



ARIZONA WATER BANKING AUTHORITY
Banking Water Now for Arizona's Future



**PROTECTING ARIZONA'S
WATER SUPPLIES
for ITS NEXT CENTURY**



YOUR WATER. YOUR FUTURE.

Recovery of Arizona Water Bank Credits: Mitigating Shortages on the Colorado River



Planning for Colorado River Shortage

- Many years of ADWR, AWBA and CAP coordination to ensure Arizona is prepared for shortage
- High level of stakeholder participation
- Increased probability of shortage requires in-depth analysis of infrastructure and recovery agreements
- Recovery Planning Advisory Group convened
- Preparing to release an updated Recovery Planning document to provide additional clarity



Colorado River Allocations

1922 Colorado River Compact established Upper and Lower Basin States' allocations

UPPER DIVISION STATES - 7.5 MAF

1948 Upper Colorado Basin Compact established the Upper Basin States' apportionment

LOWER DIVISION STATES - 7.5 MAF

California – 4.4 MAF

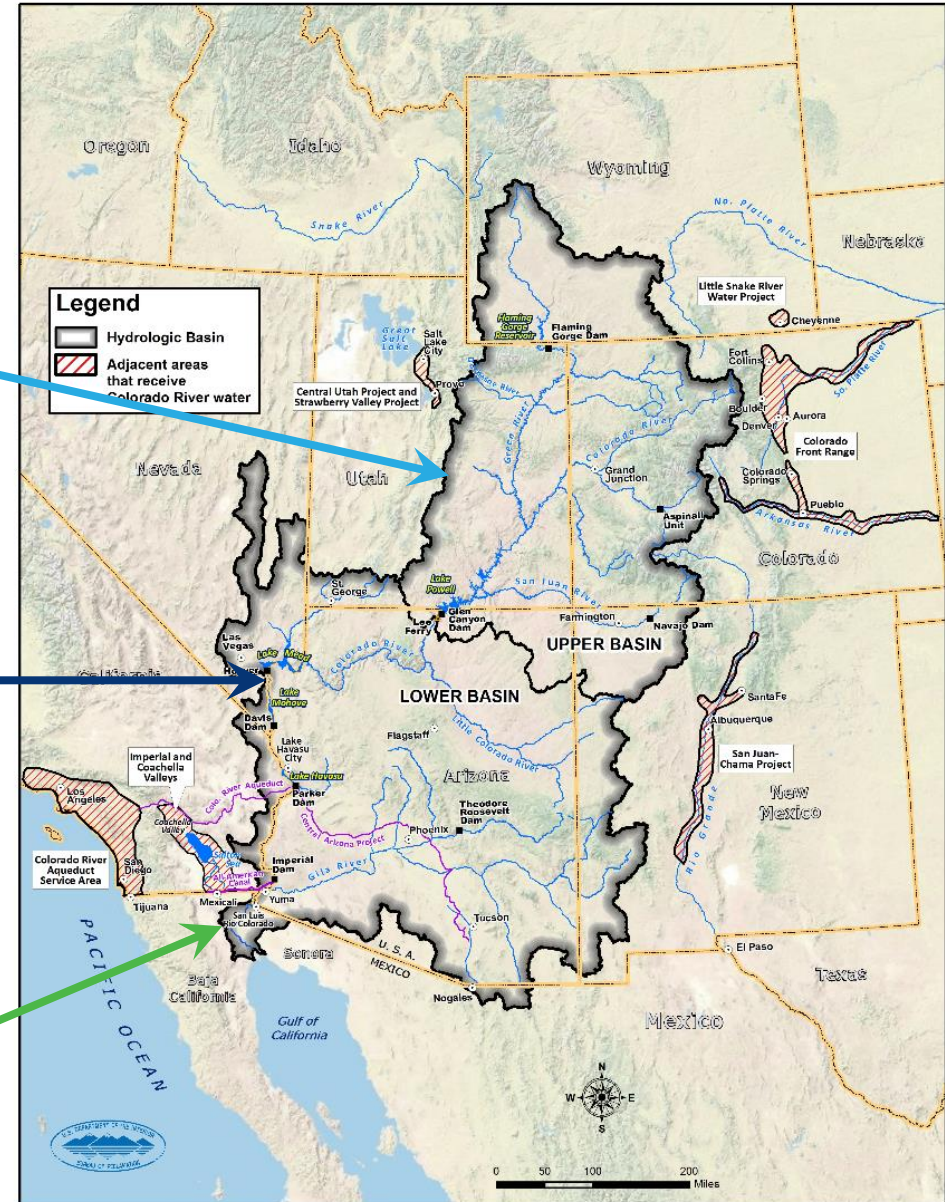
Arizona – 2.8 MAF

Nevada – 0.3 MAF

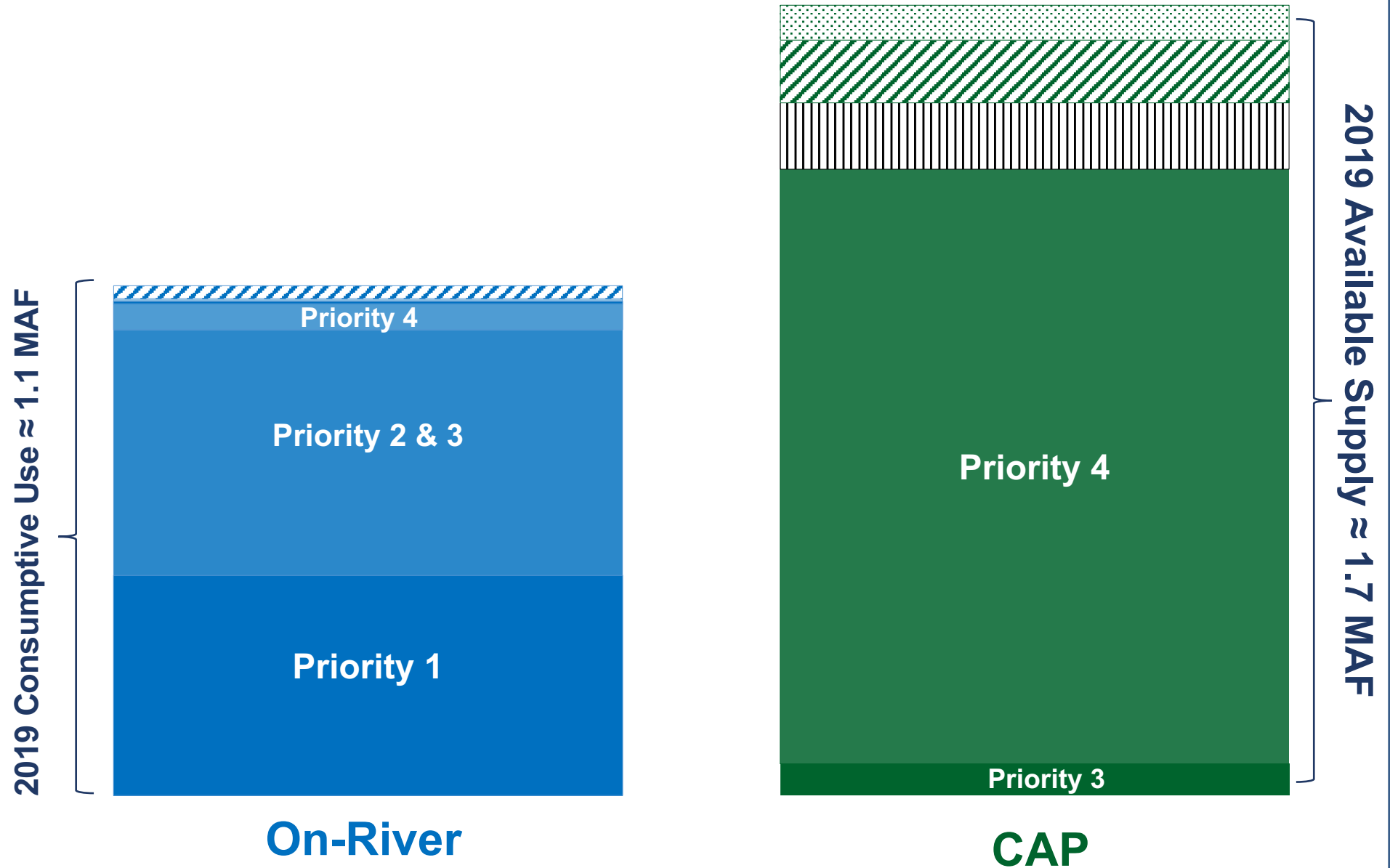
1928 Boulder Canyon Project Act established the Lower Basin States' apportionment

