Aquifer Storage and Recovery in Texas

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Discussion Outline

Introduction
 • Need for Water Storage in Texas
 • Aquifer Storage & Recovery (ASR) 101

ASR in Texas

Ongoing ASR Demonstration Projects
 • Edwards Aquifer Authority/New Braunfels Utilities
 • Victoria County GCD/City of Victoria

Questions
Texas Needs “More Water”

From 2020 to 2070

State population increases 70%:
• From 29.5 million to 51 million

Total water demand increases 17%:
• From 18.4 million AFY to 21.6 million AFY

Total additional water needed:
• 8.9 million AFY in repeat of DOR
• §290.41(b) requires that: utilities “…shall have a safe yield capable of supplying the maximum daily demands of a utility’s distribution system during extended periods of peak demand usage and critical hydrologic conditions.”
The Traditional Way: Reservoir Storage

Number of large Reservoirs in Texas

- 1913—8
- 1950—53
- 1980—179
- 2012—188
- 2017—188

Per capita storage is declining

- 1980—2.4 AF per person
- 2012—1.7 AF per person
Reasons for Declining Reservoir Storage

Fewer viable sites

Permitting delays and costs
- Environmental issues
- Landowner opposition

Must finance in advance of need

Increasing capital cost
- Greater than rate of inflation
- Increasing rural land values
Aquifer Storage & Recovery (ASR) is:

“...the storage of water in a suitable aquifer ... during times when water is available, and recovery of that water ... during times when it is needed.”

David Pyne, P.E.
ASR Systems, LLC
Gainesville, FL
ASR Concept and Terminology

*The Target Storage Volume (TSV) is the sum of the Stored Water volume and the Buffer Zone volume.
ASR Development in the U.S.

Over 500 ASR wells in 133 ASR wellfields in 21 states

Three in Texas:

- El Paso
- San Antonio
- Kerrville
Water Sources and Storage Zones

Water sources for ASR storage
- Drinking water
- Reclaimed water (AZ, TX, FL, NJ, CA)
- Seasonally-available stormwater
- Groundwater from other aquifers

Storage zones
- Fresh, brackish and saline aquifers
- Confined, semi-confined and unconfined aquifers
- Sand, clayey sand, gravel, sandstone, limestone, dolomite, basalt, conglomerates, glacial deposits
- Vertical “stacking” of storage zones

Kerrville, TX ASR Well

© Arcadis 2015
ASR Operating Ranges

Well depths
• 30 to 2,700 feet

Storage interval thickness
• 20 to 400 feet

Storage zone TDS
• 30 mg/l to 39,000 mg/L

Storage Volumes
• 100 AF to 270,000 AF

Individual well capacity up to 8 MGD

Wellfield capacity up to 157 MGD
2011 TWDB ASR Research

Answered 2 Basic Questions:

• Why is ASR not being implemented more aggressively in Texas?
• What policy changes or technical studies are needed?

Scope of Work included:

• Legal white paper
• Interviews/site visits with 3 TX ASR utilities
• Survey of other TX utilities
• Review of literature and US/global practices
• Presentations and guidance for implementation

Findings:

• Most of impediments related to regulatory/institutional
• Need for more education and demonstration projects
Texas ASR Operations

Started in 1950s
Currently 3 active ASR operations

• San Antonio Water System (SAWS)
• El Paso Water
• City of Kerrville

20 projects are evaluating ASR for future use

Source: TWDB, 2017
# Summary of Texas ASR

<table>
<thead>
<tr>
<th></th>
<th>EPWU (10 mgd)</th>
<th>Kerrville (2.65 mgd)</th>
<th>SAWS (60 mgd)</th>
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</thead>
<tbody>
<tr>
<td>Date</td>
<td>1985</td>
<td>1995</td>
<td>2004</td>
</tr>
<tr>
<td>Source Water</td>
<td>Treated Wastewater</td>
<td>Treated River Water</td>
<td>Groundwater</td>
</tr>
<tr>
<td>Storage</td>
<td>300-835 feet</td>
<td>495-613 feet</td>
<td>400-600 feet</td>
</tr>
<tr>
<td>Hueco Bolson</td>
<td>495-613 feet</td>
<td>Lower Trinity</td>
<td>Lower Trinity</td>
</tr>
<tr>
<td>Issues</td>
<td>• Original well design</td>
<td>• Litigation during permitting</td>
<td>• Initially single pipeline</td>
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<tr>
<td></td>
<td>• Customers for reclaimed water</td>
<td>• Lack of source water</td>
<td>• Distribution system limitations</td>
</tr>
<tr>
<td>Expansion Plans</td>
<td>Expanding FHWRP Constructed 4th spreading basin</td>
<td>Added 3rd ASR well WTP expansion in Regional Plan</td>
<td>Part of 50-year Management Plan Increasing TSV</td>
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</table>
SAWS

2\textsuperscript{nd} largest in the U.S.

