

Glen Canyon Dam Adaptive Management Work Group
Agenda Item Information
August 26-27, 2015

Agenda Item

Lake Mead Issues and Lower Basin Shortage Preparedness

Action Requested

Information item only; we will answer questions but no action is requested.

Presenter(s)

Jayne Harkins, Colorado River Commission of Nevada
Thomas Buschatzke, Arizona Department of Water Resources
Tanya Trujillo, Colorado River Board of California

Previous Action Taken

N/A

Relevant Science

N/A

Background Information

Colorado River water is apportioned, regulated and managed among the seven basin states (Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming) and the Republic of Mexico through compacts, treaty, federal laws, court decisions, decrees, contracts, regulatory guidelines and other documents, collectively known as the “Law of the River”.

To prepare for possible shortages in the Lower Basin and to guide Colorado River operations during low reservoir conditions, water delivery operations are described and contemplated in the 2007 Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead (2007 Interim Guidelines). Each year, the Secretary of the Interior determines the projected plan of operations of the storage reservoirs in the Colorado River Basin and determines when normal, surplus, or shortage conditions occur in the Lower Colorado River Basin. According to the 2007 Interim Guidelines, a shortage condition is determined when insufficient mainstream water is available to satisfy 7.5 million acre-feet (maf) of annual consumptive use in the Lower Division states. A key factor for determining annual operations is the amount of storage (as measured by water elevation) in Lake Mead.

Releases and diversions are made from Lake Mead to meet water deliveries in Arizona, California, Nevada, and Mexico, while Lake Powell is operated to deliver water from the Upper Basin to the Lower Basin. As part of the 2007 Interim Guidelines, water levels in these two reservoirs are coordinated to allow better management of the Colorado River supply. The 2007 Interim Guidelines outlines a method for releasing water from Lake Powell to Lake Mead that takes into consideration

Lake Mead Issues and Lower Basin Shortage Preparedness, continued

the elevations of both reservoirs – modifying annual delivery volumes according to reservoir elevations.

Three factors that significantly affect the water levels in lakes Powell and Mead are:

1. The hydrology of the Colorado River, such as the amount of precipitation that falls within the basin and the resulting runoff that flows into the river and reaches the reservoirs,
2. Colorado River water use, such as the amount of water needed for agricultural and urban purposes in both the Upper and Lower Basins, and
3. Colorado River reservoir operations.

To date, the Secretary has never determined a shortage condition in the Lower Basin pursuant to the 2007 Interim Guidelines. However, the Colorado River Basin is now likely experiencing the lowest 16-year period in the observed historical record dating back over 100 years. Further, the Basin runoff during this period is comparable with the lowest 16-year period in the paleo record that dates back over 1200 years. In addition, given the basic apportionments in the Lower Basin, the allotment to Mexico, and evaporation losses, Lake Mead annual outflow is about 1.2 maf more than the annual inflow. The result is an imbalance that causes Lake Mead to drop by 12 feet or more every year when there is a “normal” release of 8.23 maf from Lake Powell. Lake Mead elevation has fallen approximately 126 feet from 2000 to the end of 2014, bringing it closer to elevations critical to a shortage determination. If a shortage is determined in the near future, quantified reductions in deliveries to Arizona, Nevada, and Mexico (pursuant to Minute 319 in effect through December 2017) would be implemented as shown below:

Lake Mead Jan 1, Elevation*	Shortage Tier	Arizona Reduction	Nevada Reduction	Mexico Reduction
1075'	1	320,000 AF	13,000 AF	50,000 AF
1050'	2	400,000 AF	17,000 AF	70,000 AF
1025'	3	480,000 AF	20,000 AF	125,000 AF

** Projected Jan 1 Elevation from August 24-Month Study*

Nevada – Perspective provided by Colorado River Commission of Nevada

Lake Mead is currently at 37% of capacity and lake elevation is projected to decrease this summer to levels not observed since Lake Mead was filled. Reclamation modeling predicts continued decreases in lake elevations and a near equal probability of a Lower Basin shortage in 2017. If a Tier 1 shortage is determined, Nevada would suffer a 4% reduction in Colorado River deliveries. Nevada’s consumptive use, however, is currently about 75,000 acre-feet less than its full allocation due in part to the significant investment in water conservation programs by the Southern Nevada Water Authority.