MEXICO - 1.5 MAF

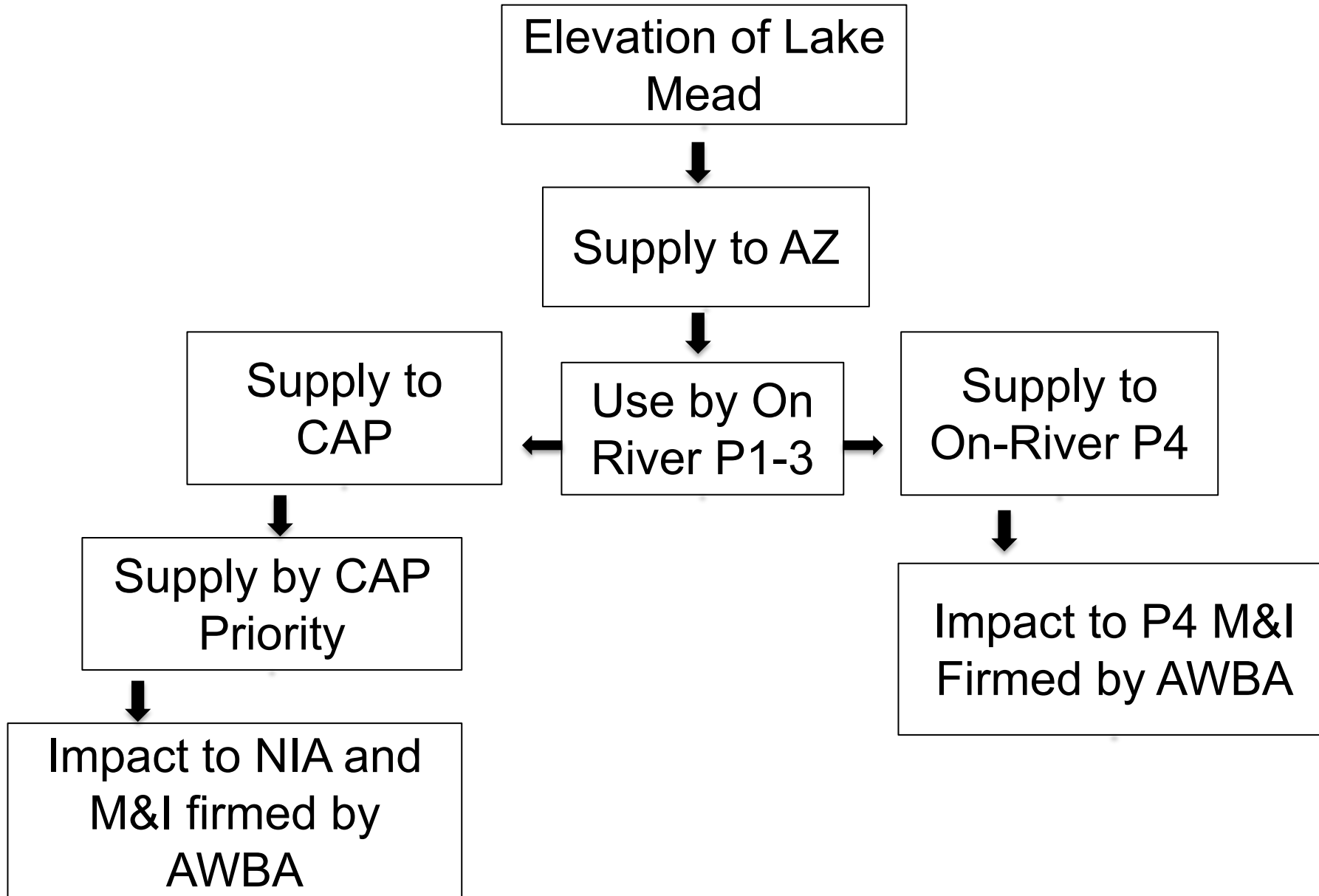
1944 Treaty with Mexico established Mexico's treaty deliveries



Arizona's Priority System



Overview of Shortage Impacts



AZ Strategies for Mitigating Effects of Shortage

- Conservation/Demand Management
- CAP Tiered Priorities
- Shortage Sharing Agreement
- Drought Plans and Provisions
- Long-Term Storage by Cities and Tribes
- **Arizona Water Banking Authority (AWBA)
Storage and Recovery**



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AZ Water Banking Authority (AWBA)

- Water Bank begins storing water in 1997
- Firming Responsibilities & Obligations
 - CAP M&I subcontractors
 - On-River fourth priority M&I users
 - Tribal Settlements
 - Interstate banking
- Transitioning to a new phase – recovery focus
- Water Bank distributes credits during shortage (does not perform recovery)



What is “firming”?

- Firming water is pumped from underground storage to replace reductions in Colorado River supplies due to shortages
- Arizona Water Banking Authority Long-Term Storage Credits (LTSCs) can be recovered (pumped) during a shortage to provide back-up water supplies (known as "firming") for Arizona water users.

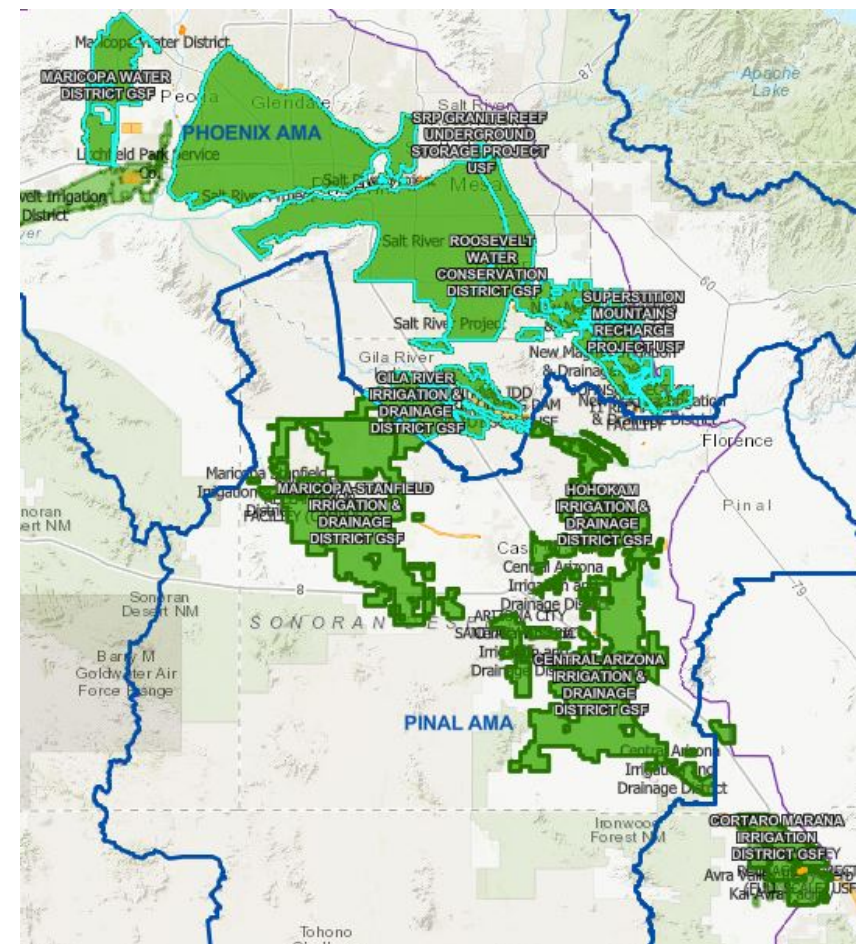


Funding, Purpose and Location of Credits

AWBA Credits Accrued (through 2019)

Funding Source	LTSCs (AF)	Phoenix AMA	Pinal AMA	Tucson AMA
Water Storage Tax	2,227,745	68%	10%	22%
Withdrawal Fees	884,436	38%	49%	12%
General Fund	403,830	10%	76%	14%
Shortage Reparation	109,489	19%	55%	26%
Interstate - Nevada	613,846	10%	72%	19%

- AWBA credits were accrued with multiple funding sources
- The funding sources used dictate the allowable uses of those credits



Arizona Firming Obligations

- Tribes firming under the Arizona Water Settlements Act (CAP NIA Priority)
- CAP NIA priority water is likely the first supply requiring AWBA firming (Tier 1)
- On-River fourth priority M&I users (MCWA)
- CAP M&I Subcontractors (Cities and Industrial)



