

# Managed Aquifer Recharge projects in Texas, protecting public health and ensuring future water

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October 14, 2026

Texas Groundwater Protection Committee October Meeting

Austin, Texas



# What is Managed Aquifer Recharge (MAR)?

*“The purposeful recharge of water to aquifers for subsequent recovery or for environmental benefit.”\**

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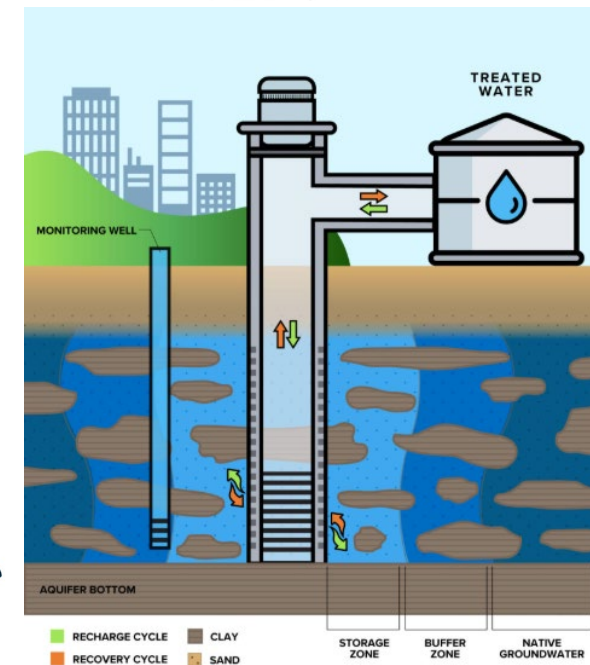
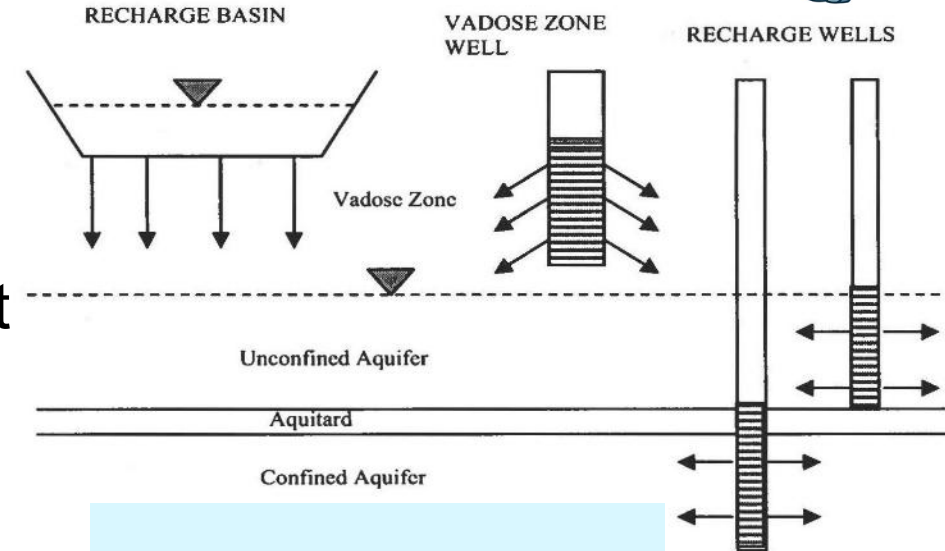
- creation or enhancement of recharge features like floodplains or rain gardens; or
- direct placement of water through injection wells

\*Dillon, Peter, Paul Pavelic, Declan Page, Helen Beringen, and John Ward. 2009. “Managed Aquifer Recharge: An Introduction.” 13. Waterlines Report Series. National Water Commission.

# Two Types of MAR

- **Aquifer Recharge (AR)**  
A natural process in which water percolates downward until it becomes part of the groundwater system. In MAR, recharge features are engineered and actively maintained to aid this natural process.
- **Aquifer Storage and Recovery (ASR)**  
The process of storing water underground in times of surplus to recover for later use.

Water investment 



Water savings account 

# A tale of two agencies



## Texas Commission on Environmental Quality (TCEQ)

The state regulatory agency providing project authorizations, permits, and enforcement.

The TCEQ strives to protect Texas's public health and natural resources consistent with sustainable economic development.



## Texas Water Development Board (TWDB)

The state agency responsible for water science, planning, and project financing.

The TWDB's mission is to lead the state's efforts in ensuring a secure water future for Texas and its citizens.