Southern Nevada relies on Colorado River water for about 90% of its water supply. The Southern Nevada Water Authority is responsible for pumping and treating Colorado River water from Lake Mead for delivery to the Cities of Boulder City, Henderson, North Las Vegas, and the Las Vegas Valley Water District (the Las Vegas Valley Water District serves the City of Las Vegas and portions

of unincorporated Clark County in the metropolitan area). Currently, there are two intakes and two pumping stations in Lake Mead at depths of 1,050 and 1,000 feet above mean sea level. If lake surface elevations continue to decline, there are risks of losing the ability to access and pump water. Design and construction of a new intake and pumping station are under way and when completed they will have the ability to pump water at a depth of 860 feet. The new intake will be completed in the fall of 2015 and the new pumping station will not be completed for another 5 years at a cost estimated around \$1.4 billion dollars for the entire project. The new lower intake will connect to the current pumping station to allow for pumping from the new intake. The cold, clear water at lower depths provides for better quality water and reduces water treatment costs. Once the intake is complete, southern Nevada will have access to better quality water and once the new pumping station is complete Nevada will have improved access if drought conditions continue.

Lower water levels in Lake Mead have reduced the amount of potential energy generated at Hoover Dam. When lake elevations are high, more energy is produced from the weight (or head) of the water pushing through the turbines. Decreased power production often causes customers to purchase power on the open market at higher costs. At lower elevations, turbines run less efficiently and can cause operational issues. Reclamation believes that power can be generated to an elevation of 950 feet with less efficiency, but there is some uncertainty of operations at these low elevations. Hoover Dam, Parker Dam, and Davis Dam derived power also fund the Colorado River Basin Salinity Control Program. Reduced power production reduces the available funding for this program.

The physical and chemical properties of water released from Glen Canyon Dam can influence Lake Mead. Temperature and salinity between the river and lake can dictate the depth at which the water inserts itself into the lake. Water inserted at the top layer can reinforce stratification and lead to less oxygenated conditions. Increased sediment delivery that reaches the water intakes can impact water treatment costs.

Arizona – Perspective provided by Arizona Department of Water Resources

The Colorado River supplies approximately 40% of Arizona's water needs. The remaining needs are met through use of other surface water supplies such as the Salt and Gila River systems, reuse of treated wastewater, water recharged in groundwater aquifers and groundwater supplies. If a shortage is declared on the Colorado River, Arizona bears the brunt of the reductions, with the Central Arizona Project (CAP) taking most of the reductions. Operational agreements and policies have been in place for many years establishing priorities for the different water use sectors of Arizona's Colorado River water.

Who in AZ will be impacted by tier 1 shortage?

Based on established priorities and the existing policies, tier 1 shortages to Colorado River water in the next few years will primarily impact agricultural users that receive CAP water. In addition, supplies available to the Arizona Water Banking Authority and the Central Arizona Groundwater Replenishment District would also be eliminated. Arizona cities will not see a reduction in their Colorado River supplies at the higher tiers of shortages.

Is Arizona prepared for shortage?

Because Arizona has recognized its lower priority on the Colorado River, Arizona has been proactively building resilience and implementing innovative water management strategies to secure and manage its other water supplies. Arizona has set a precedent with rigorous water conservation and sustainability laws that protect Arizona water users. Arizona's Groundwater Management Act is the most far-reaching groundwater management regulatory framework in the United States. Arizona leads the nation in the implementation of efficient water reuse programs to use treated wastewater for beneficial uses including agriculture, municipal uses, groundwater recharge, power generation, industrial uses, and turf irrigation uses. Arizona's engagement in collaborative long-term planning and comprehensive strategies has allowed water providers and private entities to store water supplies underground to reduce their vulnerability to shortage. Collectively, Arizona has stored over 8 million acre-feet (more than 2.5 trillion gallons) of water. Over 3.2 million acre-feet of this stored water has been recharged by the Arizona Water Banking Authority to provide back-up supplies for municipal, industrial and Native American Colorado River water users in times of a shortage.

What is being done?

