in 1924, but Dropped for Hoover
  - Compromise for No Dam in Dinosaur National Monument
- Groundbreaking for Glen Canyon Dam came 6 Months after Act's Authorization
  - 15 October 1956 – 22 September 1966

Colorado River Storage Project 1956 Act

Colorado River Storage Project Act 1956

Purposes for CRSP:

- River Regulation
- Water Storage
- Flood Control
- Power Generation: 1,875 MW
- Recreation
- Environmental
  - (Fish & Wildlife Enhancement)

Arizona vs. California, 1963

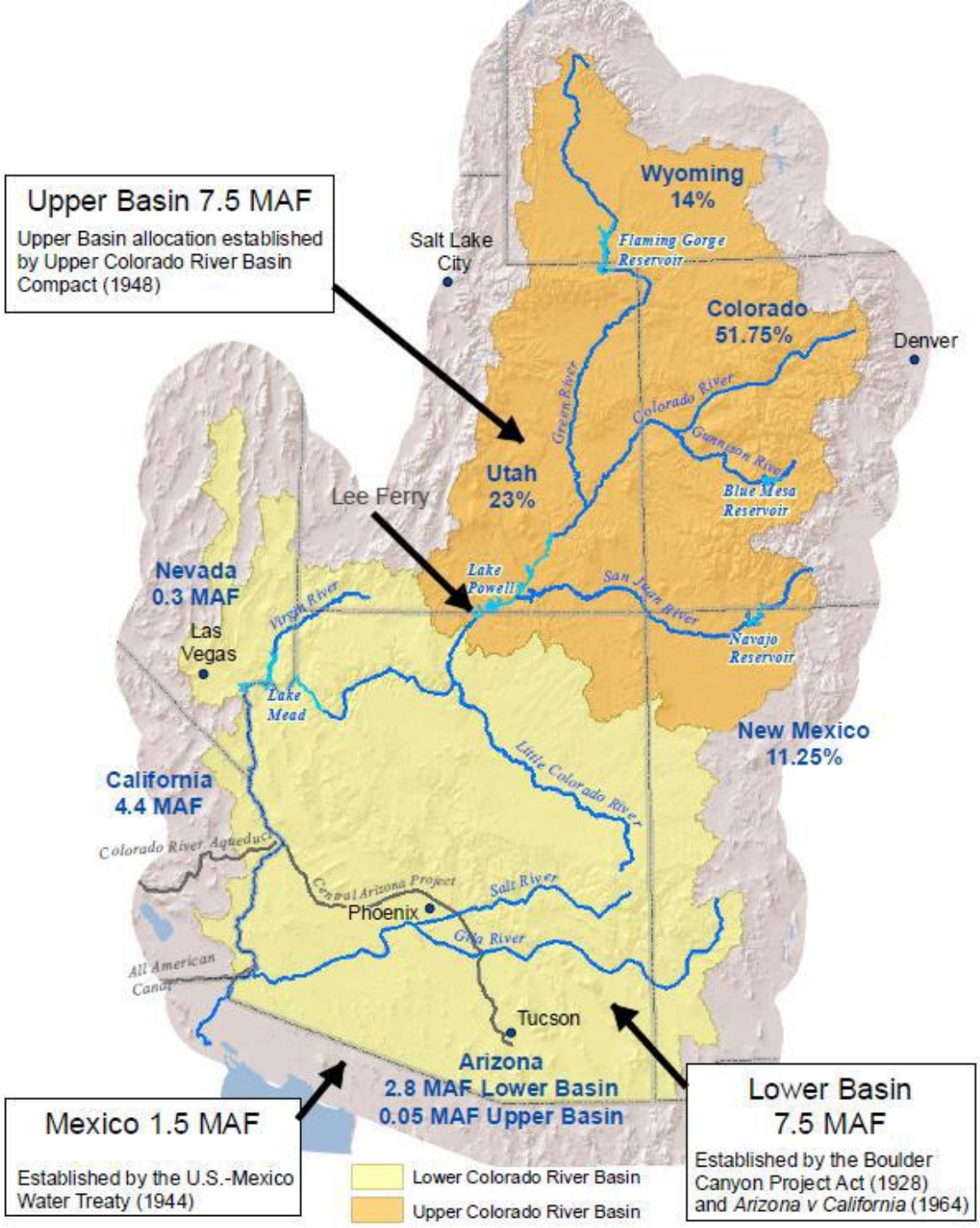
- **This original suit was brought by the State of Arizona in1952 against the State of California and seven of its public agencies.**
  - Later, Nevada, New Mexico, Utah and the United States became parties.
- Basic controversy: how much water each State has a legal right to use out of the waters of the Colorado River and its tributaries.