- 29 ASR wells
- 7 production wells
- 15 monitoring wells
- 60 MGD capacity

Source water

- Edwards Aquifer
- Storage aquifer

- Carrizo Wilcox Aquifer
SAWS ASR Storage Volume

Source: San Antonio Water System, 2017

Volume in Storage
~134,050 af
(through July 16th)
El Paso Water

1st ASR project in Texas
4 wells (2 in operation) and 6 spreading basins
Capacity: ~10 mgd
Source: Treated wastewater from Fred Hervey WRP
Storage zone: Hueco Bolson Aquifer
Stored volume: 70,843 AF by the end of 2013
City of Kerrville

2\textsuperscript{nd} ASR project in Texas (1995)

2 ASR wells (3\textsuperscript{rd} in development)

Current capacity: 2.65 mgd

Source: Treated surface water from Guadalupe River

Storage zone: Lower Trinity Aquifer
City of Kerrville Net Water Storage in ASR

Source: City of Kerrville, 2017
ASR Advantages

Minimal evaporation/loss
Fewer environmental impacts
Competitive cost (capital cost \( \approx $1.50 \) per gallon per day of capacity)
Phased development
Ability to supplement multiple water supply strategies
Broad range of applications and geographic settings
TWDB Funding for ASR

84th Texas Legislature, 2015, House Bill 1, Rider 25

$1,000,000 from the General Revenue Fund
Demonstration projects or feasibility studies:
• Prove up aquifer storage and recovery
• Use of innovative storage approaches that improve operational efficiencies
Provide cost-effective and regional water supplies
Applicants and/or their partner organizations required to provide matching funds
Request for application notice – September 22, 2015
Application deadline – November 3, 2015
Grant approval – January 7, 2016
# Application Summary

Six applications received
- Four ASR field studies
- One ASR desktop/planning study
- One enhanced recharge field study

Three grants awarded

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<tr>
<th>Recipient</th>
<th>Funding</th>
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<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Requested</td>
<td>Awarded</td>
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<tr>
<td>Edwards Aquifer Authority</td>
<td>$563,000</td>
<td>$281,500</td>
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<td>Victoria County Groundwater Conservation District</td>
<td>$570,226</td>
<td>$285,112</td>
<td>$285,112</td>
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<td>Corpus Christi Aquifer Storage and Recovery Conservation District</td>
<td>$1,000,000</td>
<td>$500,000</td>
<td>$433,388</td>
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## Summary of Demonstration Projects

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<tr>
<th>Applicant Partner Organization</th>
<th>Edwards Aquifer Authority</th>
<th>Victoria County GCD</th>
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<tr>
<td></td>
<td>New Braunfels Utilities</td>
<td>City of Victoria</td>
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<tr>
<td>Type of Project</td>
<td>Aquifer data confirmation: Wireline coring and Monitor well construction</td>
<td>Production well retrofit and cycle testing Data collection</td>
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<tr>
<td>Location in Region L</td>
<td>Central Texas—IH 35</td>
<td>Mid Texas Coast</td>
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<tr>
<td>Aquifer</td>
<td>Brackish Edwards</td>
<td>Gulf Coast</td>
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<tr>
<td>Project Duration</td>
<td>12 months</td>
<td>24 months</td>
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<tr>
<td>TWDB Funding</td>
<td>$281,500</td>
<td>$285,112</td>
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ASR Project Locations
EAA/NBU Project

May 2012 ASR Feasibility Study conclusions/recommendations:

• ASR is viable water management strategy for NBU
• Construct demonstration well in brackish Edwards Aquifer near New Braunfels Regional Airport
• More data, and coordination with EAA required

Status/ongoing activities:

• Executed Interlocal Agreement between EAA and NBU
• Working on approvals from TXDOT Aviation and FAA
• Working on design of components
Local Geography

Legend

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<th>Symbol</th>
<th>Description</th>
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<tr>
<td><img src="image1.png" alt="Symbol" /></td>
<td>Faults</td>
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<td><img src="image2.png" alt="Symbol" /></td>
<td>Potential ASR Sites</td>
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<tr>
<td><img src="image3.png" alt="Symbol" /></td>
<td>Texas Counties</td>
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Map Projection:

NAD 1983
Texas State Plane
South Central

Fresh/Saline Water Interface Report

Potelt Report 92-02a
Schultz Report 94-05
EAA/NBU Scope of Work

- Coordination with TCEQ
- Coring design
- Wireline coring and analysis
- Monitor well design
- Monitor well construction and data collection
- Final reports and presentations
VCGCD/Victoria Project

October 2014 Regional ASR Feasibility Study:

- Partially funded by TWDB (found on website)
- Found that ASR viable water management strategy for Victoria
- Recommended demonstration program in Gulf Coast Aquifer, including retrofit of existing Victoria production wells
- Significant existing data from 15 municipal wells in Victoria

Status/ongoing activities:

- All agreements and contracts in place
- Received TCEQ UIC Class V experimental well authorization
- Completed PER and detailed design documents
- Well rehab and above-ground ASR facilities contractors selected
Gulf Coast Aquifer Cross Section
Local Geography

[Map showing the location of Victoria SWTP and Well 19 in Victoria, TX, USA]
VCGCD/Victoria Scope of Work

- UIC Class V ASR permitting with TCEQ
- ASR facilities design
- Retrofit of Well No. 19 near Victoria SWTP
- Potable water pipeline design and construction
  - Approximately 2,000 feet long
  - 12-inch ID
- O&M Manual development and training for City and VCGCD
- Cycle testing and assessment
- Final reports and presentations
Imagine the result

Questions
Contact Information

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