The Arizona Department of Water Resources, along with other stakeholders such as the CAP, are committed to continuing work with the other Colorado River Basin States, Mexico and federal partners to implement proactive measures that will reduce the near-term risks of drought as well as address the long-term imbalances between supply and demands on the Colorado River system. Addressing the challenges facing the Colorado River System will require solutions that incorporate creativity, cooperation, and shared sacrifice.

California – Perspective provided by Colorado River Board of California

California and the other Basin States have been working since at least the 1990's to prepare for potential water supply shortages in the Lower Basin. Shortages to allocations, although hopefully avoided, are a fundamental element of western water law's basic priority system that has been embedded within the allocations and operations of the Colorado River Basin system. For example, in addition to addressing coordinated operations between Lake Powell and Lake Mead, the 1968 Colorado River Basin Project Act recognized existing allocations of water among the States and identified a process for allocation of shortages among Arizona, California, and Nevada. The 1968 Act provides that the Secretary should allocate water first by satisfying the present and perfected water rights that existed prior to 1929 in all three States, then to the remaining normal apportionment rights within California, then to other uses in Arizona and Nevada, and finally to the uses to be developed through the Central Arizona Project, which was newly authorized for construction through the 1968 Act. Adopted forty years later, the 2007 Interim Guidelines describe the specific delivery amounts for each of the Lower Basin states under defined Shortage Conditions when Lake Mead's elevations are projected to meet certain specified trigger levels. To date, neither the shortage provisions in the 1968 Act or the 2007 Interim Guidelines have been applied, but current low elevation levels at Lake Mead have led to continued efforts to try to improve system efficiencies, increase conservation and look for innovative ways to manage and expand existing water supplies.

In addition to the Colorado River Basin's current historic drought, California has been experiencing its own unprecedented, multi-year drought, with record-low snowpack in the northern California Sierra-Nevada Mountains, exacerbated by record-high temperatures. As a result of well below-

average precipitation, the water supply for urban and agricultural contractors from the California State Water Project and federal Central Valley Project has been severely diminished over the past three years. In response to the unprecedented drought conditions, California's Governor Brown issued an Executive Order on April 1, 2015, requiring each municipal water supplier in the State to reduce its water use in order to achieve a 25% average statewide reduction. Over 500,000 acres of irrigated land has been fallowed within California during each of the past three years due to lack of water. During these exceptionally dry years, the Colorado River provides a very important component of the water supply for over 19 million people in southern California in addition to providing water to irrigate over 800,000 acres of farmland.

For over two decades, California's Colorado River water users have spent billions of dollars to implement programs to conserve and efficiently utilize Colorado River water, which has resulted in a reduction in overall use by California of approximately 800,000 acre-feet of water per year since 2003, and has allowed California to stay within the normal allocation of 4.4 million acre-feet of Colorado River water allocated to California under the 1928 Boulder Canyon Project Act. To date, over 3 million acre-feet of water have been conserved and transferred from agricultural to municipal users per the 2003 Quantification Settlement Agreement (QSA) and other long-term, innovative agreements such as the fallowing agreement between the Palo Verde Irrigation District and Metropolitan. Over the past two years, the Metropolitan Water District (MWD) has invested over \$500 million on turf removal, appliance rebates and other conservation programs, in addition to amounts spent on conservation programs by the State of California and other local agencies. In November 2014, California voters approved a \$7.4 billion bond initiative that will enable construction of additional water storage and conservation projects and other programs over the next several years. On the Colorado River, California entities have participated with other States to fund ongoing programs to generate additional water for the Colorado River System, improve system reliability and create additional water for storage in Lake Mead. Flexibility and innovative programs on the Colorado River System have helped California manage its diverse water supplies during the current drought.

As water levels drop in Lake Mead, California entities (representing 56% of the contracted power allocation from Hoover Dam) are affected along with contractors in Arizona and Nevada by decreased power production capacity at Hoover Dam and decreased benefits from programs such as the Colorado River Basin Salinity Control Program. During Shortage Conditions under the 2007 Interim Guidelines, Colorado River contractors in California, Arizona and Nevada are subject to reduced water delivery flexibilities in connection with programs such as the Inadvertent Overrun Payback Policy.

There are strong incentives for California to continue its efforts to coordinate with Arizona and Nevada, the other Basin States, federal agencies, and our partners in Mexico through the efforts to implement Minute 319 and potential successor agreements, on efforts to bolster the strength of the Colorado River System, prevent Lower Basin shortages, improve water use efficiencies and increase the amount of water stored in Lake Mead.