Arizona vs. California, 1963

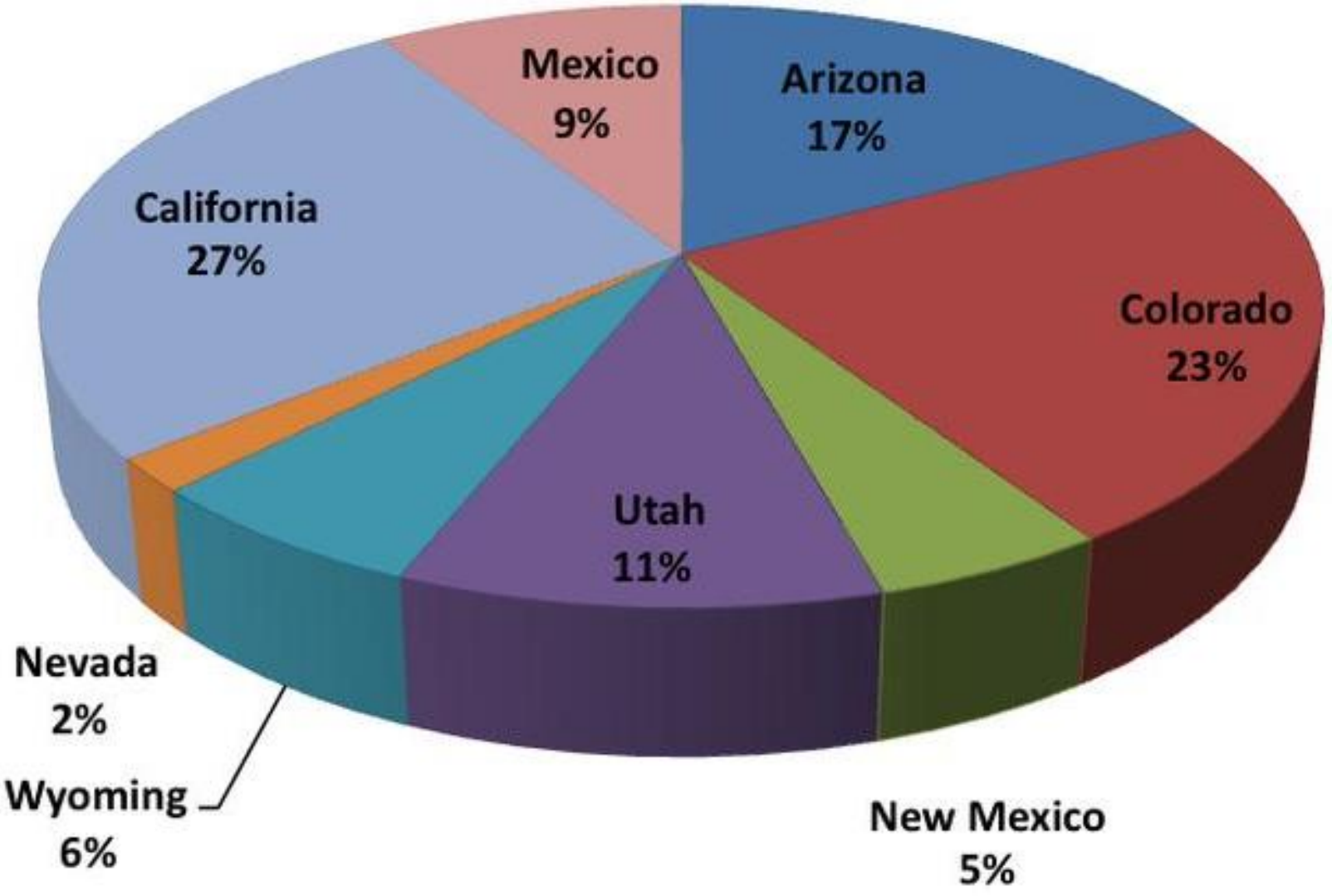
- A Special Master appointed by the Court conducted a lengthy trial and filed a report.
  - conclusions and a recommended decree, to which various parties took exceptions….
- First 7.5 MAF of lower basin mainstream waters would give 4.4 MAF California
  - 2.8 MAF to Arizona
  - 300 KAF to Nevada

Arizona vs California, 1963

- Arizona and California should each get one-half of any surplus.
- Congress gave the Secretary of the Interior adequate authority and power to make contracts for the delivery of water
  - and by providing that no person could have water without a contract.



