

Desalination

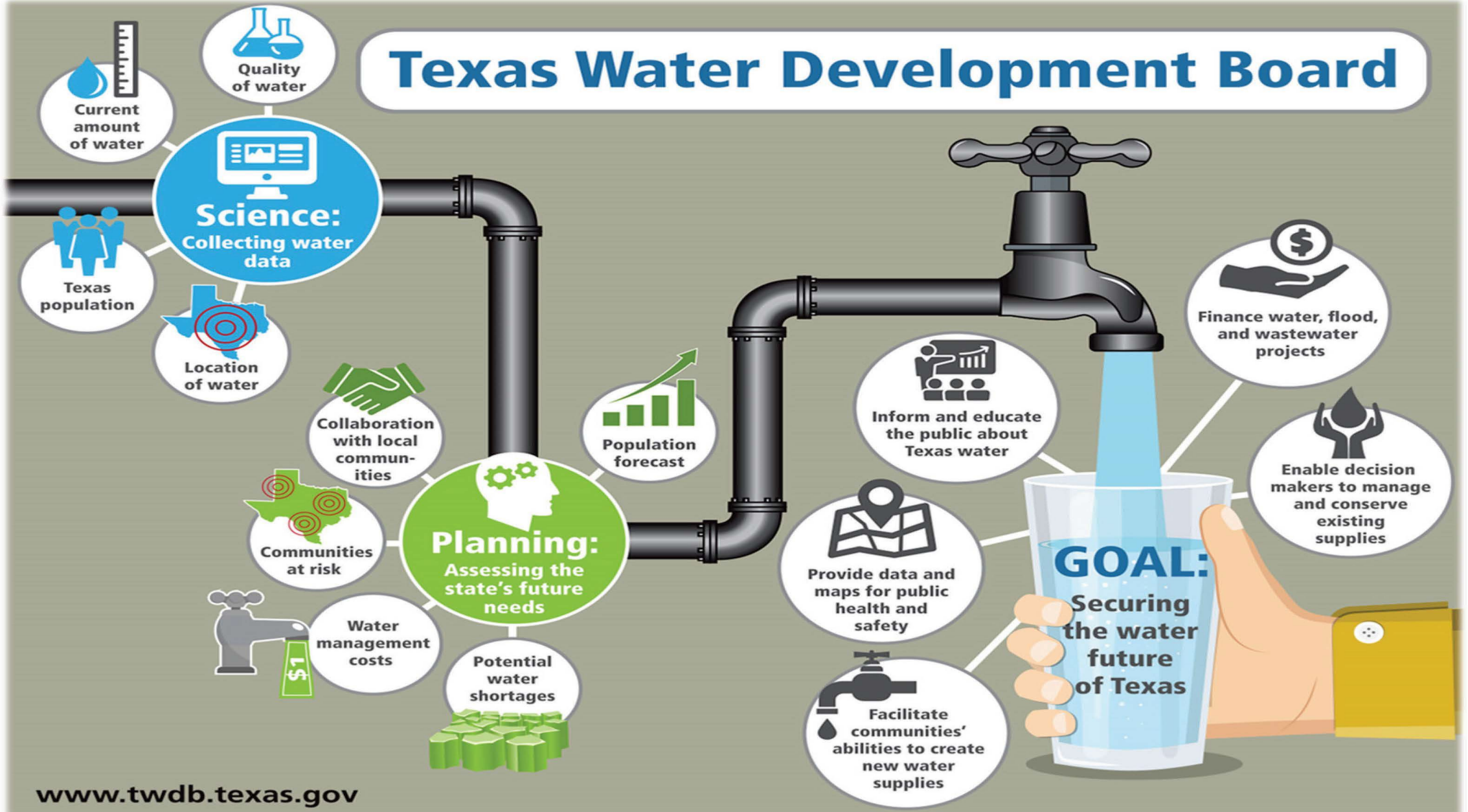
Webinar

Texas Tech University

October 9, 2020