Central Arizona Project Canal



Lake Havasu City, AZ

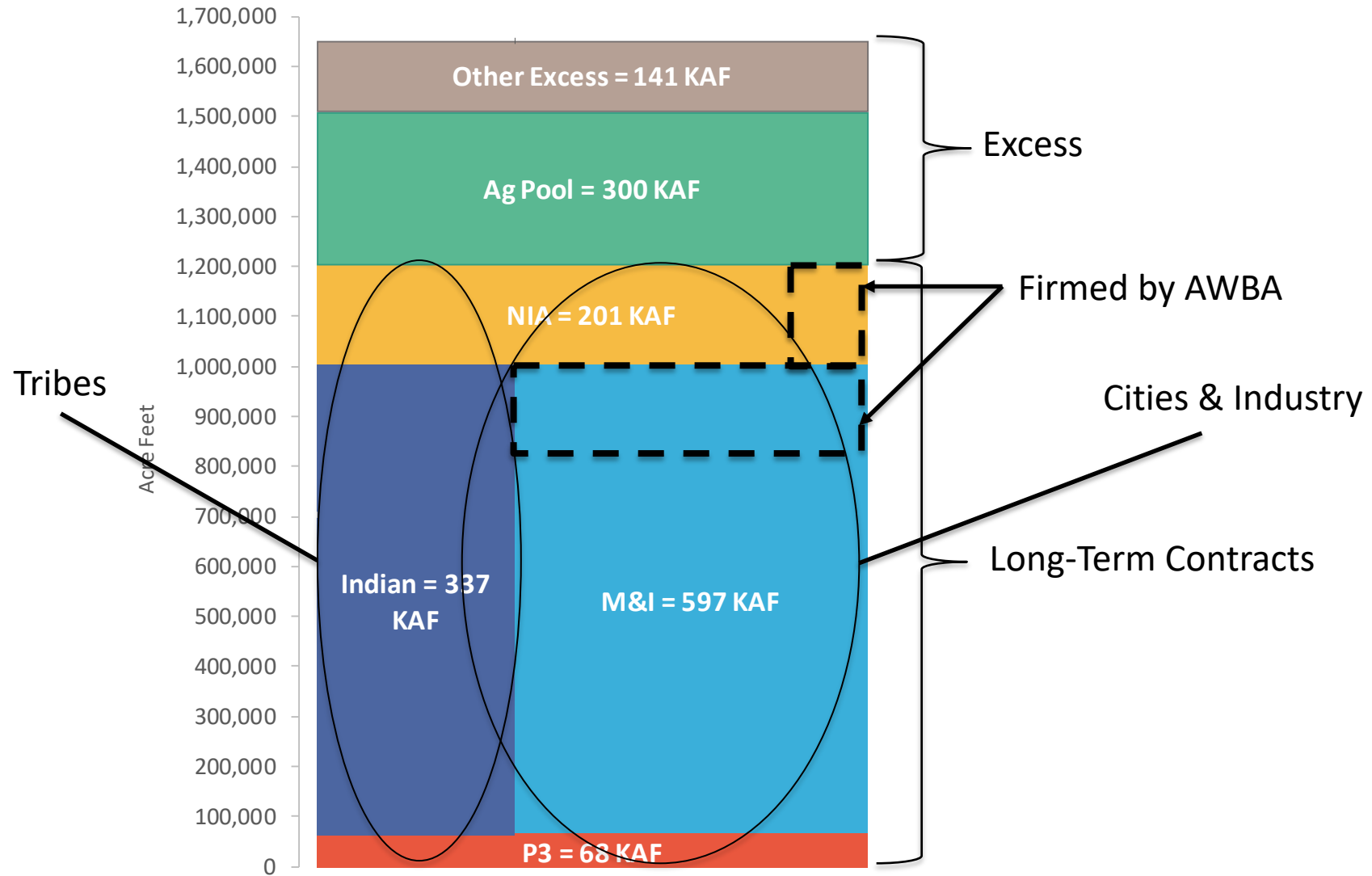


Bullhead City, AZ



Gila River Indian Community

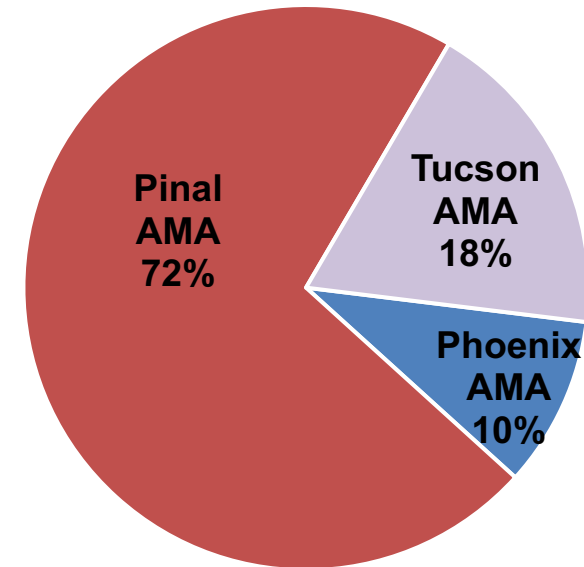
CAP Priority Pools – Firmed Portions



Interstate Banking - Nevada

- Interstate Banking – Southern Nevada Water Authority (SNWA)
- Recovery agreement between CAP and interstate parties to address recovery schedules, quantities, payments etc.
- SNWA makes a request → AWBA credits are pumped and delivered to an Arizona water user instead of CAP water → water remains in Lake Mead to be diverted by SNWA

Interstate Credits by AMA

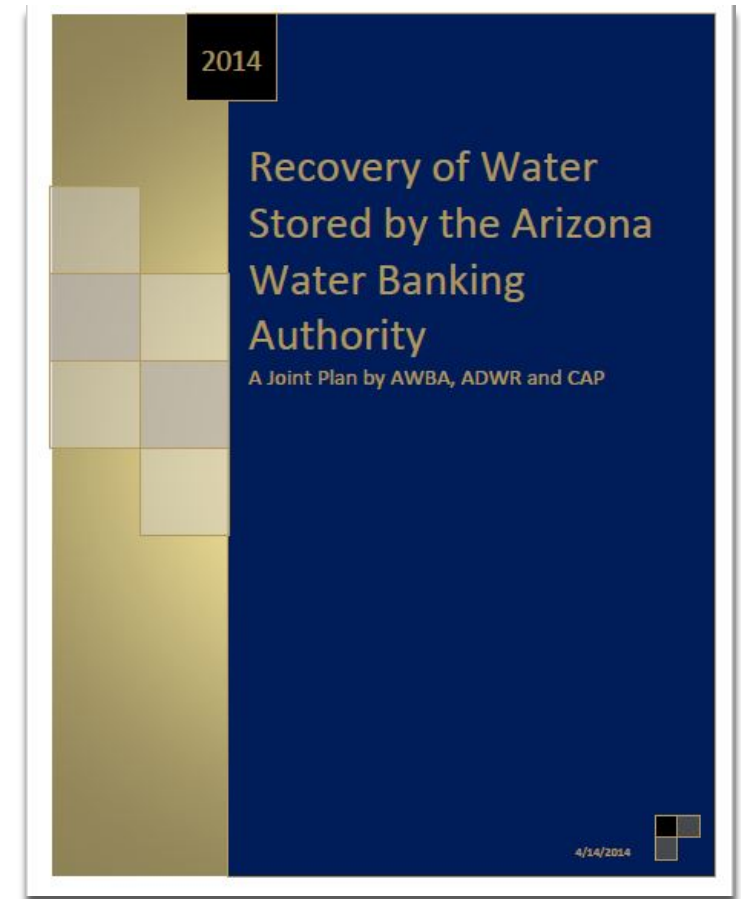




How do we plan for recovery?

2014 Joint Recovery Plan

- *Recovery of Water Stored by the Arizona Water Banking Authority: A Joint Plan by AWBA, ADWR and CAP (2014 Joint Plan)*
- Roadmap for the recovery of AWBA credits
- Defines roles, reviews modeling efforts, identifies recovery methods, recovery opportunities and implementation concepts



Recovery Planning Advisory Group

- 14-member advisory group convened in 2018
 - Representatives - agricultural, municipal, tribal, utilities and on-River
- Addresses recovery planning and implementation for AWBA firming
 - Recovery modeling
 - Shortage impacts
 - Implementation & Costs
- Objectives
 - Greater planning clarity
 - Gather stakeholder input
- Key questions
 - When will recovery occur?
 - How much recovery capacity is needed?
 - How much will recovery cost?
 - How will recovery work?



<https://new.azwater.gov/rpag>

2021 Recovery Planning Update

- Updated planning document will be released in early 2021
- General Approach – expand on 2014 Plan and discuss updates
- Role of the Recovery Planning Advisory Group and stakeholders
- Updated modeling for AWBA firming
- Analyze impact of DCP reductions on firming volumes
- Identify the recovery capacity required (CAP Recovery & Independent Recovery)
- Identify key decision points and actions within the planning horizon (2045)
- Provide the framework for continued cooperation among ADWR, AWBA, CAP and stakeholders

