

Geologic Characterization for the Corpus Christi ASRCD Project

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DEVELOPATE

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Texas Water Development Board Water Science and Conservation Innovative Water Technologies

State and regional water planning



Recommended Water Management Strategies include:

Aquifer Storage and Recovery

- Develop 80,869 acre-feet/year by 2060
- 6 regions recommended strategy (E, G, H, J, K, L)



What is ASR?

- Aquifer Storage and Recovery (ASR) is the storage of water in a suitable aquifer through a well during times when water is available, and the recovery of water from the same well during times when it is needed – Pyne, 2005
- Other frequently used broader terms are Managed Aquifer Recharge (MAR) and Managed Underground Storage of Recoverable Water (MUS) – National Research Council, 2008
- In Texas statute, an ASR project is a project:
 - with two phases (Phase I and Phase II)
 - that anticipates the use of a Class V aquifer storage well
 - with injection into a geologic formation capable of underground storage for subsequent retrieval and beneficial use – Chapter 297 (Definitions)

History of Early ASR Studies at TWDB

Upper Guadalupe River Authority, Kerrville

studies completed in 1992, system operational in 1998

Brownsville Public Utility Board

studies completed in 1996, no plant to date

San Antonio Water System

study completed in 1998, Twin Oaks plant built in 2004

City of Laredo

study completed in 1999, no plant to date

An Assessment of Aquifer Storage and Recovery in Texas (report, 2011)

Goal: Ascertain the reasons for ASR not being used more widely in Texas and make recommendations

<u>Conclusion</u>:

- Technical factors not major impediments to implementation of ASR
- Main challenge is perceived lack of ability to protect stored water

Recommendations:

- TWDB/TCEQ joint demonstration program and interagency coordination
- Legal and regulatory modifications
- Develop incentives for utilities to gather and keep accurate cost data
- Fund statewide data gathering program
- Research
- Additional focused education

Statutory Authority for TWDB in ASR Studies

- TWDB shall participate in pilot projects
- Pilot projects are eligible for grants from the water loan assistance fund
- TWDB may authorize use of money from the research and planning fund for pilot projects
- TWDB shall make other studies, investigations, and surveys of the aquifers in the state as it considers necessary

Texas Water Code §11.153, 11.154, 11.155

Corpus Christi Aquifer Storage and Recovery Conservation District

•Created in 2005 by the 79th Texas Legislature (enactment SB 1831, Section 1, Subtitle H, Title 6)

•Prepared a groundwater management plan (2008)

•District is committed to maintaining a sustainable, adequate, reliable, cost-effective and high quality source of groundwater to promote the vitality, economy, and environment of the district.

•Prepared a five-year plan for district operation and evaluation of ASR (2009)

Corpus Christi Aquifer Storage and Recovery Conservation District (CCASRCD)

Project objective is to:

Collect well data

Append data to relational database

Characterize geology within ASR District :

sand and clay sequences water chemistry aquifer parameters potential problems: hydrocarbons high gamma ray spikes

Project focus is on the Evangeline Aquifer in the area of the Stevens Water Treatment Plant at the west end of the district

Provide database, GIS datasets, raw well data, and summary report

Project Completion Date: February 29, 2012







District Geology

Will use hydrostratigraphy of the Gulf Coast Aquifer developed for the TWDB groundwater availability model program (Young and others, 2010)

Collect and interpret water well and geophysical well logs within San Patricio and Nueces counties

Extrapolate water chemistry and aquifer test information to CCASRCD region

Source: Young and others, 2010



TWDB Relational Database Primary Tables

TWDB Groundwater Database

Well Data Remarks Water Levels Water Chemistry (2 tables) Casing

> New Tables

TWDB BRACS* Database

Well Data (location, depth, owner, ...)

Water Levels Water Chemistry (2 tables) Casing

Foreign Keys (well ids) Well Geology (lithology/stratigraphy) Net Sand and Sand Percent Interpreted TDS from Geophysical W.L. Aquifer Determination Analysis Digital Water Well Reports Digital Geophysical Well Logs Geophysical Well Log Suites Aquifer Test Information

* BRACS: Brackish Resources Aquifer Characterization System

BRACS Supporting Well Databases





Well Attributes: location, source, log types, well numbers, ...

Well logs are hyperlinked to database, simplifying retrieval.

| -8 | TWDB WSC IWT BRACS Geophysical Log Search Task | | | | | | | |
|-------|---|-----|------------------|------------------|--|---|----------------|-------------|
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| | County Name WINKLER Load Attributes NEW Load Attributes NEW | | | | | | | |
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| | Drill Date 05/03/2005 Horizontal Datum 83 Vertical Datum 29 V | | Owner Heritag | ge Standard Corp | oration | | | |
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| ue ID | autonumber, assigned to each well with a potential geophysical log | | | | | | Num | ock 🗖 🗖 🛱 🕅 |

TWDB staff are using a NeuraScanner to scan paper geophysical well logs.

The TWDB has hundreds of paper logs in its files and the Railroad Commission of Texas has over 300,000 paper geophysical well logs in the Groundwater Advisory Unit collection.







Upper Goliad Sands (yellow; SP response) in the upper Evangeline Aquifer

The lithology of geophysical well logs was interpreted from base of surface casing to several hundred feet below the Oakville Formation (base of Jasper Aquifer).

Lithology from each water well was loaded into the database and a simplified lithology was applied to the driller 's descriptions.