# TCEQ MAR Responsibilities

- Issue Permits or Authorizations for wells used to inject water for Aquifer Recharge (AR), or for Aquifer Storage and Recovery (ASR)
- Issue Permits for land application of water or infiltration basins for ASR and AR
- Review required operational reports
- Exercise enforcement authority as needed

# TCEQ MAR Rules and Statutes

- [Texas Water Code \(TWC\) Chapter 27](#)
  - Class V injection well statutes
- [Title 30 Texas Administrative Code \(TAC\) Chapter 331](#)
  - State regulations for injection wells
- [Title 30 Texas Administrative Code \(TAC\) Chapter 290](#)
  - Drinking water regulations
- [Texas Water Code \(TWC\) §11.023\(a\)-\(c\) and §11.157](#)
  - Surface water rights for recharge and special rules to move state water to ASR

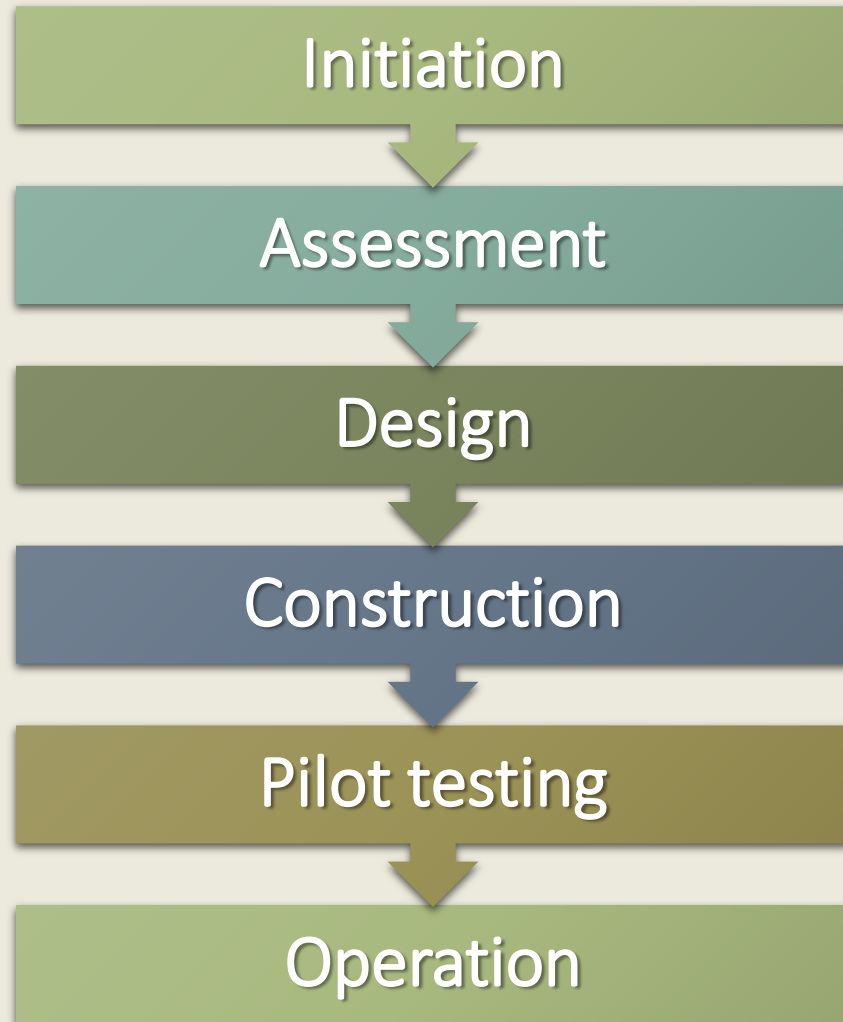
# TWDB MAR Responsibilities

- Goals of Aquifer Storage and Recovery Program:
  - Disseminate information through public education
  - Consolidate and map all available study materials
  - Facilitate the application of best practices among entities
- ASR & AR authorities ([TWC §11.155](#)):
  - conduct a statewide survey...to identify the relative suitability of aquifers for use in ASR projects and AR projects [COMPLETED]
  - conduct ASR & AR studies in the state water plan or identified by interested persons
  - work with appropriate interested persons to conduct studies
  - share the results of studies with regional water planning groups and interested parties