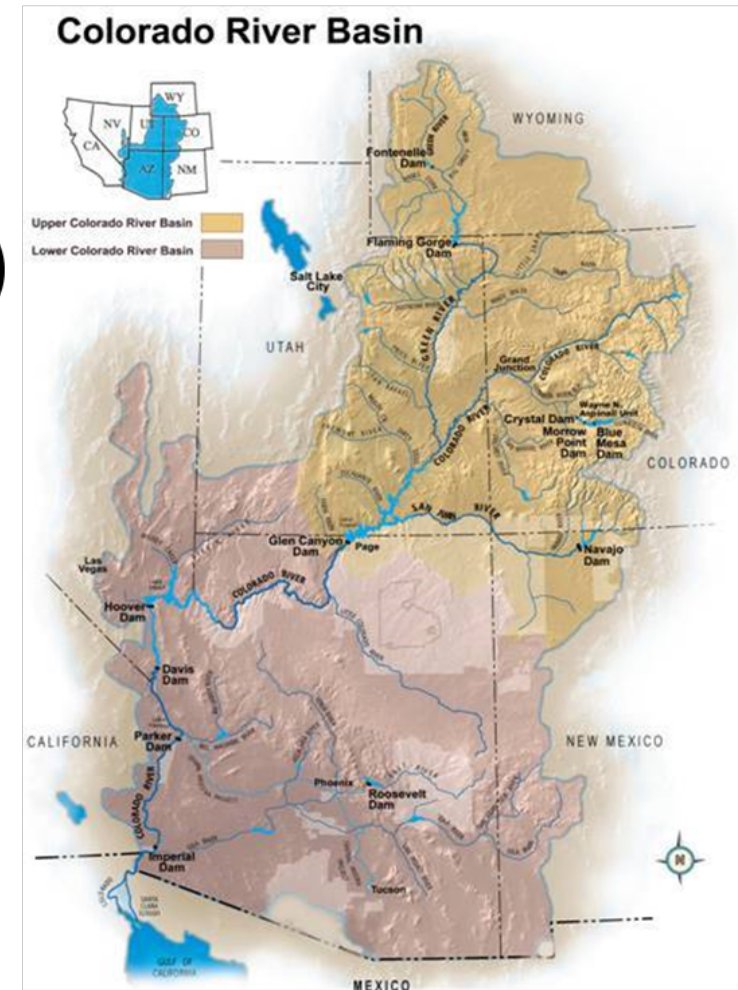
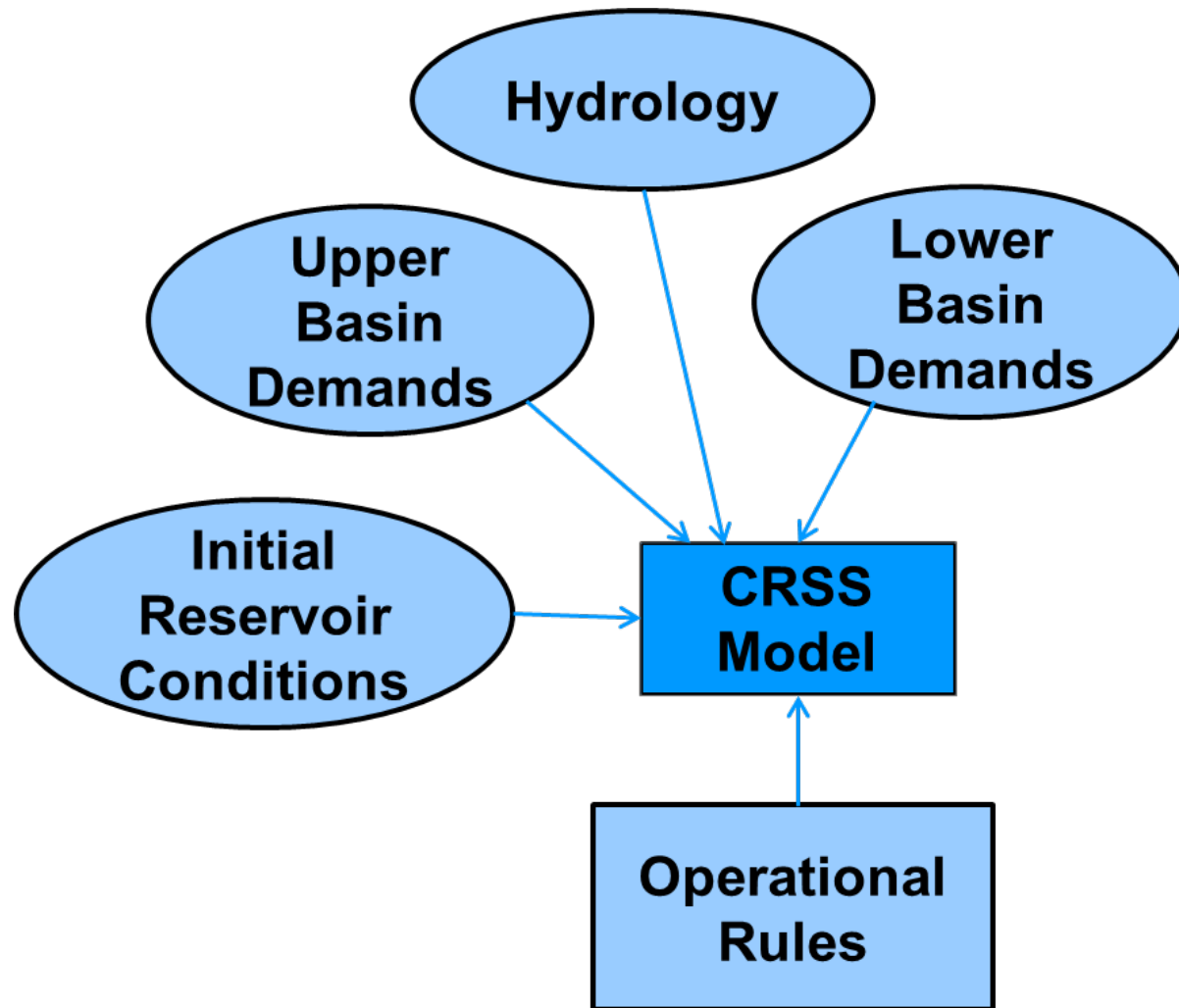
Recovery Roles & Responsibilities

- **AWBA** – Firming | Credit Distribution
- **CAP** – Shortage Notifications | Recovery Agent
- **ADWR** – Advisory | Regulatory
- **Arizona Beneficiaries** – on-River P4 M&I, CAP M&I subcontractors and Tribal Settlements firmed by AWBA
- **Interstate Beneficiaries** – Southern Nevada Water Authority
- **Bureau of Reclamation** – Contracting authority for water on the Lower Colorado River
- **Recovery Partners** – CAP vs. Independent Recovery



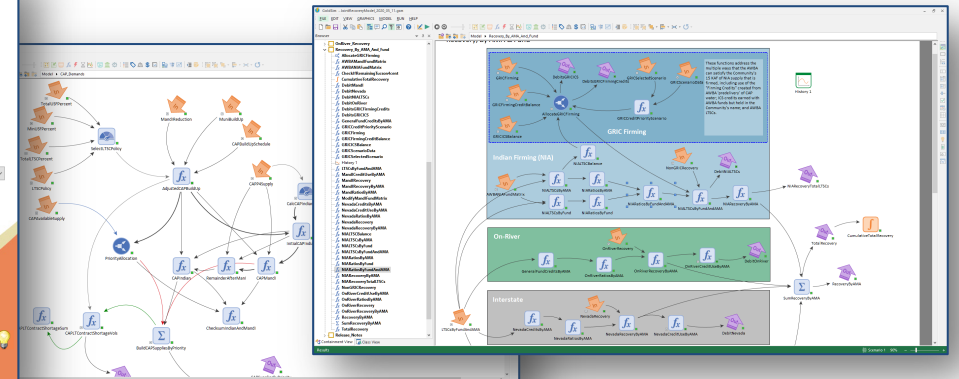
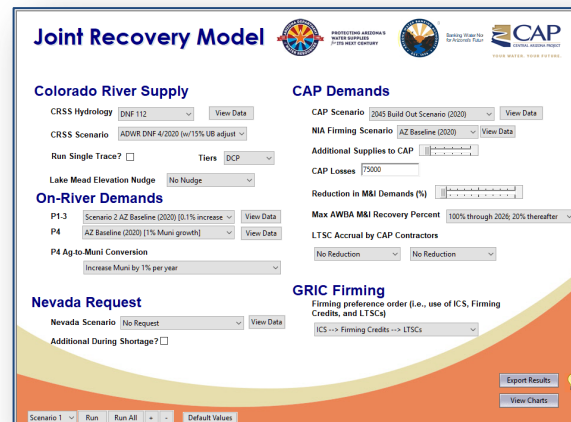
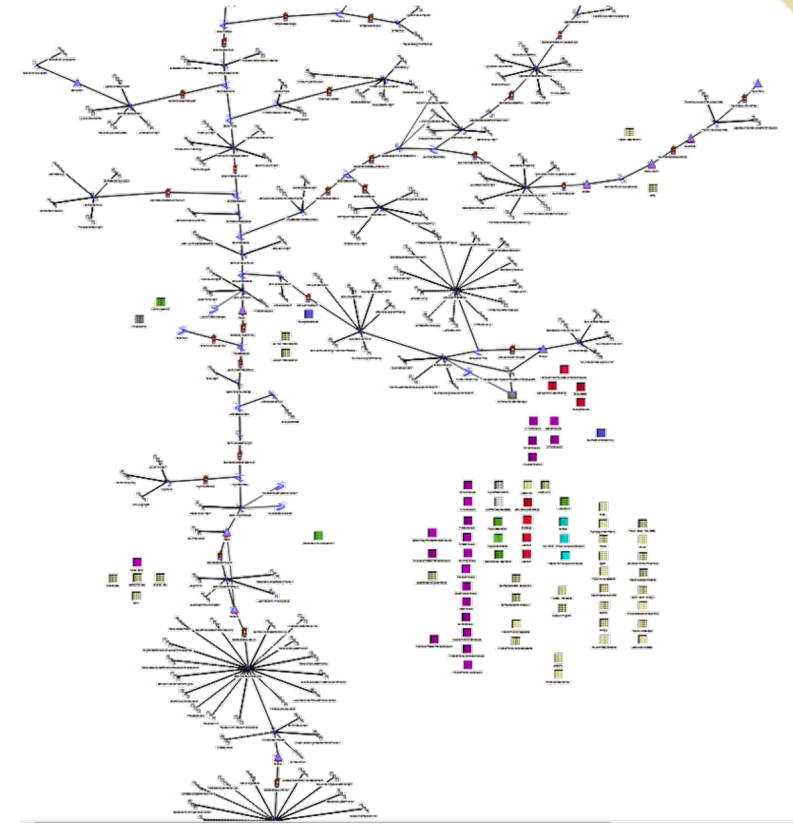
When will recovery occur?