Colorado River Apportionment



Colorado River

- Agriculture utilizes ~ 70-80% of the river water,

  ~ 70% of Arizona freshwater is *diverted* to agriculture

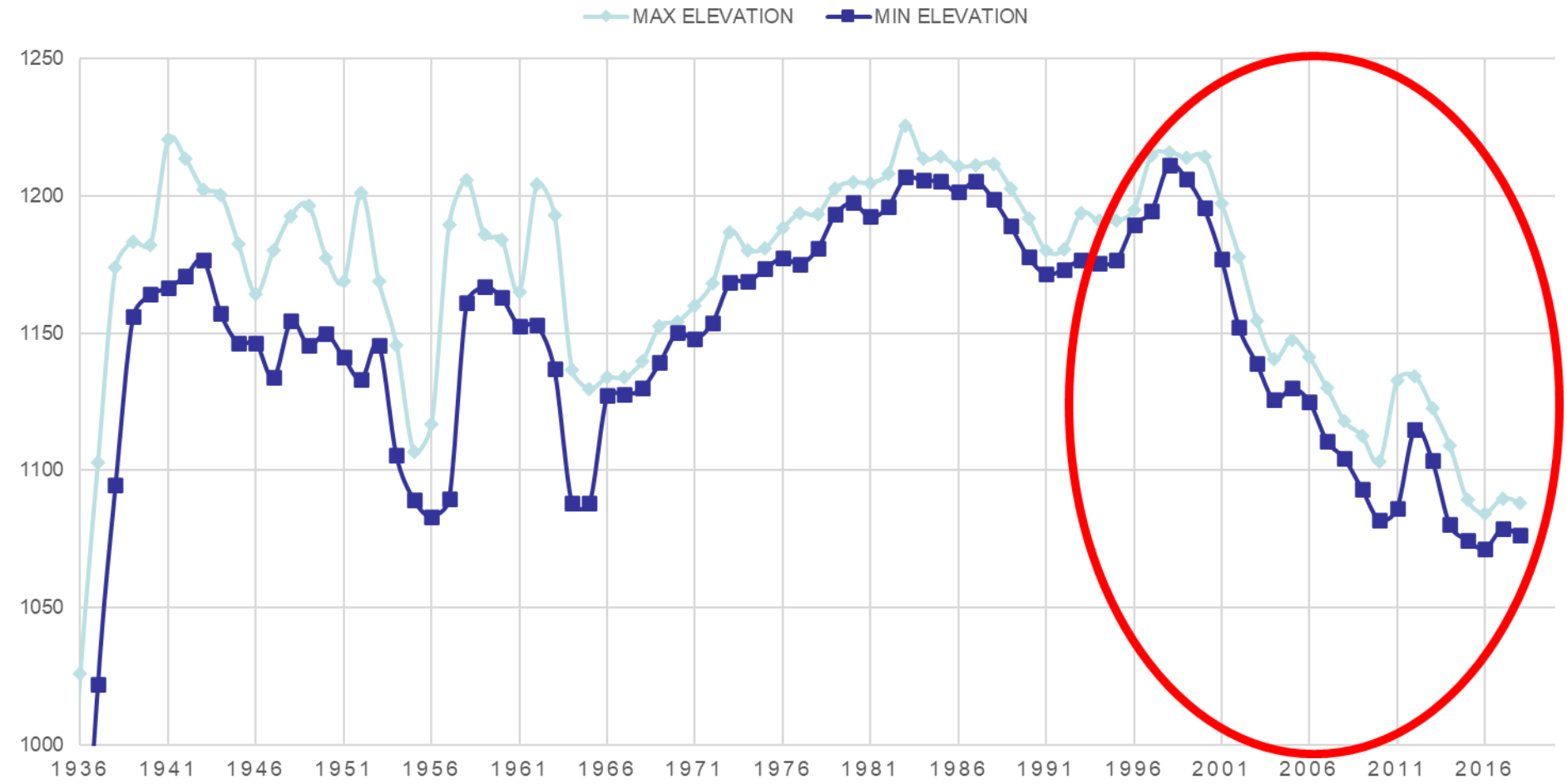
- Lower Colorado River Agriculture

  $5B industry annually

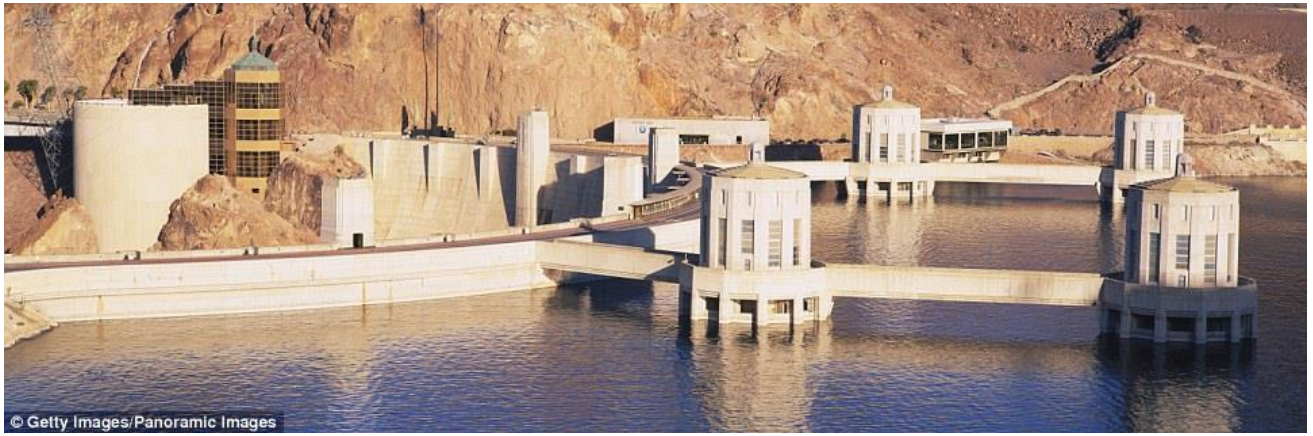
  ($1.4T total economic activity/year from the Colo. R. and 16 million jobs)

  Food and fiber products for region, nation, and world.

HISTORY OF LAKE MEAD ELEVATIONS



Lake Mead



2000 - Full

Lake Mead

- *Lake Mead* is the largest reservoir in the United States in maximum water capacity (28 MAF)