# TWDB Funding/Appropriations

- General revenue funds for 3 ASR/AR staff (2020 to present)
- Statewide, non-MAR specific water infrastructure funds (supply, waste, flood), <https://www.twdb.texas.gov/financial/index.asp>
- Occasional MAR-specific funds tied to legislative bills for research, feasibility studies, and/or pilot testing
  - 2015: House Bill 1, Rider 25, \$1 million from General Revenue Fund for ASR projects (awarded to Victoria County Groundwater Conservation District, the Edwards Aquifer Authority, and the Corpus Christi Aquifer Storage and Recovery Conservation District)
  - 2009: contracted a report on why ASR is not being more widely implemented in Texas (completed 2011)
  - 1995: House Bill 1989 funded ASR feasibility studies in Laredo, San Antonio, and Brownsville.
  - 1992: TWDB-funded study for City of Kerrville ASR plant completed.
  - 1952: Texas Board of Water Engineers cooperate on El Paso artificial recharge study

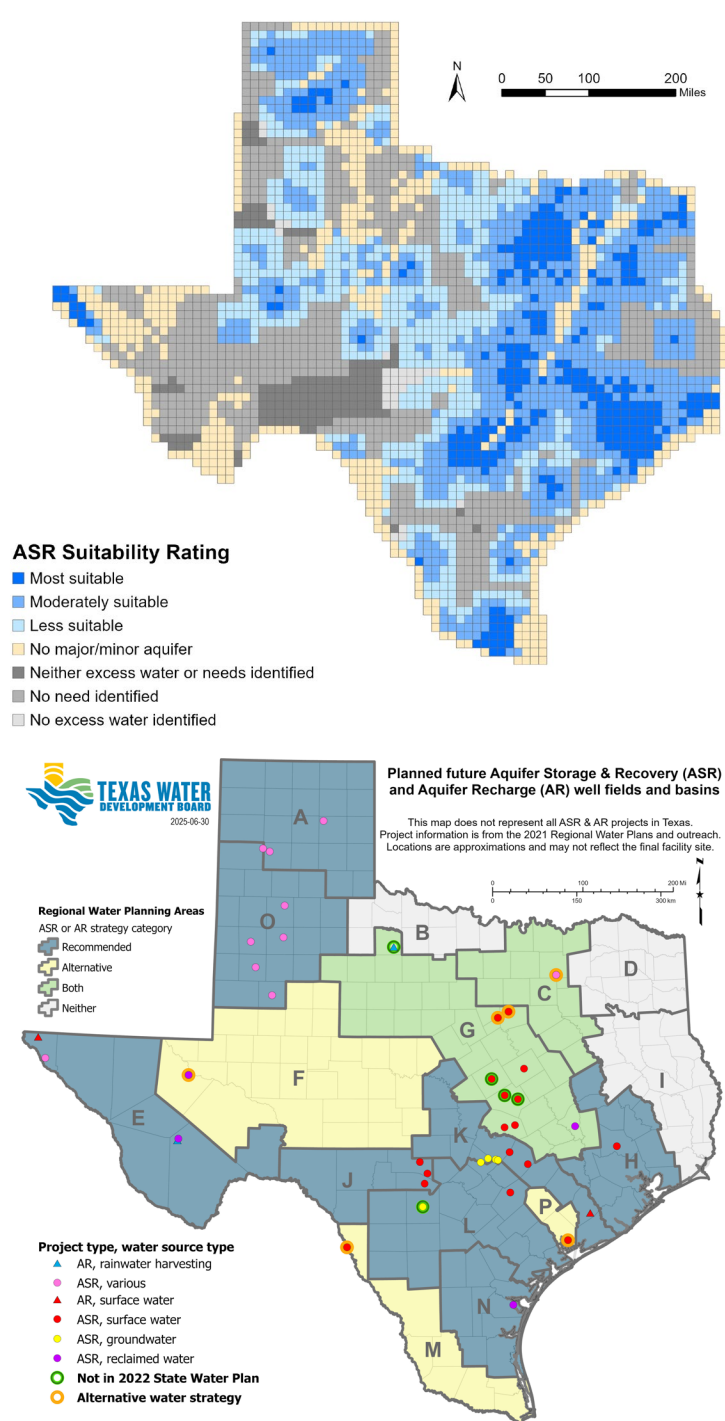
# General phases of development



City of Buda  
ASR well #1

# Initiation

- Define project purpose and goals
- Define timeframes for data collection and project implementation
- Develop decision framework
- Identify potential source water and water rights
- Identify target aquifer and ownership
- Assess funding availability



# Initiation



It is beneficial to reach out to TCEQ early so staff can provide resources and guidance.