Colorado River Simulation System model (CRSS)



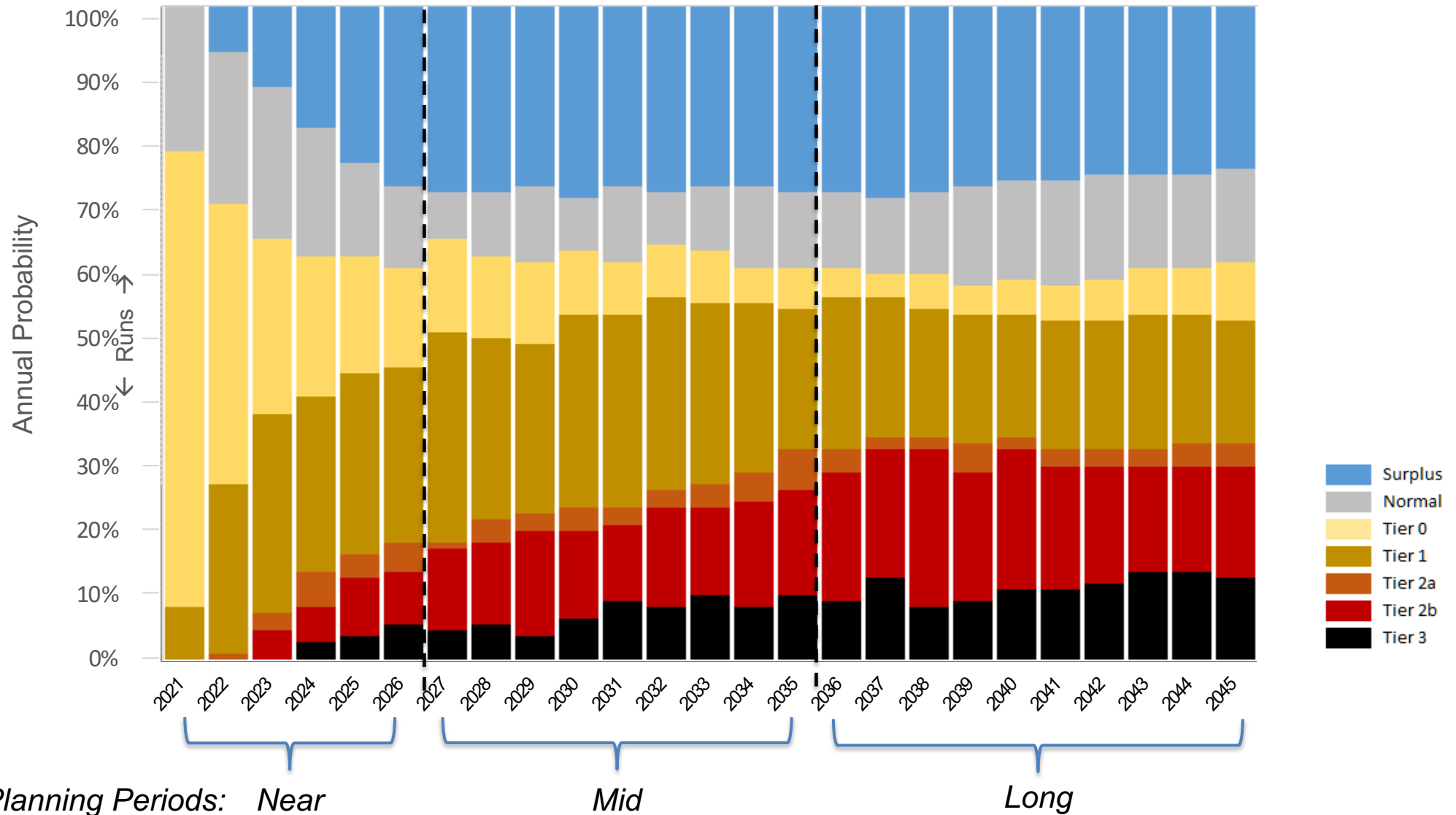
Water Bank Recovery Modeling

- Colorado River Simulation System (CRSS)
 - Bureau of Reclamation model used by the Colorado River basin states
 - Long-term projections of Lake Powell and Lake Mead elevations
- Joint Recovery Model (JRM)
 - Multiple Scenario Planning
 - Developed collaboratively by ADWR, AWBA and CAP
 - Supply and Demand scenarios using shortage sequences from CRSS

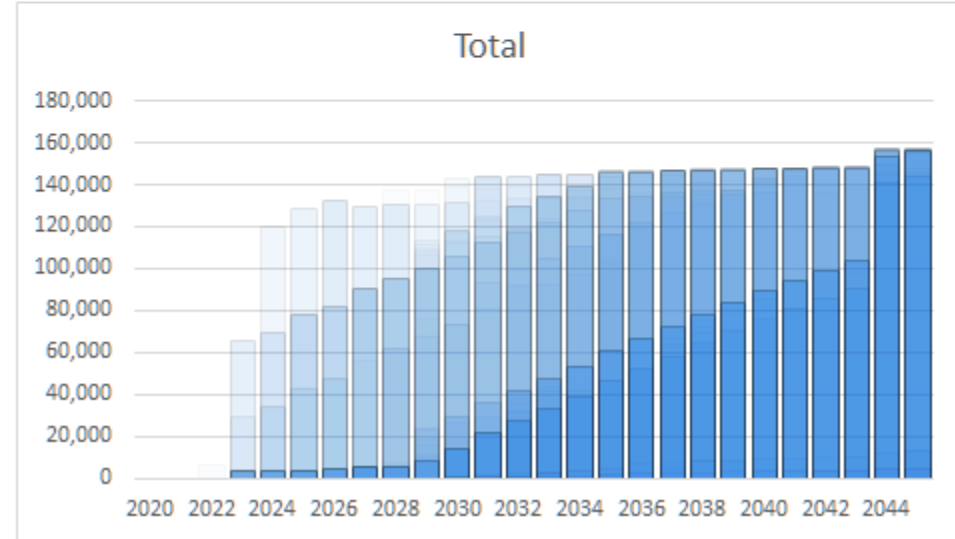
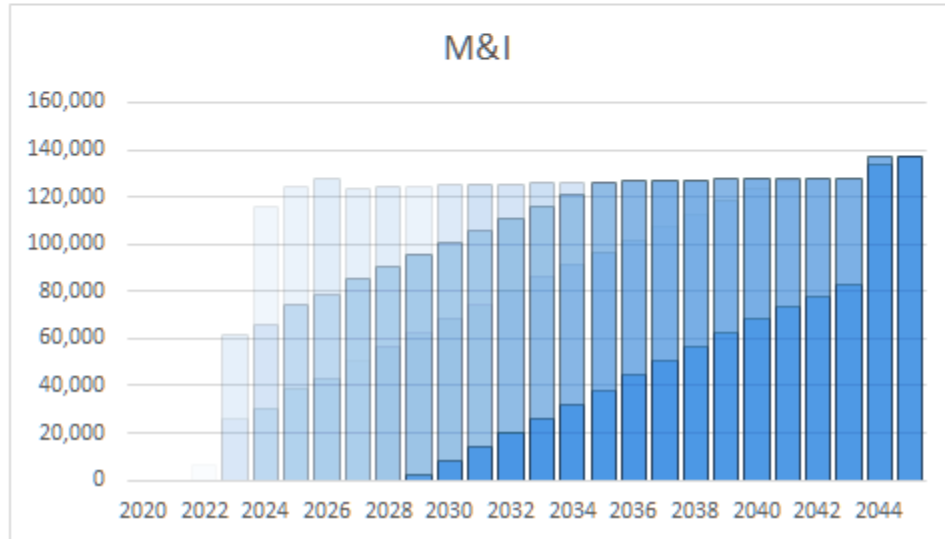
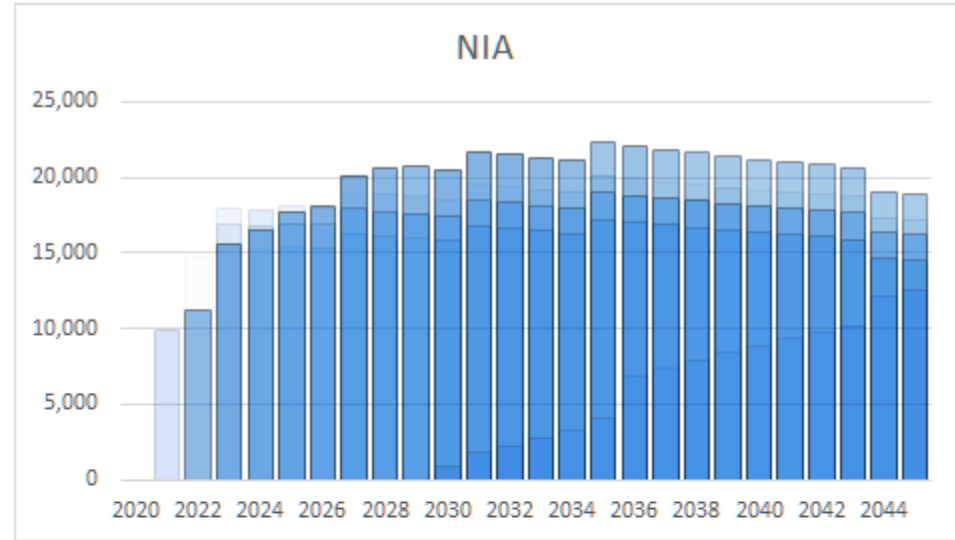
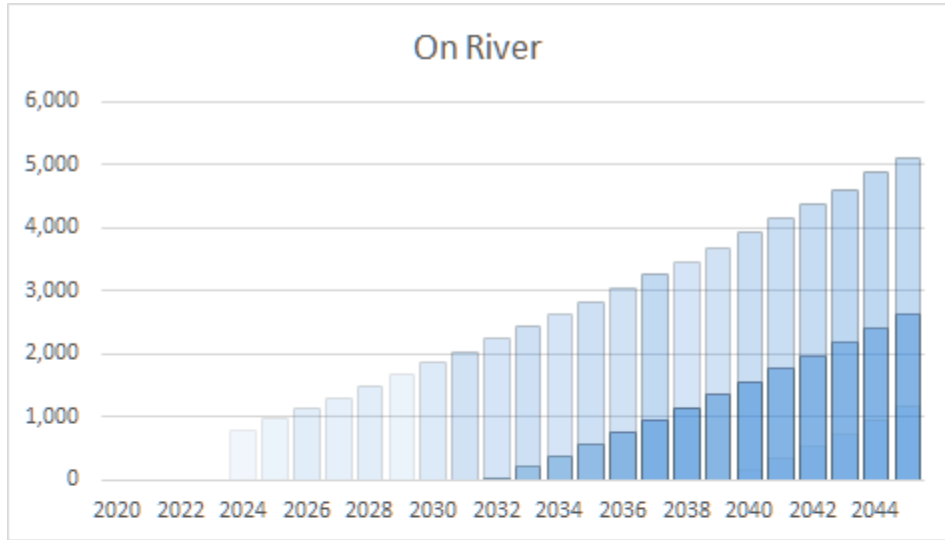
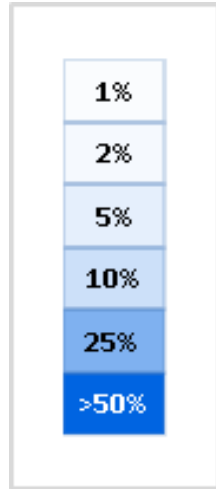