Arizona - Shortage Preparedness

Tom Buschatzke, Director, Arizona Department of Water Resources
AMWG, August 27, 2015



ADWR – Critical Functions

Colorado River
Negotiations

Adjudications &
Tribal Water Settlements

Assured and Adequate
Water Supply Program

Demand &
Supply Planning

Floodplain Management &
Dam Safety

Technical Support &
Data Gathering

Recharge & Recovery

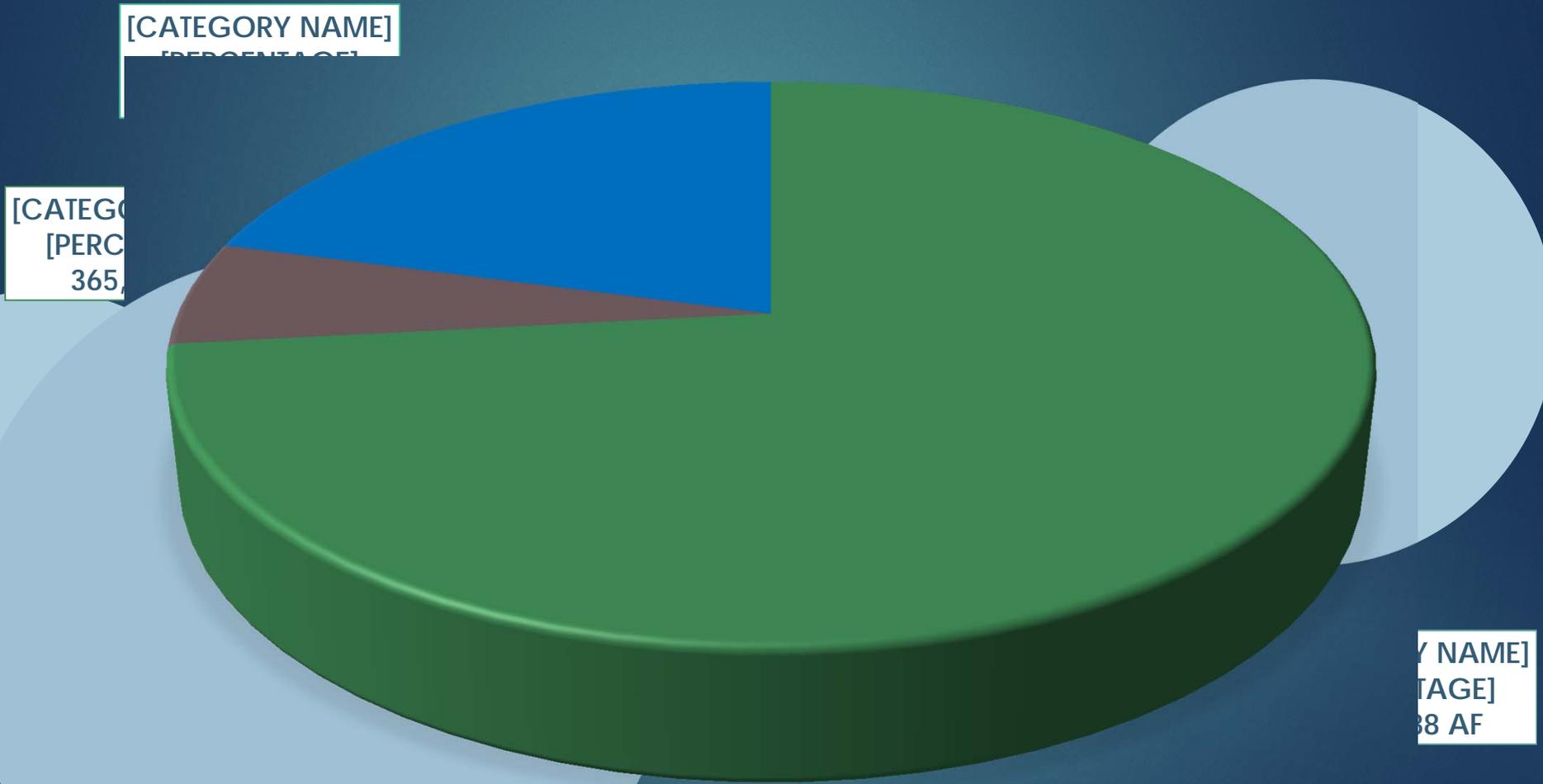
Water Banking Authority

Most Critical – Leadership on Water Issues

Water Supply Annual Water Budget (2013)