- Lake Mead is now less than 25 % capacity

Lake Mead

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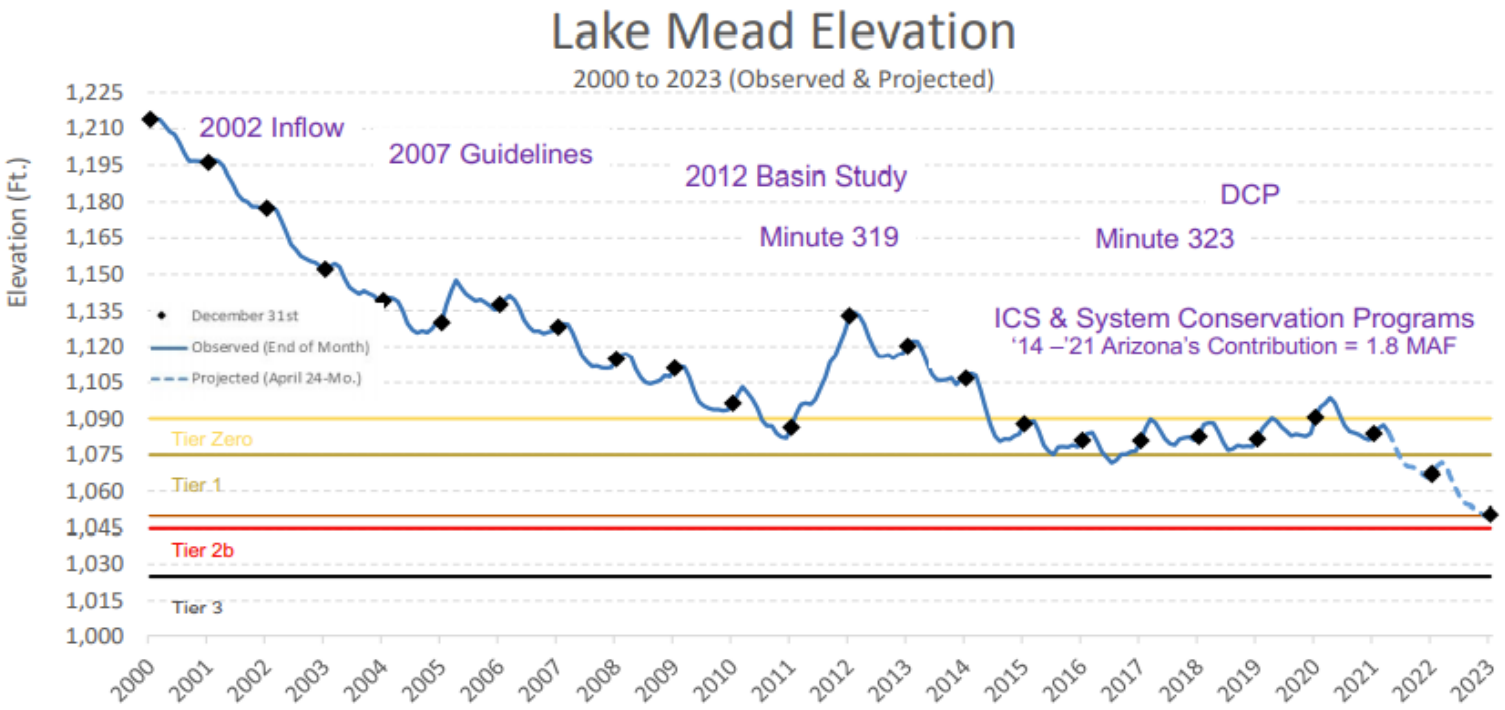
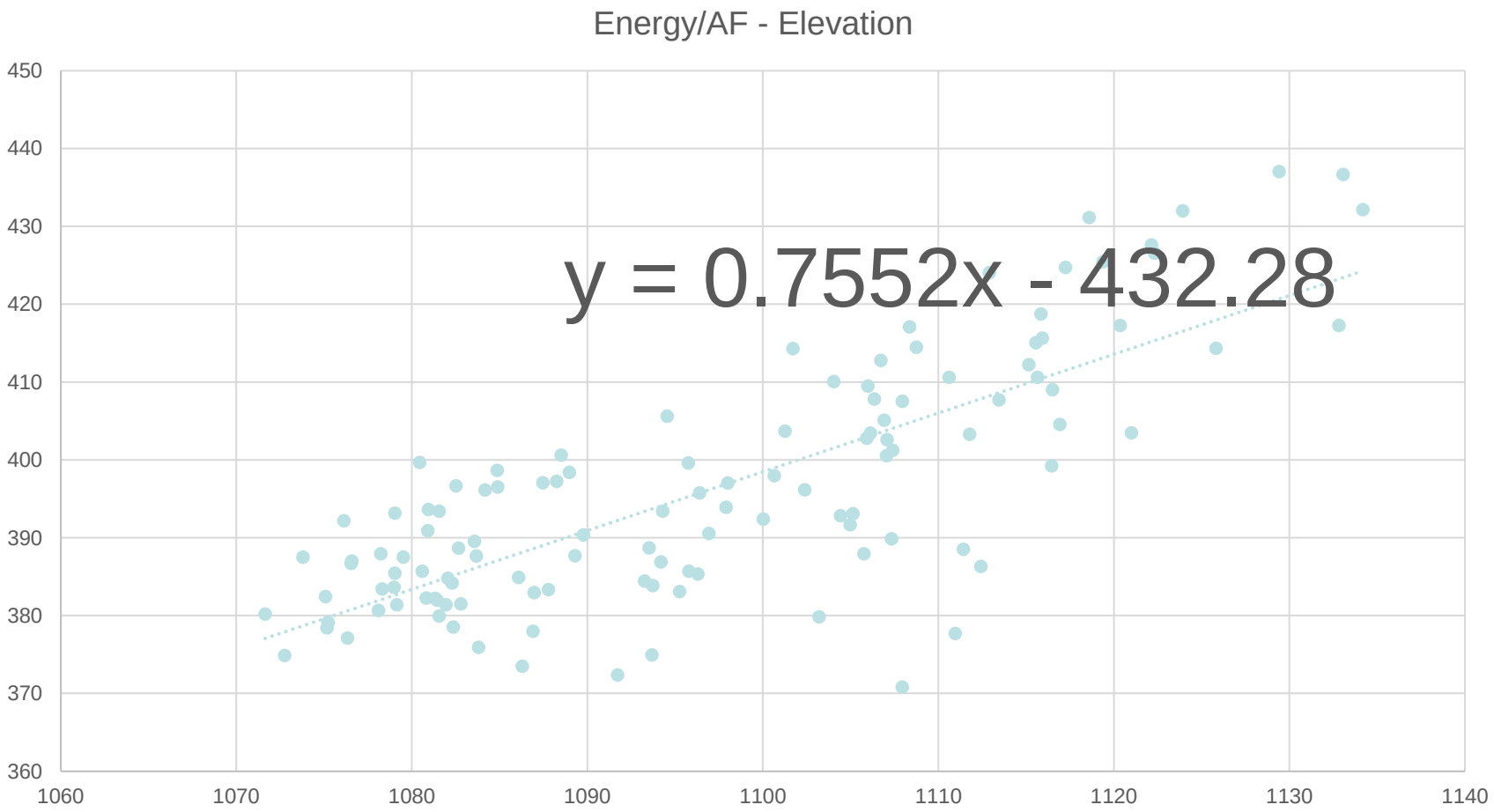
20 Years of Shortage Preparation



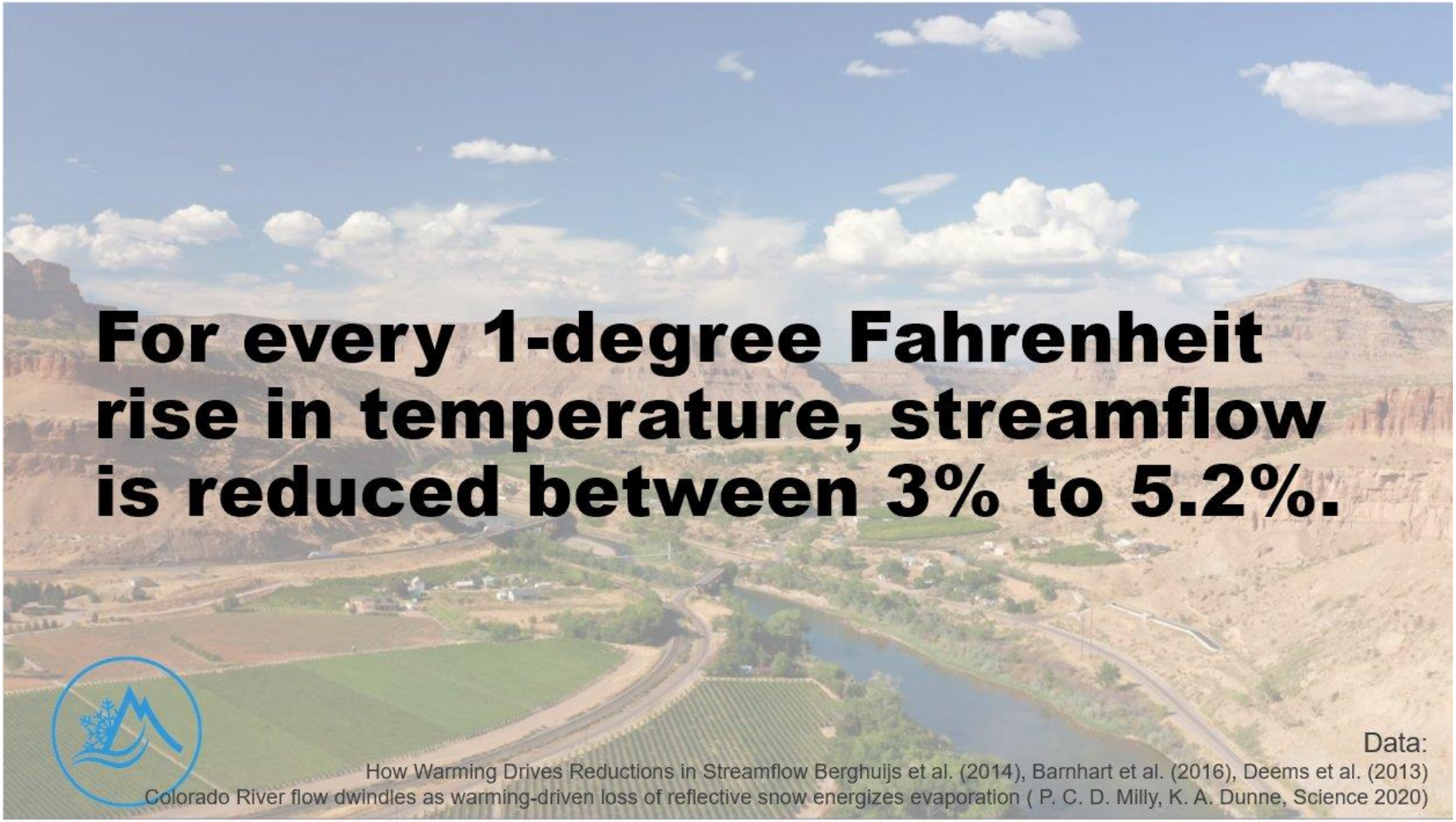
Average Energy Production Based on Elevation at Hoover Dam