CRSS— Annual Probabilities

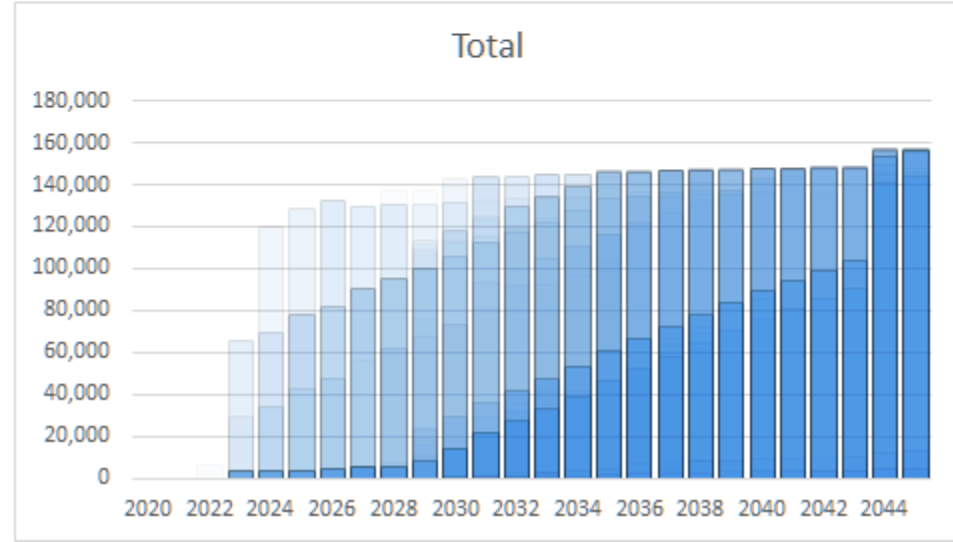
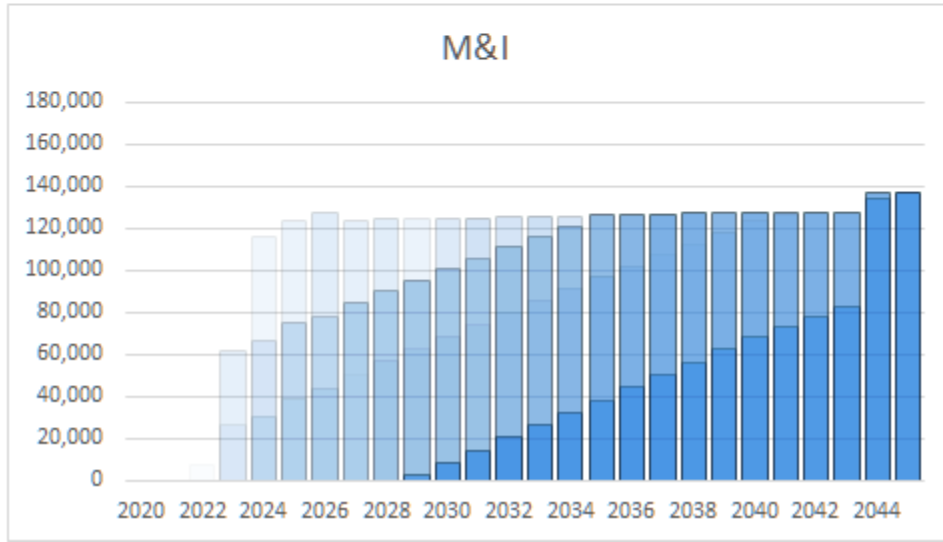
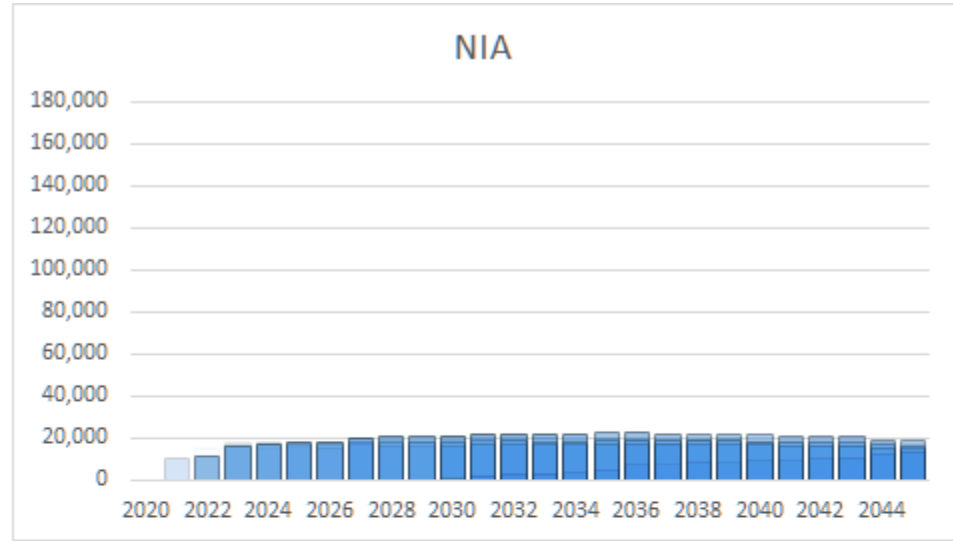
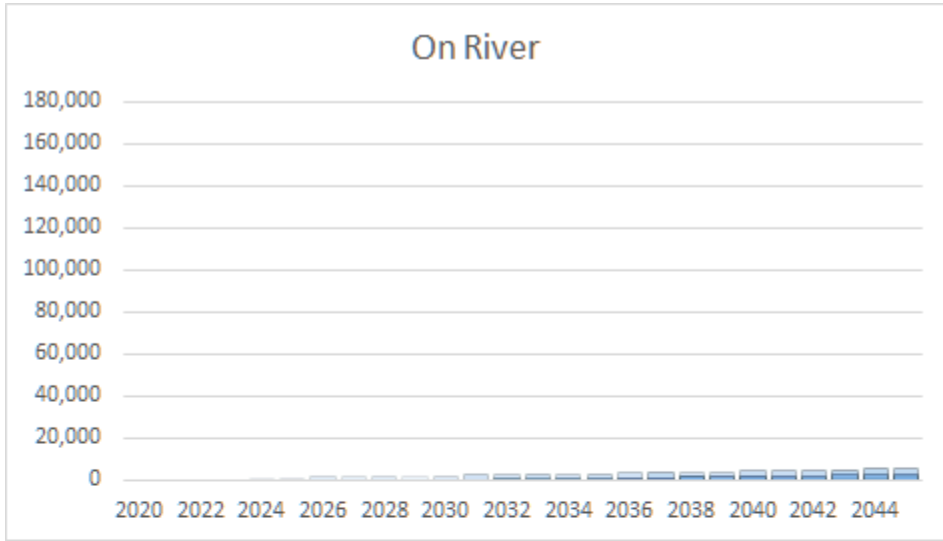
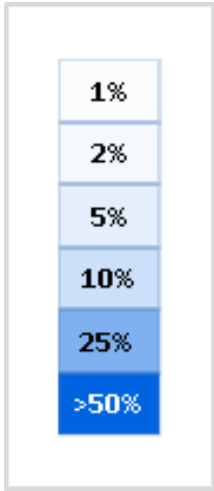
Full Observed Hydrology (112 years), no Upper Basin adjustment