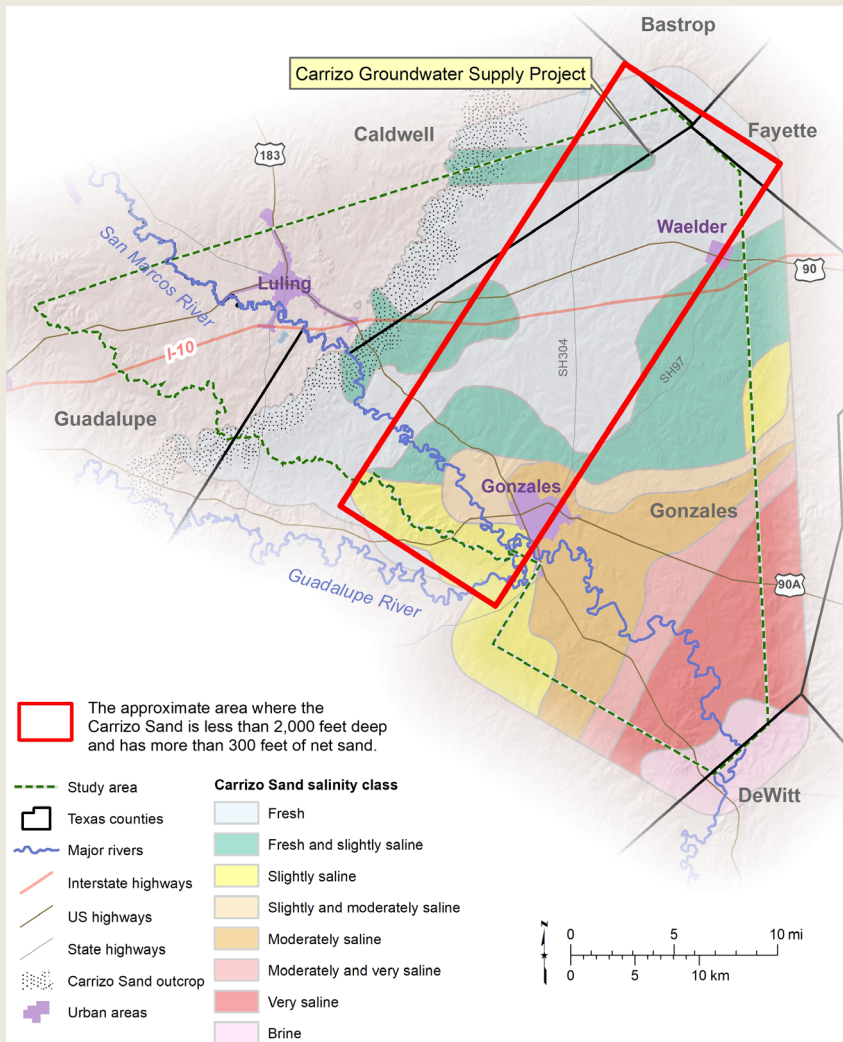


The Office of Planning assists with adding projects to the State Water Plan. Based on 2027 plan MAR would provide 3.3% of the total supply by 2080.

TWDB Innovative Water Technologies staff provide technical assistance to stakeholders, planners, and financial managers.

# Assessment

- Evaluate economic feasibility.
- Assess data availability.
- Investigate target aquifer characteristics and geochemistry.
- Evaluate historic and current aquifer water levels.
- Run field investigation.
- Evaluate source water compatibility, treatment requirements, and potential effects on nearby wells.
- Select project final site.
- Assess possible environmental impacts.



Map from Report 387 (2022)

# Assessment



It is essential to ensure all permitting required data are collected for the application(s).