Lithology top/bottom depths and thickness were loaded into the database and net sand and sand percent maps can be made for any formation or combination of formations.

The upper and lower formation boundaries were obtained from the Gulf Coast Hydrostratigraphy report by Young and others (2010) and applied to each well in the two-county project area.

Geology Table

| -8 | frmWell_ | Lithology_DE | | | | | | | | | | | | | | |
|--|--------------------------------------|----------------|-----------------|----------|---------------------------------------|---------------|--|-----------|------------|-----------------------|--------------------|-------------------------------------|--------------------|------------------|----------------|----------|
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Wells with net sand evaluations performed.



Wells with complete Upper Goliad Formation net sand evaluation performed.



Chicot Aquifer wells showing TDS, well yield, and transmissivity data



Chicot - Evangeline Aquifer wells showing TDS, well yield, and transmissivity data



Evangeline Aquifer wells showing TDS, well yield, and transmissivity data



Determining resistivity values for calculating TDS





Calculation of TDS from geophysical well logs

Staff load method-specific log values and correction factors and the analysis is performed by the software

| == | TWDB Water Science and Conservation Innovative Wa | ter Technologies Brackish Resources Aquifer Characterization System |) X |
|-----|--|---|-----|
| • | Well Id 1376 BRACS Geopt GL Number 844 Depth Formation (DF): 530 | hysical Log Analysis for TDS Calculations Blue Field: Auto Loaded Gray Field: Calculated by CPU SP Method Mean Ro | |
| | Thickness Lithologic Unit: 30 | Alger - Harrison Rwa Method Initials: JEM V | |
| | TDS Interpreted 3428 Consensus TDS Method SP Method | Ts 63 Dt 1015 Estepp Tf 69.2660 Rmf 1.7 Remarks: High sulfate water in the Pecos Valley Aquifer, Reeves County, Tx Tbh 75 Rmf Tf 1.546213 High sulfate water in the Pecos Valley Aquifer, Reeves County, Tx | |
| | TDS Method: SP Method Geophysical Log Used: SPONTANEOUS POTENTIAL | Rwe 2.010062 Rw 2.211068 Rw75 2.042024 Cw 4897.101 TD5 3428 Initials: JEM 💌 | Ĩ |
| | SP 8 Rxo 0 | Correction Factors 70.21238 K (Temperature): SP Method 1.1 Rwe Rw: Sp, Alger Harrison, and Rwa Minimum Methods | |
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Recent ASR Reports available on the TWDB Website:

•ASR Feasibility in Bandera County (2009)¹

•Water Rights Analysis and ASR Feasibility in Kerr County (2009)¹

•An Assessment of Aquifer Storage and Recovery in Texas (2011)²

1 www.twdb.texas.gov /wrpi/rwp/rwp_study.asp

2 <u>www.twdb.texas.gov/innovativewater</u>

Summary

- The project was structured to collect as much data as possible in the region, and evaluate the entire Gulf Coast Aquifer sequence to offer CCASRCD flexibility on site and target depth selection.
- Additional data can be loaded into the database should CCASRCD decide to move to an area other than the Stevens WTP site.
- Database and analysis techniques developed for the BRACS program are well suited to characterize region geology for other ASR projects.
- The variability of geophysical log quality, age, and completeness precluded automated analysis of net sand using LAS files.
- Each aquifer is different and techniques of analysis will need to fit data available.
- The methods to characterize the geology are only a preliminary step before the site-specific development drilling and evaluation is performed.
- Future well drilling information can be loaded into the database, and GIS maps can be updated with site-specific test results.



Sustainable, affordable, quality water for Texans, our economy, and our environment.

| Home Financial Assistance | Water Planning Gro | oundwater Surface | Water Conservatio | on Innovative Water | Publications | | |
|--------------------------------------|---------------------|----------------------|---------------------|--|----------------------|--|--|
| Introduction ASR BRAC | S Desalination R | lainwater Harvesting | Water Reuse | | | | |
| 2010 | _ | Report | | Innovative Water T | echnologies) | | |
| Seawater Desalination Biennial | Texas Innovative Wa | and Reco in Texas | er Storage overy | Aquifer Storage and Recovery BRACS Desalination Rainwater Harvesting Water Reuse | | | |

Questions?

TWDB: (512) 463-7847

http://www.twdb.texas.gov

Innovative Water Technologies

The mission of the Innovative Water Technologies is to educate the water community on the use of nontraditional water supplies. This mission is accomplished by participating in research needed to advance technology demonstration projects; developing publications and educational materials; making presentations to the public; and, actively participating in key water organizations.

To promote and advance the use of non-traditional water supply development and management technologies such as desalination; rainwater and stormwater harvesting; water reuse; and aquifer storage and recovery in Texas, Innovative Water Technologies:

- · funds and participates in research and demonstration projects; and,
- · disseminates information through outreach activities.

Innovative Water Technologies (IWT) is primarily involved in the areas of nontraditional water supply and management activities including: desalination, rainwater and stormwater harvesting, water reuse, and aquifer storage recovery.

Through our desalination program, we administer grants for brackish groundwater desalination projects and seawater desalination pilot studies. To date, TWDB has funded eight brackish groundwater desalination demonstration projects worth a total of about \$2.2 million, and two seawater desalination pilot plant studies worth approximately \$3.13 million.

We promote rainwater and stormwater harvesting and water reuse through grants for research and demonstration projects and outreach activities.

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