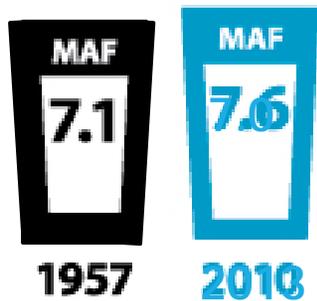
Water Source	Million Acre-Feet (MAF)		% of Total
SURFACE WATER			
Colorado River		2.8	40 %
<i>CAP</i>	1.6		22.5%
<i>On-River</i>	1.2		16.9%
In-State Rivers		1.2	17%
<i>Salt-Verde</i>	.7		
<i>Gila & others</i>	.5		
GROUNDWATER		2.7	40%
RECLAIMED WATER		0.2	3%
Total		7 MAF	

Arizona's Water Use by Sector(2013)



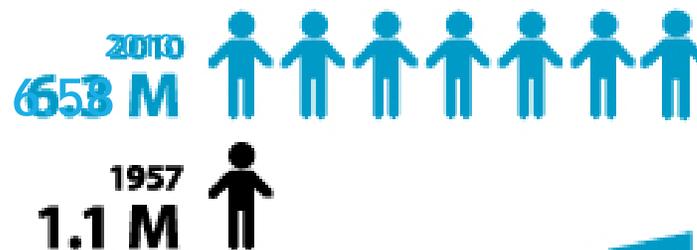
Arizona's Population, Water Use and Gross Domestic Income from 1957-2013

TOTAL WATER USE



REMOVED
VIRTUALLY
BY
UNCHANGED
100,000 AF

POPULATION GROWTH IN MILLIONS



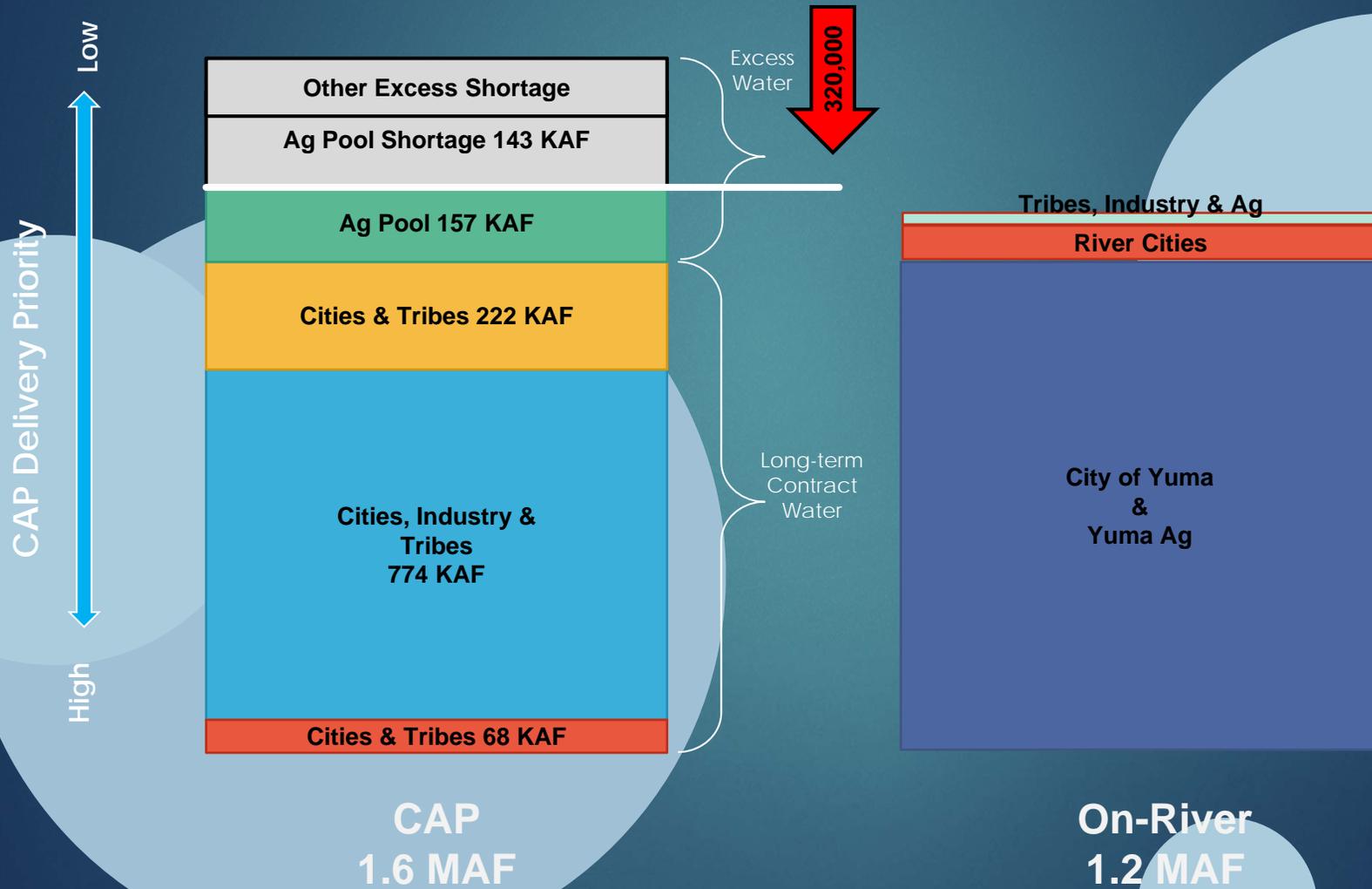
Arizona's population has grown steadily over the years, to more than 6 times and our economy has grown to more than 19 times that in 1957