Rio Colorado – Sonora/Baja California/Arizona

Colorado River

- Average flow between 2000 and 2018
  - ~ 12.4MAF
    - 16 % lower than the 1906-2017 average of 14.8MAF/year


For every 1-degree Fahrenheit rise in temperature, streamflow is reduced between 3% to 5.2%.
Data:
How Warming Drives Reductions in Streamflow Berghuijs et al. (2014), Barnhart et al. (2016), Deems et al. (2013)
Colorado River flow dwindles as warming-driven loss of reflective snow energizes evaporation (P. C. D. Milly, K. A. Dunne, Science 2020)

Colorado River Water Budget

- **16.5 MAF** Currently budgeted total

  (7.5+7.5 MAF = 15 MAF + 1.5 MAF Mexico)

- Average annual flow 2000 - 2018

  ~ **12.4MAF**

  - 16 % lower than the 1906-2017 average of 14.8MAF/year

~ **4 MAF differential**

Restructure Budget @ 12 MAF ????

Bureau of Reclamation
14 June 2022

- Commissioner Camille C. Touton: **BoR needs 2-4 maf** in reductions of Colorado River use.
  - U.S. Senate Energy and Natural Resources Committee held hearings in Washington, D.C. to review the conditions and impacts of drought in the western U.S
- Basin states have **60 days (until mid-August)** to propose plans of action.
- BoR has the authority to “act unilaterally to protect the system, and we will protect the system.”

Colorado River Budget

12 MAF Budget: 27% less than 16.5 MAF

Proportionate reductions:

Arizona: 2.8 MAF ⟶ 2 MAF

California: 4.4 MAF ⟶ 3.2 MAF

Bureau of Reclamation
16 August 2022

- U.S. Department of the Interior Deputy Secretary Tommy Beaudreau
  - Assistant Secretary for Water and Science Tanya Trujillo
  - Bureau of Reclamation Commissioner Camille Calimlim Touton
- 2023 Colorado River Operational Plan: Tier 2a reductions

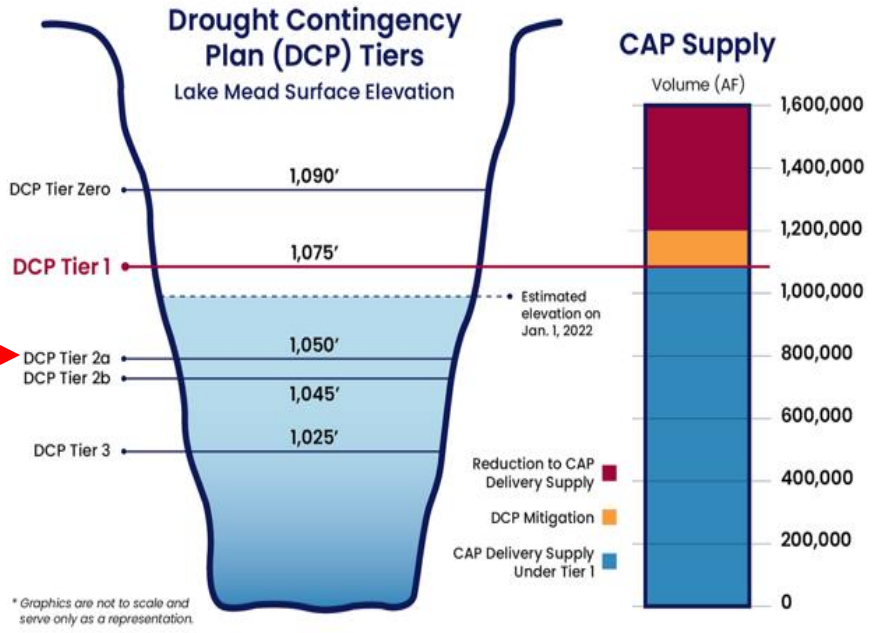
  = 512 + 80KAF from Arizona = 592KAF (21%)

  Nevada: 25 KAF, 8% annual allotment
  Mexico: 104 KAF, 7% annual allotment

  No required water savings contribution for California in 2023 under this operating condition.
- BoR has the authority to “act unilaterally to protect the system, and we will protect the system.”