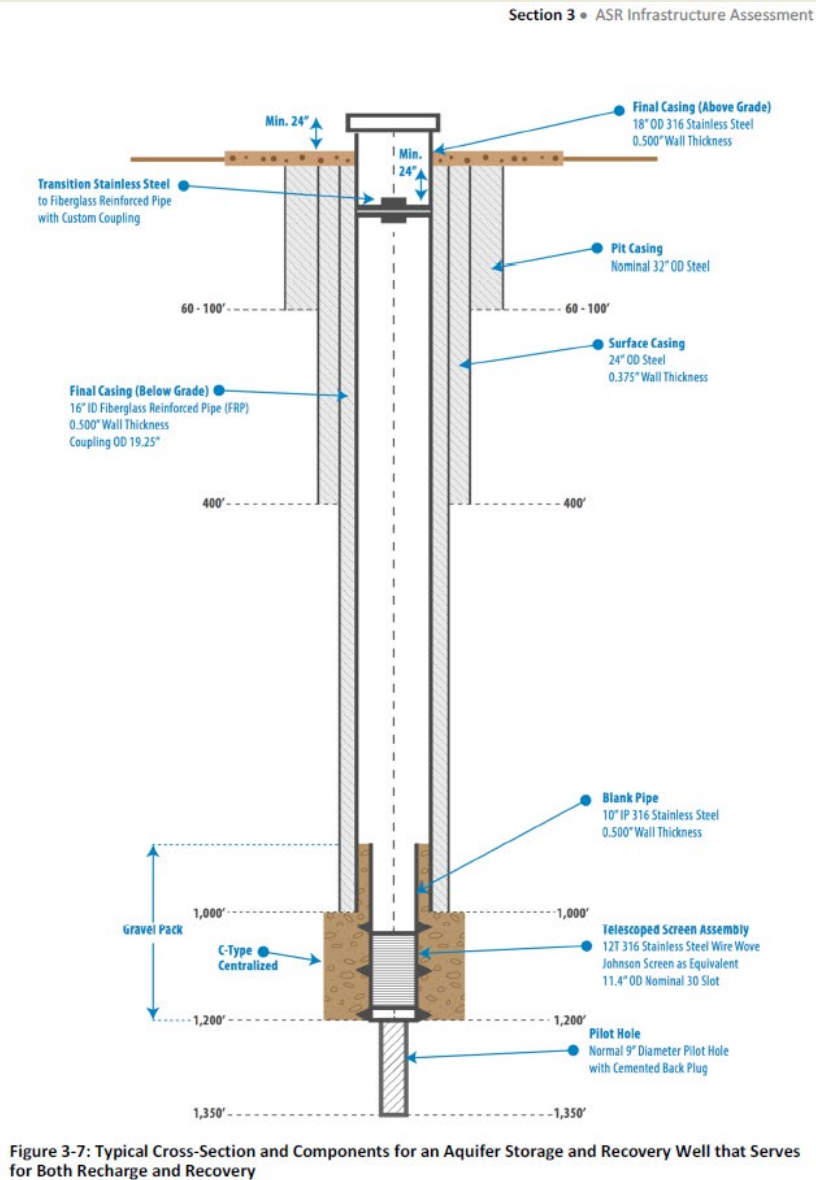


The ASR team performs studies throughout the state and has completed four studies since 2020: a statewide suitability survey, an aquifer characterization, a well longevity assessment, and a utility-scale suitability assessment.

# Design

Design considerations for an ASR/AR well:

- Well depth and borehole diameter
- Casing materials and diameter, casing setting depth(s)
- Cement type and volume
- Screen interval and well spacing
- Monitor well locations
- Operational plan - Time and volume to develop storage and buffer zones for ASR wells



*Basins and Infiltration Galleries may also be used  
but have different permitting requirements.*

# Design



Designs need to meet permitting standards.  
Designs should be substantially complete prior to applying for permits.



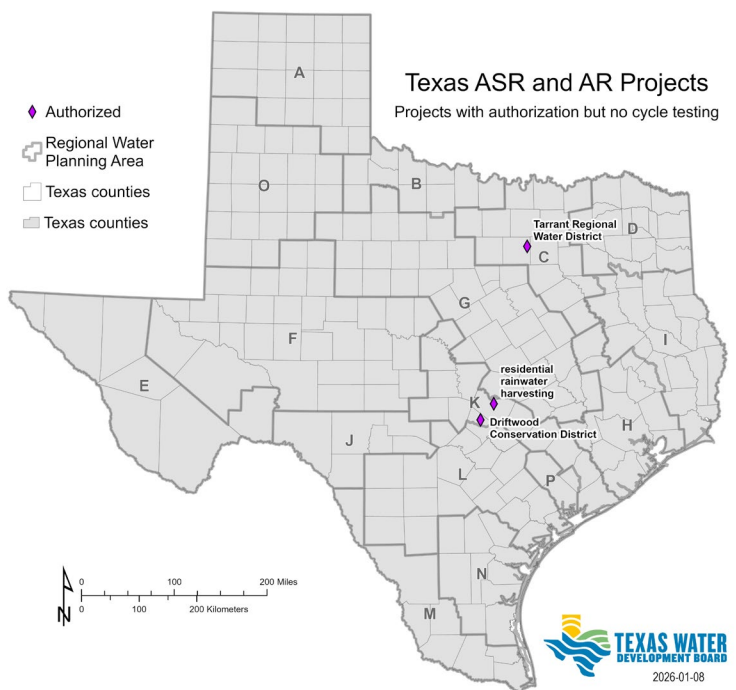
A variety of federal and state low interest loans and grants, with special programs for agricultural, rural areas, economically distressed areas can be used at various phases and are commonly used for designing and engineering professional costs.



# Construction

System construction in compliance with design can include wells or surface recharge basins, pre and post treatment systems, connection to the distribution and disposal systems, and monitoring wells.

Drilling at TRWD/TRA ASR well site



Permits/authorizations from multiple programs at TCEQ may be required prior to construction.