Through significant investments in conservation, reuse and infrastructure, our water use is essentially the same as it was more than half a century ago

Shortage Impacts to Lower Basin

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* Projected Jan 1 Elevation from August 24-Month Study California does not take shortage				

Arizona Tier 1 Shortage



Is Arizona Prepared for Shortage?

We've Planned for This!

THE GROUNDBREAKING
1980
GROUNDWATER MANAGEMENT ACT REQUIRES



1 MANDATORY CONSERVATION
FOR AGRICULTURAL, INDUSTRIAL AND MUNICIPAL WATER USERS

2 100 YEAR ASSURED WATER SUPPLY

3 NO NEW AGRICULTURE

IN THE REGION WHERE 80% OF THE STATE'S POPULATION LIVES

Collaborative Long term Planning

Innovative Water Management Strategies

Resilience through Underground Storage

*Arizona's Next Century:
A Strategic Vision for Water Supply Sustainability*



ARIZONA DEPARTMENT OF WATER RESOURCES

January 2014



100%
OF MUNICIPAL
WATER PROVIDERS ARE REQUIRED TO HAVE CONSERVATION PLANS



Is Arizona Prepared for Shortage?

Groundwater Management Act

1980 Groundwater Management Act

- 35 Years of groundwater management
- Established active management areas and irrigation non-expansion areas

Goals of the Act:

- Control severe groundwater depletion
- Provide the means for allocating Arizona's limited groundwater resources to most effectively meet the state's changing water needs
- Augment Arizona's groundwater supplies through development of additional water supplies



Is Arizona Prepared for Shortage?

Assured & Adequate Water Supply Program

PROGRAM CRITERIA	ASSURED WATER (AMAs) SUPPLY PROGRAM	ADEQUATE WATER (Non AMAs) SUPPLY PROGRAM
Physical Availability (100-years)	✓	✓
Continuous Availability (100-years)	✓	✓
Legal Availability	✓	✓
Water Quality	✓	✓
Financial Capability	✓	✓
Consistent with AMA Management Goal	✓	
Consistent with AMA Management Plan	✓	

Is Arizona Prepared for Shortage?