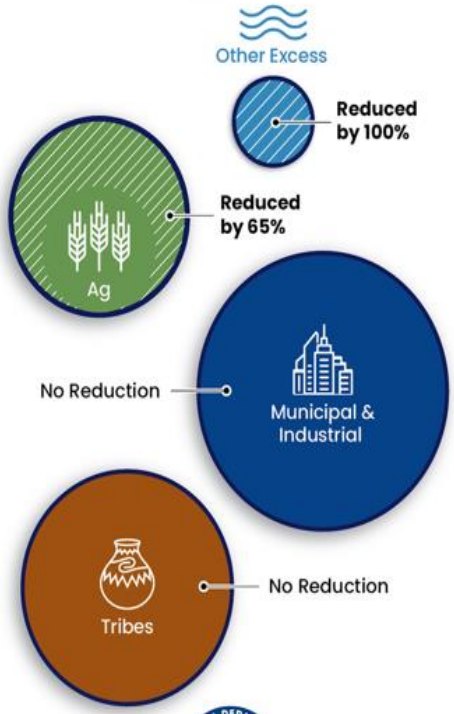
2022 – Tier 1 Shortage

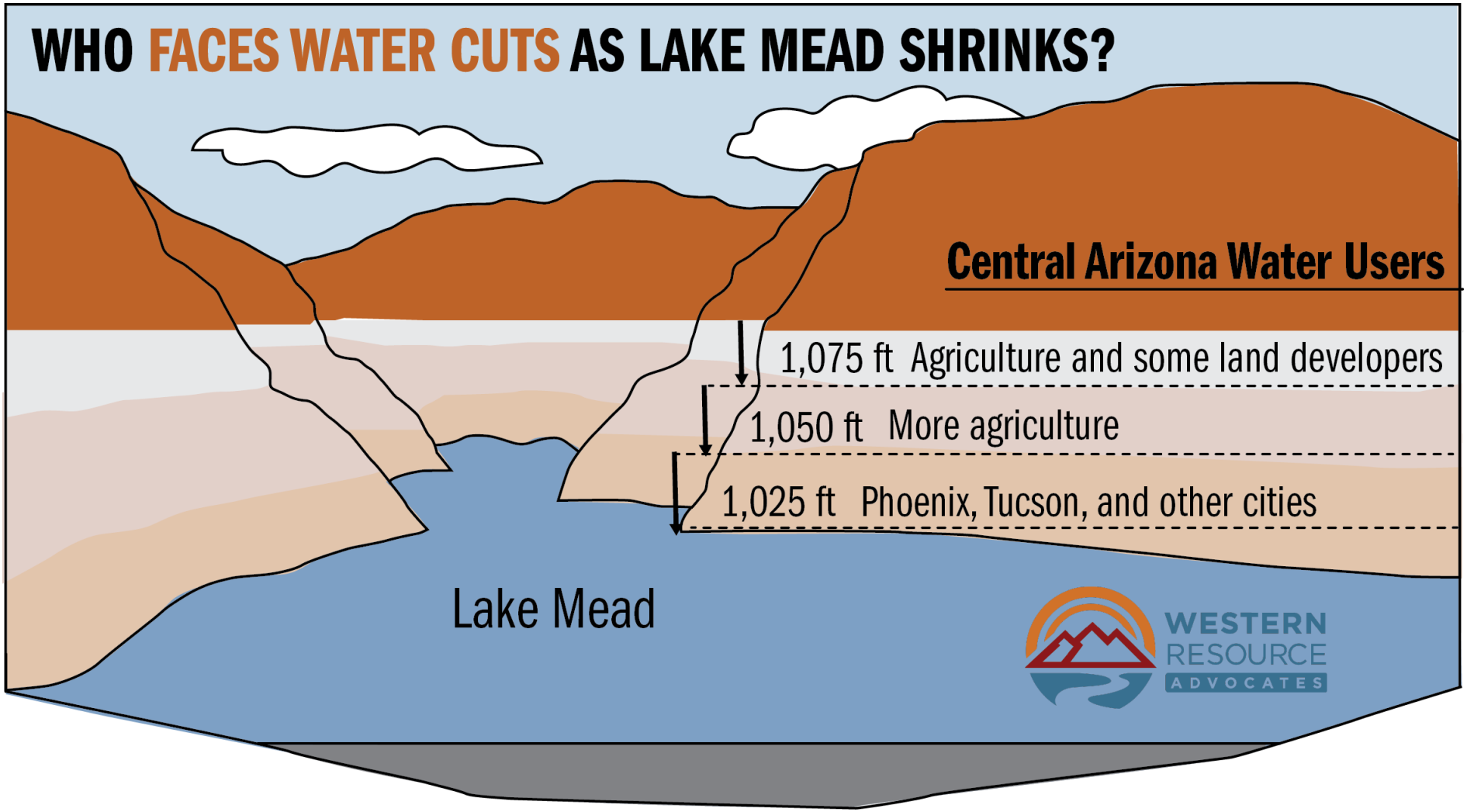
CAP Reductions



To learn more, please visit: www.cap-az.com/colorado-river-shortage

2022 Reduction to CAP Users After DCP Mitigation





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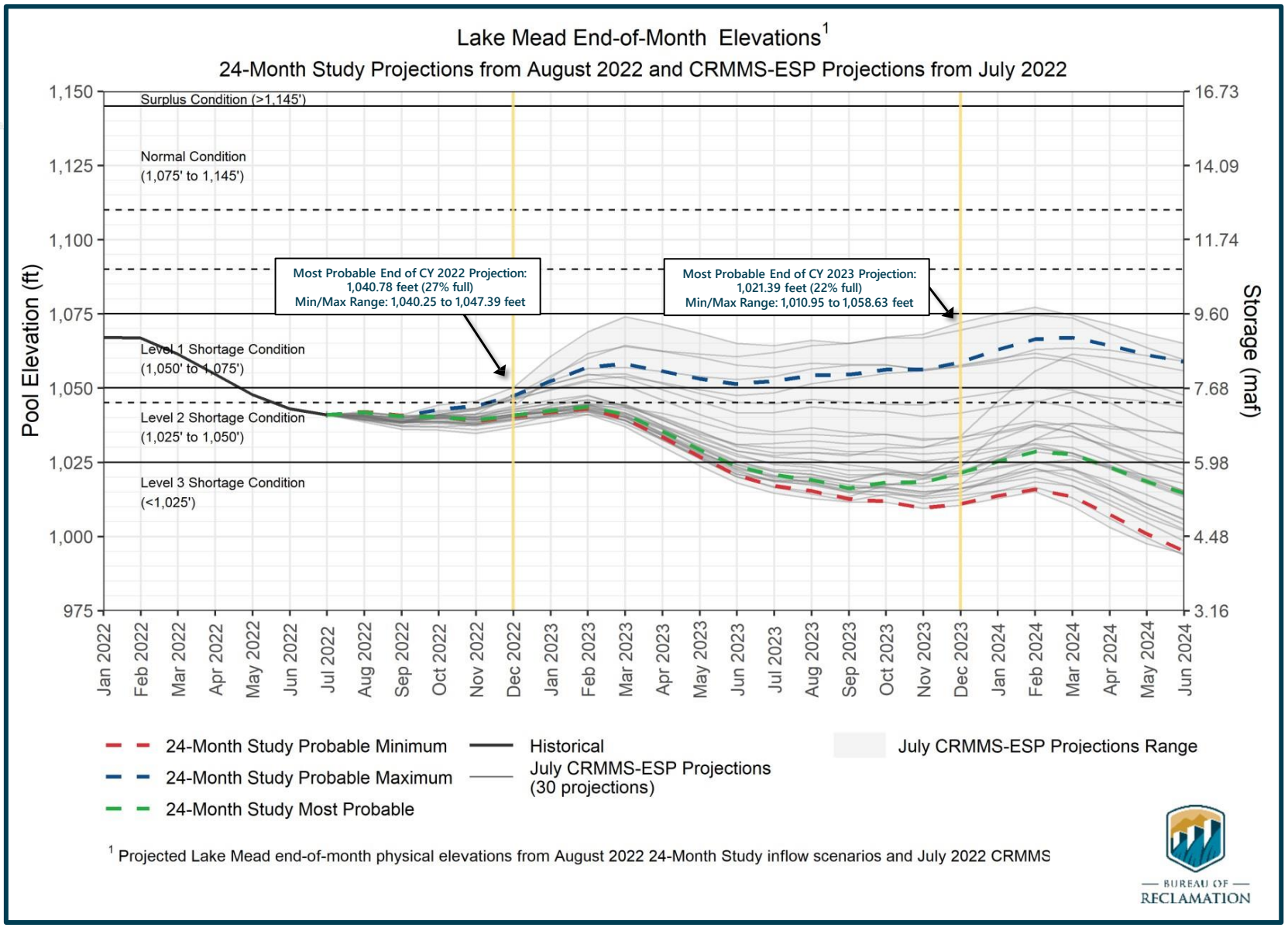
Santa Rosa Canal – Pinal County



The chart above displays projected "physical" elevations for Lake Mead. Based on August 2022 24-Month Study modeling, Lake Mead's operating condition for calendar year 2023 is the Level 2 Shortage Condition within the 1,045 – 1,050 elevation band.

Lake Mead – End of CY23 Projection

- Most Probable End of CY 2023 Projection: **1,021.39 feet above sea level** (22% full)
  - Tier 3 (DCP)
- Min/Max Range: 1,010.95 to 1,058.63 feet
- Current: 1,047.64 ft. above sea level

2007 Interim Guidelines, Minute 323, Lower Basin Drought Contingency Plan, and Binational Water Scarcity Contingency Plan

Total Volumes (kaf)

Lake Mead Elevation (feet msl)	2007 Interim Guidelines Shortages		Minute 323 Delivery Reductions	Total Combined Reductions	DCP Water Savings Contributions			Binational Water Scarcity Contingency Plan Savings	Combined Volumes by Country *US: (2007 Interim Guidelines Shortages + DCP Contributions)* *Mexico: (Minute 323 Delivery Reductions + Binational Water Scarcity Contingency Plan Savings)*					Total Combined Volumes
	AZ	NV	Mexico	***Lower Basin States + Mexico***	AZ	NV	CA	Mexico	*AZ Total*	*NV Total*	*CA Total*	*Lower Basin States Total*	*Mexico Total*	***Lower Basin States + Mexico***
1,090 - 1,075	0	0	0	***0***	192	8	0	41	192	8	0	*200*	*41*	***241***
1,075 - 1050	320	13	50	***383***	192	8	0	30	512	21	0	*533*	*80*	***613***
1,050 - 1,045	400	17	70	***487***	192	8	0	34	592	25	0	*617*	*104*	***721***
1,045 - 1,040	400	17	70	***487***	240	10	200	76	640	27	200	*867*	*146*	***1,013***
1,040 - 1,035	400	17	70	***487***	240	10	250	84	640	27	250	*917*	*154*	***1,071***
1,035 - 1,030	400	17	70	***487***	240	10	300	92	640	27	300	*967*	*162*	***1,129***