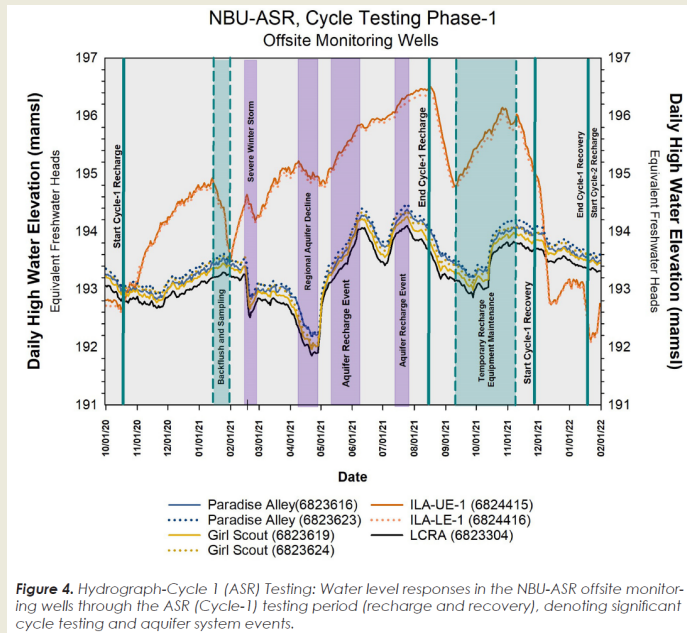
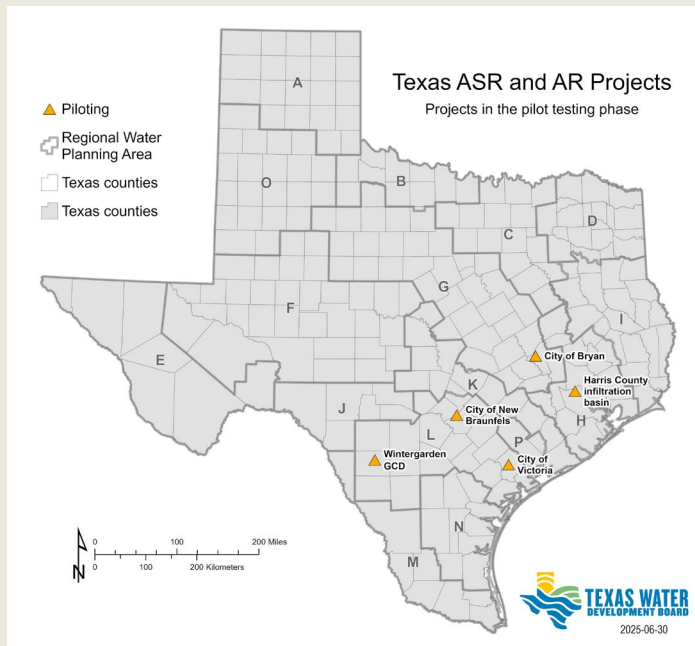


Finance assistance has been used for the construction of some of the ASR projects in Texas.



# Pilot testing

Cycle testing and sampling to ensure the facility is meeting standards. Assess and understand operational issues that may arise (e.g., water quality or loss) and identify maintenance and repair needs.

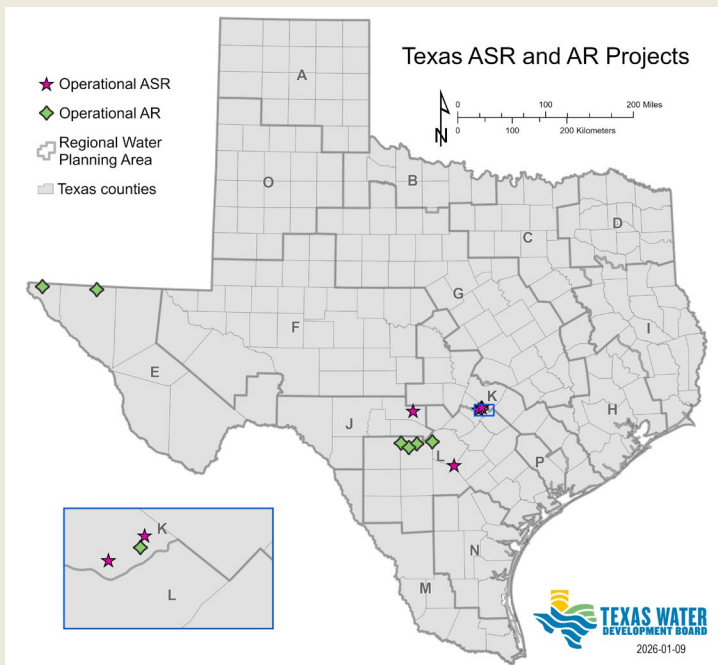


Receiving and reviewing reports, may amend permits based on testing results.