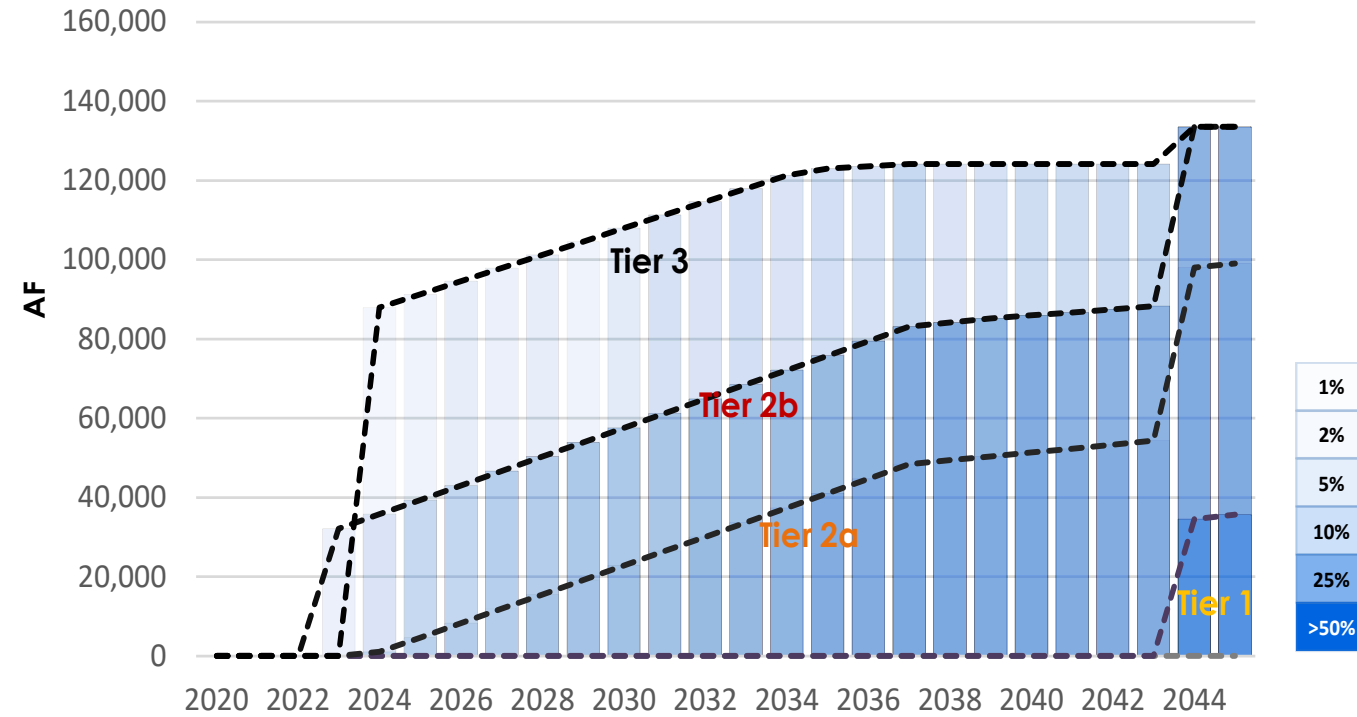
Firming Volumes: All Traces



Firming Volumes: All Traces, Same Scale



CAP M&I Modeling Results



Maximum Annual Firming Volume

Tier	Near (2021-2026)	Mid (2027-2035)	Long (2036-2045)
0	0	0	0
1	0	0	35,700
2a	8,300	41,100	99,100
2b	43,000	75,800	133,600
3	94,600	123,000	133,600

How much recovery capacity is needed?

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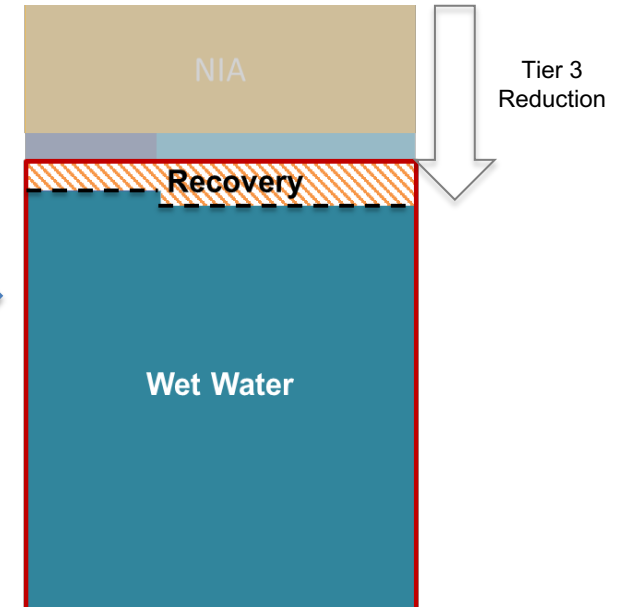
CAP M&I Recovery Capacity Analysis

- M&I firming volumes vs. estimating required recovery well capacity
- Comparing total CAP supplies available during a Tier 3 reduction & annual direct use demands
- Stakeholder feedback and refining the assumptions

A. Subcontractor "X" - CAP supplies in a normal year (non-shortage year)



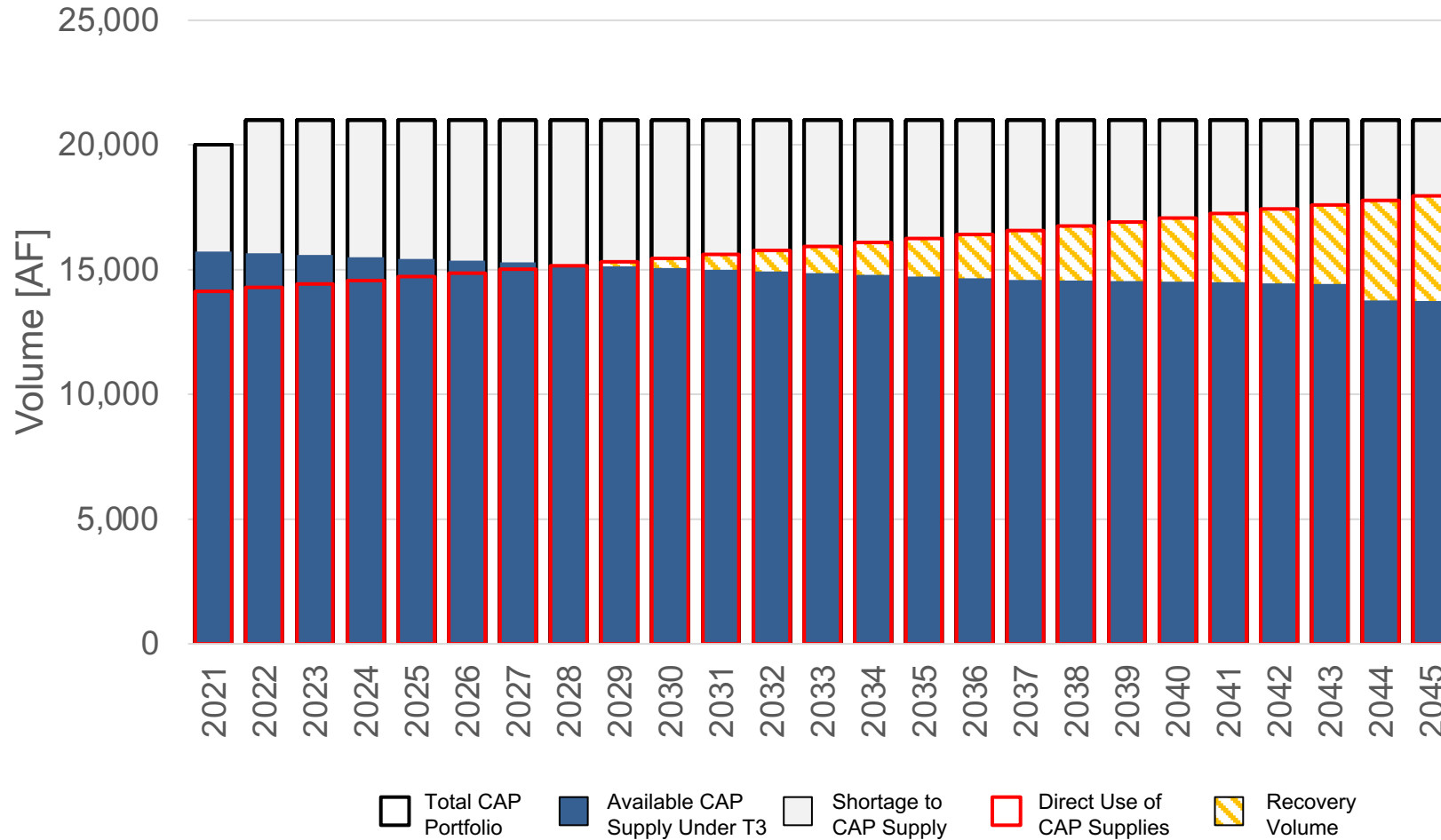
B. Subcontractor "X" – Reduction to CAP supplies in Tier 3 shortage



- Direct Use Demands (includes annual storage and recovery)
- - 2026 Tier 3 Shortage

CAP M&I Subcontractor Example *(Full Projection Period)*

Annual Direct Use - CAP Supply Available = Recovery Volumes



Total AWBA Recovery Capacity Required

Estimated AWBA M&I Recovery Capacity Required under a Tier 3 reduction¹

Tier 3 Reduction – M&I Impacts (AFY)	2026³	2035³	2043³	2045³
AWBA M&I Recovery Capacity Needed²	27,000	51,100	71,000	68,000
Capacity Met by CAP	11,500	15,100	18,800	21,700
Capacity Met by Independent Recovery ⁴	15,500	36,000	52,200	46,300

¹ Includes Phoenix, Pinal and Tucson AMAs. All values in acre-feet per year (AFY).