1,030 - 1,025	400	17	70	***487***	240	10	350	101	640	27	350	*1,017*	*171*	***1,188***
<1,025	480	20	125	***625***	240	10	350	150	720	30	350	*1,100*	*275*	***1,375***

2022 Reductions + Contributions

2022 Reductions + Contributions

2023??

The Secretary of the Interior will take affirmative actions to implement programs designed to create or conserve 100,000 acre-ft per annum or more of Colorado River System water to contribute to conservation of water supplies in Lake Mead and other Colorado River reservoirs in the lower basin. All actions taken by the United States shall be subject to applicable law, including availability of appropriations.

Here’s the deal…

Colorado River Water Budget

- **16.5 MAF** Currently budgeted total

  (7.5+7.5 MAF = 15 MAF + 1.5 MAF Mexico)

- Average annual flow 2000 - 2018

  ~ **12.4MAF**

  - 16 % lower than the 1906-2017 average of 14.8MAF/year

~ **4 MAF differential**

The Current Situation

- Began during negotiations over the seven-state 1922 Colorado River Compact

- Current basin states failure to meet a 31 Jan. 2023 federal deadline
  - Follow the Law of River - OR
  - Restructure their water rights to accommodate the current demands
    - nearly unrestrained growth
    - and the implacable realities of global warming.

4 Major Questions

1. How much water do we have?
2. How much water do we need?
3. Who gets the water and how much?
4. How do we decide where the water goes?

Six Basin State Proposal

The proposal submitted by Arizona, Colorado, New Mexico, Nevada, Utah, and Wyoming

2-4 MAF/yr by accounting for system losses that include evaporation and other losses between Lake Mead and the Imperial Dam (approximately **1.5 MAF/yr**).

The calculations result in large reductions for California due to its large share of the river water.

This proposal also addresses reductions in Colorado River allocations more rapidly than the California proposal.

Six Basin State Proposal

Collective reductions of **250,000 acre-feet (KAF)** when the Lake Mead reservoir level drops to an elevation of **1,030 feet and below**.