Funding is sometimes awarded for pilot testing, such as for the city of Victoria.





# Operation

Develop buffer zone, store water, and integrate into supply system. Maintain and monitor water level, flow rates, water quality, and compliance with project goals. Scale up as needed. Properly dispose of waste products.



City of Kerrville ASR 2 well



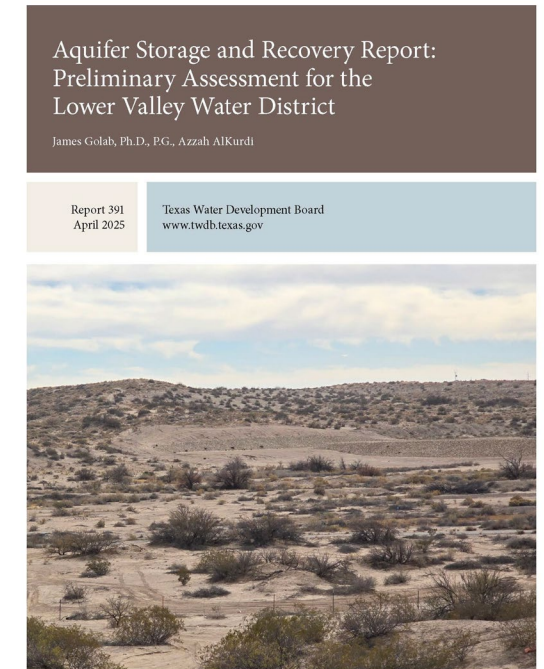
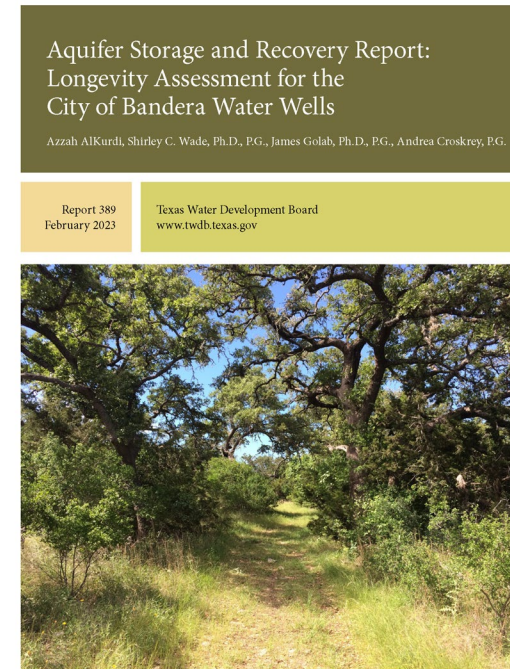
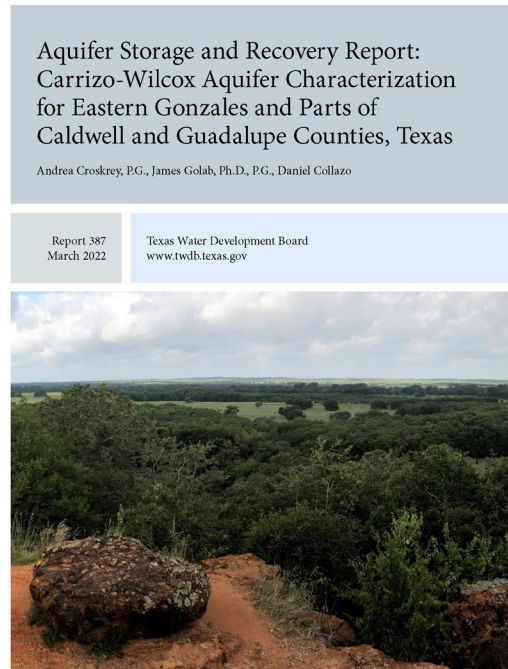
Full scale ASR operation may require additional TCEQ permits/authorizations for water supply or waste disposal and periodic reporting.



Engaged to share updates, lessons learned, and best practices with other entities considering ASR.