² Recovery capacity past 2026 is capped at 20% of the total M&I priority pool, excluding the San Carlos Apache Tribe's M&I priority supply of 18,145 acre-feet.

³ Reflects the final year of each planning period, with 2043 and 2045 separated to show certain NIA priority supply converting to M&I priority in 2044.

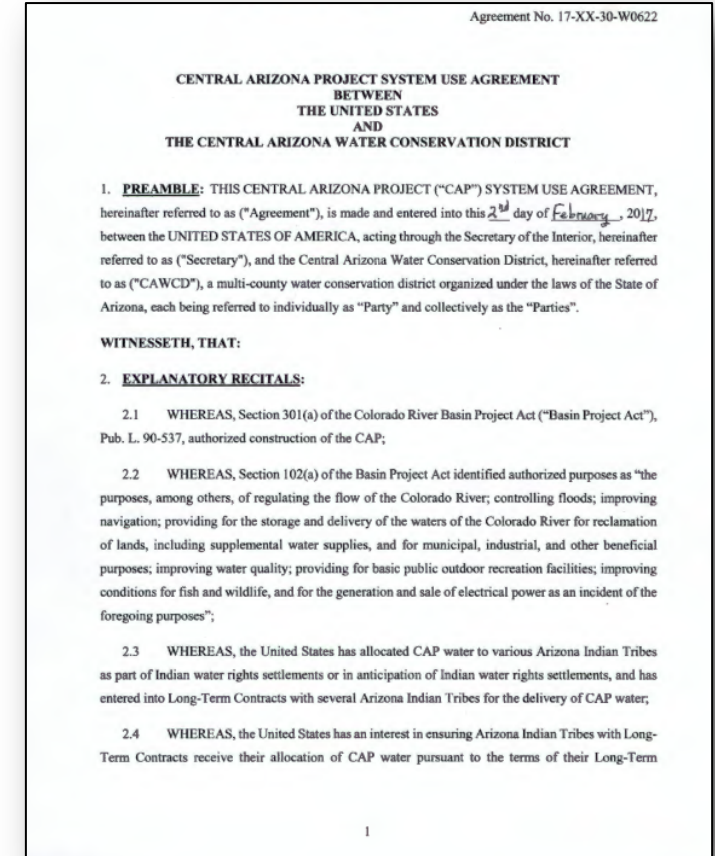
⁴ Estimates based on feedback provided by subcontractors. Numbers may not sum due to rounding.



How will recovery work?

CAP System Use Agreement

- CAP and Reclamation staff developed a framework for wheeling new supplies, exchanges of CAP water with other supplies, and firming
- Influenced recovery implementation in two ways
 - Defined “firming water”
 - Defined Exchanges including AWBA recovered LTSC’s exchanged for CAP water
- Altered CAP’s role in recovery



Recovery Implementation

- Recovery Methods
 - Direct - Pump water from storage and deliver via the CAP canal
 - Indirect - Credits assigned to (sub)contractor and (sub)contractor recovers and uses the water or delivers water
 - Credit Exchange - Credits assigned to (sub)contractor for storage in place of wet water
- Independent Recovery
 - M&I subcontractors recover AWBA credits using their own infrastructure (or with a partner)
- CAP Recovery



Implementation Timing & Triggers

Event or System Condition	2020	2021	2022	2023
Surplus Condition – any amount (Mead ≥ 1,145 ft)	0	0	<1	6
Surplus – Flood Control	0	0	0	<1
Normal or ICS Surplus Condition (Mead < 1,145 and > 1,075 ft)	100	100	91	63
Recovery of DCP ICS / Mexico's Water Savings (Mead >= 1,110 ft)	0	0	5	15
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,090 and > 1,075 ft)	100	94	77	44
Shortage Condition – any amount (Mead ≤ 1,075 ft)	0	N	9	31
<i>Shortage / Reduction – 1st level (Mead ≤ 1,075 and ≥ 1,050)</i>	0	0	9	30
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,075 and > 1,050 ft)	0	0	9	30
<i>Shortage / Reduction – 2nd level (Mead < 1,050 and ≥ 1,025)</i>	0	0	0	7
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,050 and > 1,045 ft)	0	0	0	1
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,045 and > 1,040 ft)	0	0	0	<1
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,040 and > 1,035 ft)	0	0	0	0
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,035 and > 1,030 ft)	0	0	0	0
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,030 and ≥/ > 1,025 ft)	0	0	0	0
<i>Shortage / Reduction – 3rd level (Mead < 1,025)</i>	0	0	0	0

Lower Basin – Lake Mead
Percent of Traces with Event or System Condition
Results from April 2020 MTOM/CBS using the Full Hydrology and Stress Test Hydrology (values in percent)

Event or System Condition	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
Surplus Condition – any amount (Mead ≥ 1,145 ft)	0	0	<1	6	10	0	0	0	<1	1
Surplus – Flood Control	0	0	0	<1	2	0	0	0	0	0
Normal or ICS Surplus Condition (Mead < 1,145 and > 1,075 ft)	100	100	91	63	53	100	100	88	53	44
Recovery of DCP ICS / Mexico's Water Savings (Mead >= 1,110 ft)	0	0	5	15	21	0	0	1	4	8
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,090 and > 1,075 ft)	100	94	77	44	34	100	94	78	41	32
Shortage Condition – any amount (Mead ≤ 1,075 ft)	0	N	9	31	37	0	N	12	47	55
<i>Shortage / Reduction – 1st level (Mead ≤ 1,075 and ≥ 1,050)</i>	0	0	9	30	28	0	0	12	44	32
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,075 and > 1,050 ft)	0	0	9	30	28	0	0	12	44	32
<i>Shortage / Reduction – 2nd level (Mead < 1,050 and ≥ 1,025)</i>	0	0	0	7	9	0	0	0	3	23
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,050 and > 1,045 ft)	0	0	0	1	3	0	0	0	2	5
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,045 and > 1,040 ft)	0	0	0	<1	2	0	0	0	<1	5
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,040 and > 1,035 ft)	0	0	0	0	2	0	0	0	0	7
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,035 and > 1,030 ft)	0	0	0	0	1	0	0	0	0	4
DCP Contribution / Mexico's Water Savings (Mead ≤ 1,030 and ≥/ > 1,025 ft)	0	0	0	0	1	0	0	0	0	3
<i>Shortage / Reduction – 3rd level (Mead < 1,025)</i>	0	0	0	0	<1	0	0	0	0	0
DCP Contribution / Mexico's Water Savings (Mead <= 1,025 ft)	0	0	0	0	<1	0	0	0	0	0

Notes:
 * Modeled operations include the 2007 Interim Guidelines, Upper Basin Drought Response Operations, Lower Basin Drought Contingency Plan, and Minute 323, including the Binational Water Scarcity Contingency Plan.
 † Reservoir initial conditions on December 31, 2020 were simulated using the April 2020 MTOM based on the CBSIC unregulated inflow forecast ensemble dated April 3, 2020.
 ‡ Each of the 35 initial conditions from MTOM were coupled with 113 hydrologic inflow sequences from the Full Hydrology that resamples the observed natural flow record from 1906-2018 for a total of 3955 traces analyzed and with 31 hydrologic inflow sequences from the Stress Test Hydrology that resamples the observed natural flow record from 1988-2018 for a total of 1,085 traces analyzed.
 § Percentages shown in this table may not be representative of the full range of future possibilities that could occur with different modeling assumptions.
 ¶ Percentages shown may not sum to 100% due to rounding to the nearest percent.
 ** The chance of a Lower Basin Shortage in 2021 is negligible.

- Progressive levels of recovery implementation in the three year period leading up to a shortage
- Proposed triggers for M&I firming
 - Trigger 1: The April 5-year table > 15% probability of M&I shortage in third year
 - Trigger 2: The “Min Probable” forecast, April 24-Month Study - M&I shortage in second year
 - Trigger 3: The “Most Probable” forecast, April 24-Month Study - M&I shortage in following year

How much will recovery cost?

- CAP recovery agreements, each with unique costs and terms
- Recovery costs are partly dependent on the volume of requested
 - Higher volumes = higher average costs
- For planning purposes, it is anticipated that CAP recovery costs will be comparable to CAP delivery rates

Next Steps

- Release the 2021 Update to the 2014 Joint Recovery Plan
- Both AWBA and CAP have additional work to continue preparing for recovery implementation
- Recovery Planning Advisory Group will continue to meet regularly



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Questions?