Mandatory Conservation Requirements

List of Best Management Practices

- Public Awareness/Public Relations
- Conservation Education & Training
- Outreach Service
- Physical System Evaluation and Improvement
- Ordinances/Conditions of Service/Tariffs
- Rebates/Incentives
- Research/Innovation Program



Arizona's Leak Detection Program



Water Conservation Rebates



Landscape Conversion up to \$3,000
Smart Irrigation Controller up to \$250
New Home Xeriscape \$200



Mandatory Conservation requirements for Municipal, Industrial and agricultural users within the AMAs have been in place since 1987

Is Arizona Prepared for Shortage?

Recharge & Recovery Program

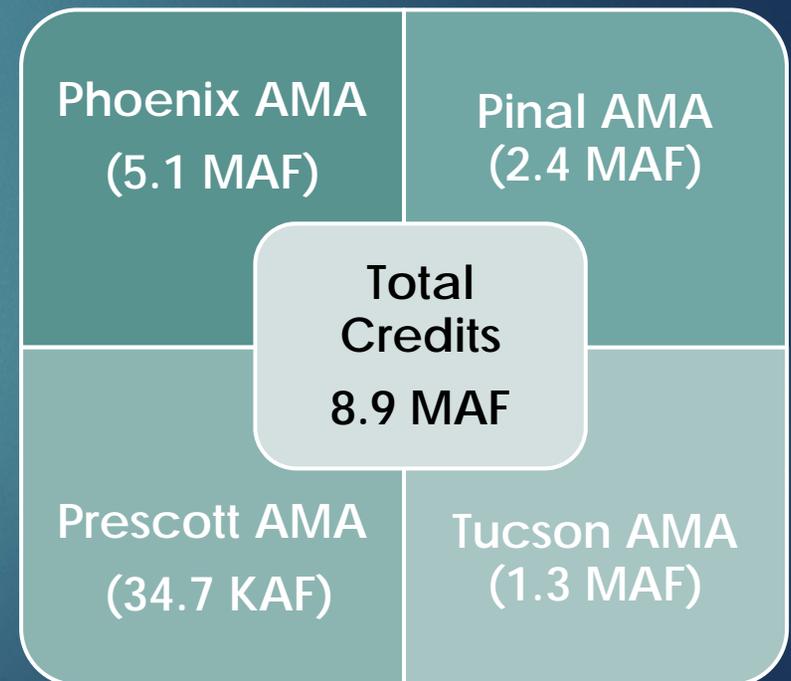
Established by Arizona Legislature in 1986 (and additional amendments)

Program Goals:

- Encourage the use of renewable water supplies
- Allow for flexible, & cost-effective water management
- Support active management area goals
- Mitigate local aquifer conditions
- Augment current and/or future water supplies
- Accommodate seasonal demand

Sources of Stored Water

- Reclaimed
- Central Arizona Project
- Surface Water



Is Arizona Prepared for Shortage?

Arizona Water Banking Authority

- Authorized by Arizona State Legislature in 1996
- Initially established to store Arizona's unused Colorado River water entitlement underground for future use
- Provides drought protection for certain municipal and industrial users of Colorado River water
- Assist in fulfilling water management objectives
- Assist the State in the settlement of Tribal water rights claims
- Provide a mechanism for interstate water banking

3.9 MAF long-term storage credits accrued since 1997

- 3.3 MAF for Arizona (including Tribes) uses (\$207 million)
 - over 601 KAF for Interstate (\$109 million)

Is Arizona Prepared for Shortage?

Collaborative Long Term Planning

- **Colorado River Drought Contingency Planning**
 - Seven Basin States, May 2013
 - Reduce the risks of Lake Mead falling below 1,000 ft elevation
 - Conserve 1.5 to 3 MAF by 2019
 - Pursuant to Min. 319, Mexico has stored 3 ft of water in Lake Mead
 - Memorandum of Understanding (CAP/MWD/SNWA/BOR)
 - 740,000 AF of protection volume between 2014 and 2017
 - CAP to conserve 345,000 AF in Lake Mead by 2017
- **ADWR's Strategic Vision for Water Supply Sustainability**
 - **Water Resources Development Commission (WRDC)**
 - WRDC was tasked with assessing Arizona's water demand and supplies for the next 25, 50 and 100 years
 - Estimated a Supply and Demand Imbalance between 900,000 AF – 3.2 MAF
 - Continued commitment to water conservation
 - Resolution of Indian & Non-Indian Water Rights Claims
 - Watershed/Forest Management
 - Augmentation

Questions?