# TWDB Interests

Generally, facilitating ASR & AR projects to increase water supply in Texas while protecting water rights and aquifers



# TCEQ's Charge

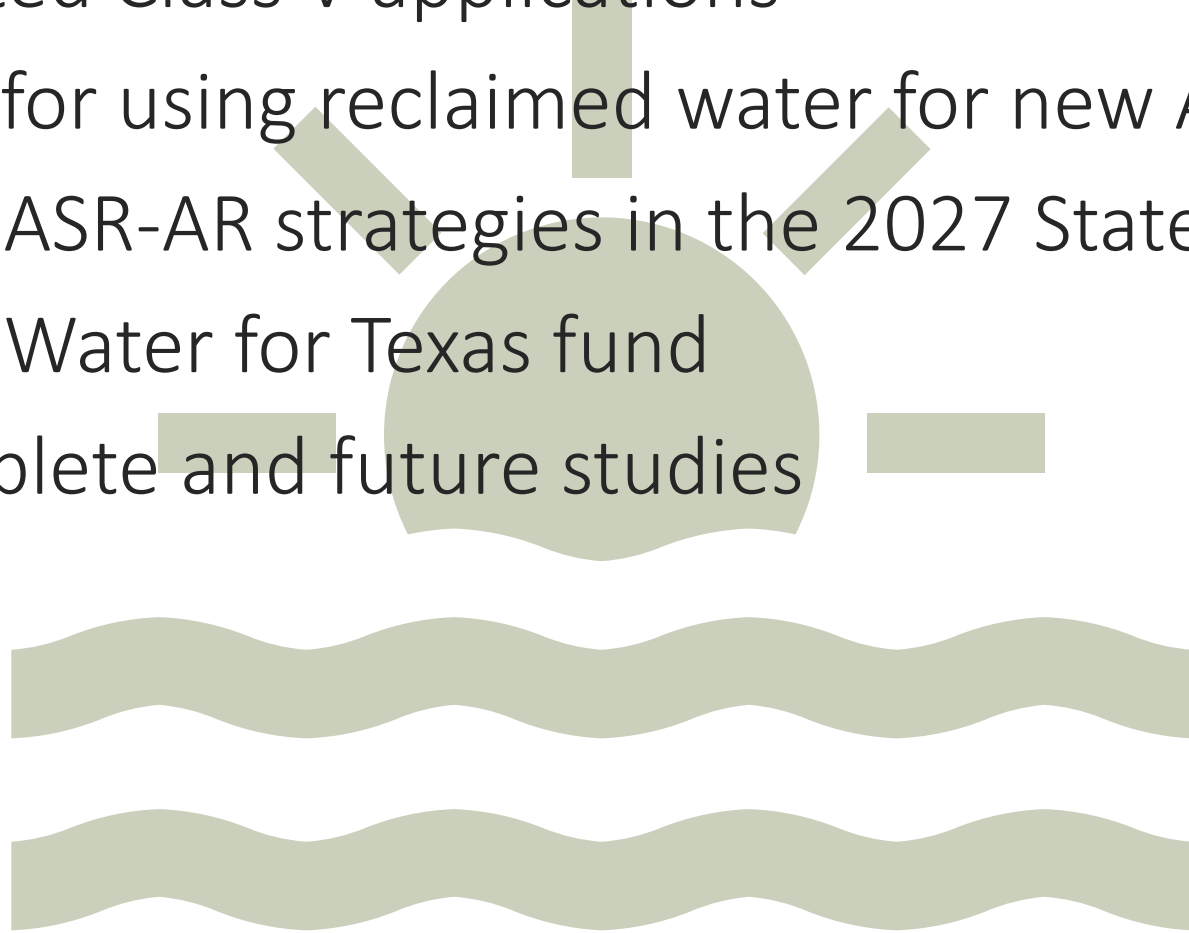
- Authorizing ASR and AR projects in a way that protects groundwater and surface water quality, while meeting the needs of Texans.
- Providing efficient regulation of the production, treatment, delivery, and protection of safe and adequate drinking water.



# Areas of Collaboration

- 
- 1) Coordination to efficiently utilize resources to meet mandates
  - 2) Information exchange
    - a) Notification of new projects and authorizations
    - b) Meeting and training announcements
    - c) Project and authorization updates
  - 3) Assistance when applications are outside of the agency's knowledge base
  - 4) Education on regulatory requirements and latest science
  - 5) Discuss program challenges and seek solutions with mutual benefit

# On the horizon

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- A decorative background graphic featuring a stylized sun with a large circular body and several rectangular rays extending upwards and outwards. Below the sun are two horizontal wavy lines representing water. The entire graphic is rendered in a light olive green color.
- 1) TCEQ: Updated Class V applications
  - 2) TCEQ: Rules for using reclaimed water for new ASR projects
  - 3) TWDB: New ASR-AR strategies in the 2027 State Water Plan
  - 4) TWDB: New Water for Texas fund
  - 5) TWDB: Complete and future studies

# Contact Information

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