250 KAF total would consist of:

93 KAF from Arizona,

10 KAF from Nevada,

147 KAF from California.

An additional collective reduction of **200 KAF** would come from these lower basin states if Lake Mead's elevation plunged to **1,020 feet and below**.

Lake Mead is **currently at an elevation of 1,047.64 feet**.

California Proposal

Heavily based on the "Law of the River" and the high-priority senior water rights of the Golden State

The current California position has an emphasis on "**present perfected rights, PPRs**", their interpretation of the Law of the River (**first in time, first in right**)

CA offer to conserve an additional **400 KAF/year through 2026**.

California Proposal

California proposal also includes **voluntary cuts of 560 KAF from Arizona and 40 KAF from Nevada**.

California proposal also includes considerations of Lake Powell water levels and additional reductions if the elevations of that reservoir were to drop further.

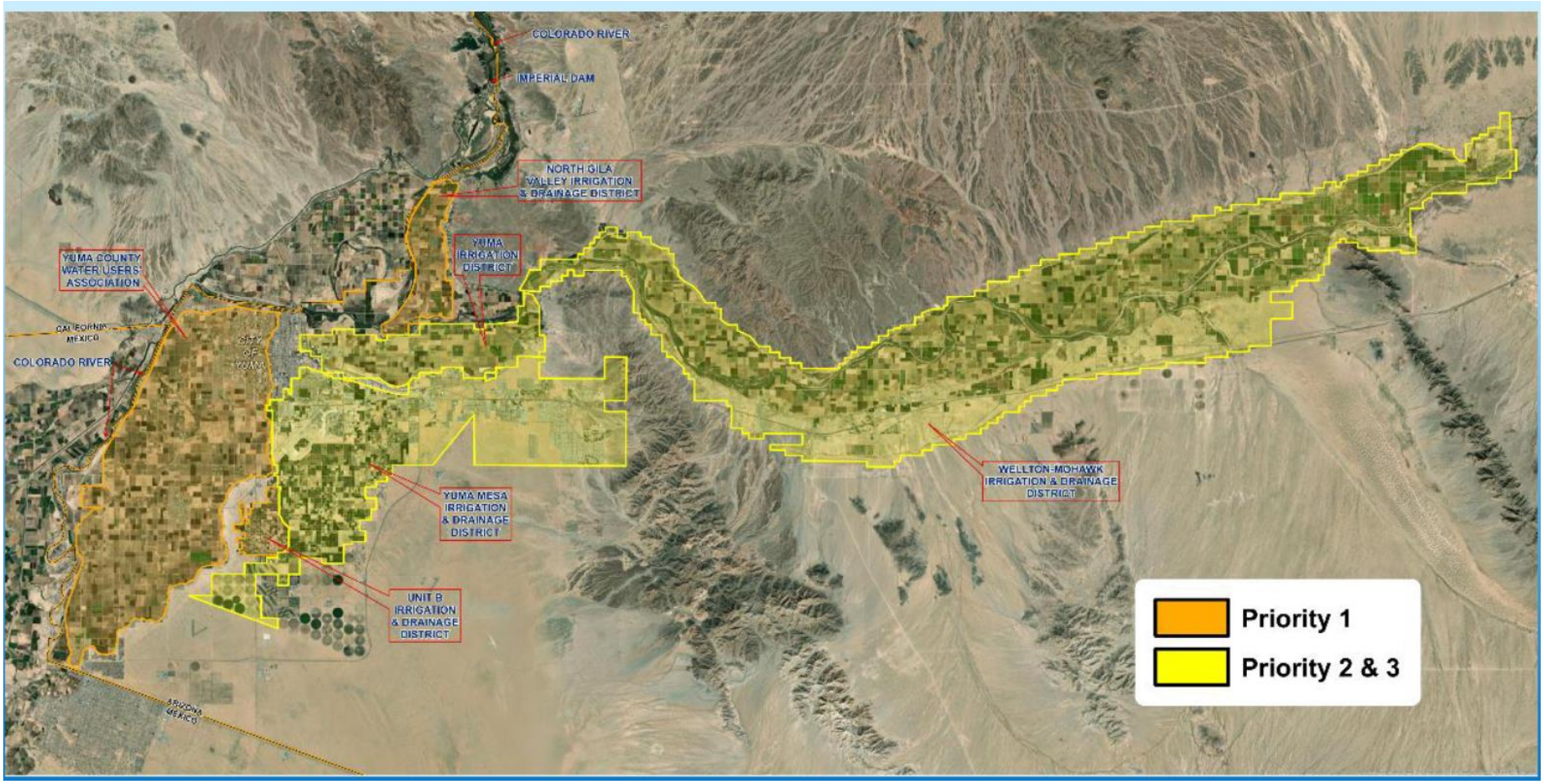
Present Perfected Rights, PPRs

The "present perfected rights PPRs" is an important aspect of the Law of the River.

The PPRs are those rights to use Colorado River water that were acquired or "perfected" by prior appropriation under state law before the Boulder Canyon Project Act of 1928 was passed.

BoR has established a priority ranking of water rights to administer diversions from the river on a

"first-in-time-first-in-right" basis.


COLORADO RIVER
IMPERIAL DAM
NORTH GILA VALLEY IRRIGATION & DRAINAGE DISTRICT
YUMA IRRIGATION DISTRICT
YUMA COUNTY WATER USERS' ASSOCIATION
CALIFORNIA
MEXICO
COLORADO RIVER
CITY OF YUMA
YUMA MESA IRRIGATION & DRAINAGE DISTRICT
UNIT B IRRIGATION & DRAINAGE DISTRICT
ARIZONA
MEXICO
WELLTON-MOHAWK IRRIGATION & DRAINAGE DISTRICT
Priority 1
Priority 2 & 3

Current Impasse

- Follow the Law of the River
- Create a “New Deal” for the Colorado River

Water & Desert Agriculture

Good Stewards of Desert Land & Water Resources

Manage irrigation systems for efficiency & sustainability

Avoid Strategic Narcissism*

- The corresponding tendency to artificially separate interconnected problem sets.
  - Encourages short term and simplistic solutions to complex problems

*Hans J. Morgenthau, "*Politics Among Nations*", 1948.
H.R. McMaster, "*Battlegrounds",* 2020.

Water is Life

Photo Credit: Jon Dinsmore


Photo Credit: Jon Dinsmore