Meeting Water Management Objectives through Water Storage and Recovery in Arizona, USA

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Overview

After providing background, discuss how Arizona’s storage and recovery programs facilitate meeting state water management objectives

1. Regulatory context – recharge and recovery framework
2. Facilitating meeting 100-year Assured Water Supply requirements
3. Preparing for future Colorado River shortage conditions

Acknowledgement: Selected and limited slide content is from a joint presentation I made with Ken Seasholes, Central Arizona Project, on March 10, 2016 to recognize Groundwater Awareness Week. Graduate Student Rebecca Bernat assisted with some slides as noted.
Population of 6.5 million people expected to almost double by 2050.

Water use estimated to be about 7 Million Acre Feet (MAF) (8,633 MCM)

- Approx. 40% of total use is groundwater
- Approx. 3% is recycled or reclaimed water
- Of the remaining use, which is surface water, 2.8 MAF (3,453 MCM) is from the Colorado River
  - 1.5 MAF (1,850 MCM) of that is delivered through the Central Arizona Project (CAP)
- Approx. 70% of water diverted or extracted by agriculture
- Groundwater and surface water laws not integrated
Central Arizona Project is 540km long

Pumps water from near sea level to a maximum elevation near Tucson of about 730m (major electricity requirements)

Built to transport ~1,850 MCM of water annually

I serve as an elected member of the 15-person CAP board of directors
1. **Arizona’s regulatory framework**

**1980 Groundwater Management Act**

- Created the Arizona Department of Water Resources (ADWR)
- Established Active Management Areas (AMAs) in parts of the AZ
  - Hydrologic boundaries
  - Stringent regulations
  - Long-range management goals
- Ensured completion of the Central Arizona Project (CAP)
  - In 1968, grand bargain struck for funding CAP: *Low priority in times of shortage*
Recharge & Recovery Framework
(last major revision, 1994)

The Arizona Department of Water Resources administers a system of permits and accounts

- Permit system allows storage and recovery while protecting other land and water users
  - Facility permit
  - Storage permit
  - Recovery permit
- Requires extensive monitoring and annual reporting
- Stored water retains its legal character
  - i.e., recovered CAP water ≈ ‘wet’ CAP water
Recharge & Recovery Framework

- Arizona’s recharge & recovery program uses a “paper water” accounting system that relies on a “mass balance” approach
  - Recharging a volume of water allows an equal, or nearly equal, volume to be recovered
  - Generally, anywhere within the same AMA

- Recharge & recovery can occur within the same year, or a Long-Term Storage Credit (LTSC) is issued for future use
  - LTSCs can be transferred among users, with some restrictions
Recharge Facility Types

Underground Storage Facilities (USF)
- “Direct” recharge
- Water is delivered to spreading basins, trenches, injection wells or natural channels

Groundwater Savings Facilities (GSF)
- “Indirect” or “in lieu” recharge
- Water is delivered to agricultural user that would otherwise have pumped groundwater
Annual Recharge Capacity

Total = 2,531 MCM (2 MAF)/year

By Rebecca F.A. Bernat
Source: ADWR Status Reports, 2/24/16 - Permitted capacity, by facility type and AMA
Long-Term Storage Credits as of 2014
Central Arizona AMAs

11,900 MCM (9.6 MAF) on account at end of 2014

By Rebecca F.A. Bernat
Source: ADWR 2014 LTSA updated 05/25/2016
2. Mechanism for meeting 100-year Assured Water Supply

Assured Water Supply Rules are critically important requirement of the Groundwater Management Act

- Physically, continuously, and legally available water for 100 years
- Water meets water quality objectives
- Water meets consistency with the Management Goal for the Active Management Area, which is safe-yield in most AMAs
City of Tucson Water Supply Strategy

• Shift from groundwater to surface water use through aquifer storage and recovery
  • 88% of total water demand was from groundwater pumping in 2000
  • In 2015, use of groundwater was largely replaced by use of CAP water

• Storage and recovery of CAP water to deliver potable use
  • Three major CAP storage facilities
  • Use of surface water without large scale and expensive treatment systems
  • Exchange agreement with City of Phoenix
Water Production (1940-2015)
Central Arizona Groundwater Replenishment District (CAGRD)

- Established in 1993 to assist Central Arizona AMAs with meeting consistency with AMA management goal
- Operated by the Central Arizona Project
- Replenishes the aquifer on behalf of its members in the same AMA but not always in the same area as pumping, largely through recharge or through extinguishment of LTSC
Estimate of CAGRD Replenishment Obligations

CAGRD Estimated Replenishment Obligation (MCM)

By Rebecca F.A. Bernat
3. Colorado River Shortage Conditions and the role of the Arizona Water Banking Authority (AWBA)

CAP System and some other Arizona users of Colorado River water are vulnerable to Colorado River Shortage Declaration
Arizona Water Banking Authority created by Arizona Law in 1996

• 4,829 MCM in storage
  – 4,347 MCM for Arizona
  – 482 MCM for Nevada

• In the Phoenix, Pinal and Tucson Active Management Areas
  – 10 Underground Storage Facilities (USFs)
  – 15 Groundwater Savings Facilities (GSFs)
Arizona Water Banking Authority
Storage of CAP Water through 2015

Total = 4,828 MCM (3.9 MAF) stored since 1997

By Rebecca F.A. Bernat
2014 Joint Recovery Plan
ADWR, AWBA, and CAP


Describes basic framework, methods, timing, volume, and potential partnering opportunities – 81 pages
Recovery Roles & Responsibilities

- **ADWR** – administers the regulatory framework for recharge & recovery

- **AWBA** – manages the distribution of its credits, consistent with firming requirements, location and sources of funding

- **CAP** – serves as a designated recovery agent for the AWBA; works with the AWBA and partners to turn credits into firmed water

- **Recovery Partners** – entities that agree to recover credits to make up for reduced deliveries of CAP water
Concluding Points about Arizona’s Storage and Recovery Framework and Practices

- Integral to meeting Arizona water management goals
- Permitting, monitoring and accounting systems are in place
- Implementation involves complexities, including multiple levels of jurisdictions and water users
- Provides flexibility and opportunity for cost savings
- Recovery can be complex and costly and is still being worked on
Thank you!

A few references and web sites:
www.azwater.gov
www.cap-az.com
www.cagrd.com
www.azwaterbank.gov
www.wrrc.arizona.edu
www.tucsonaz.gov/water
www.mdpi.com/journal/water/special_issues/MAR