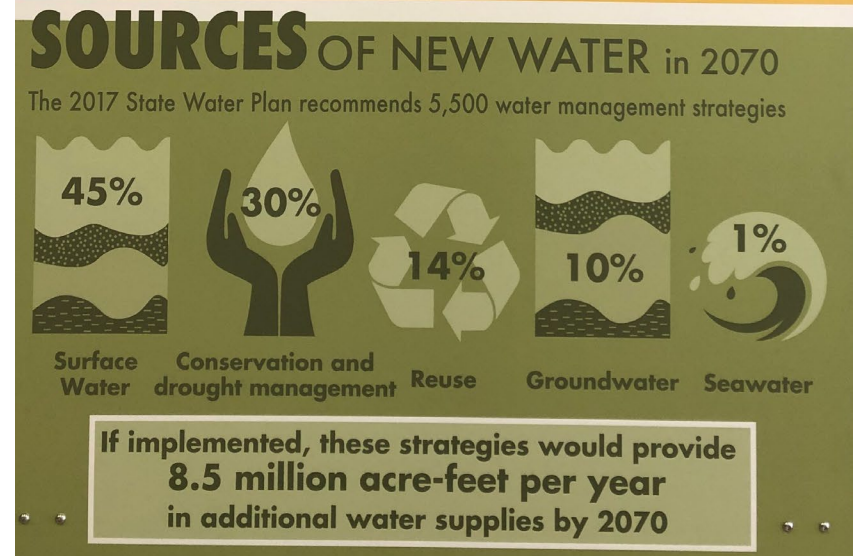
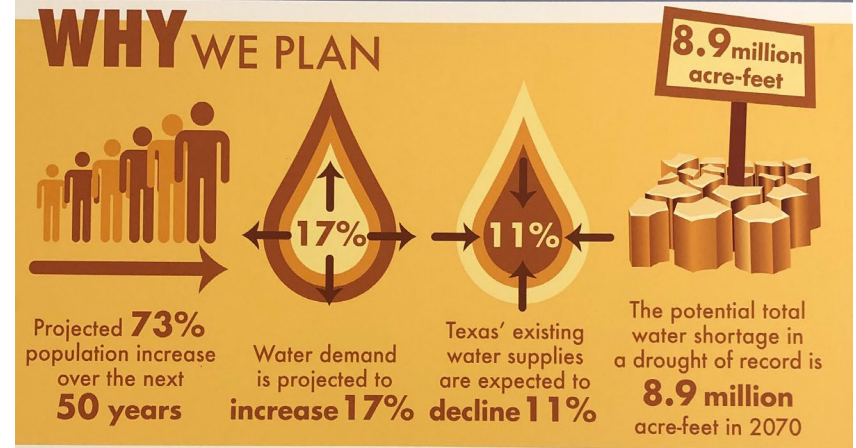
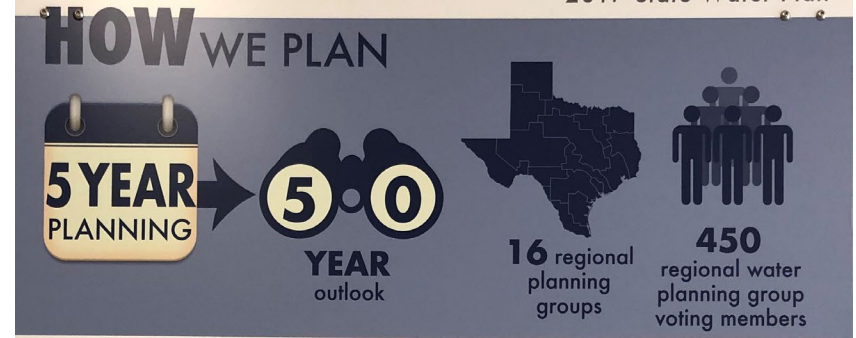
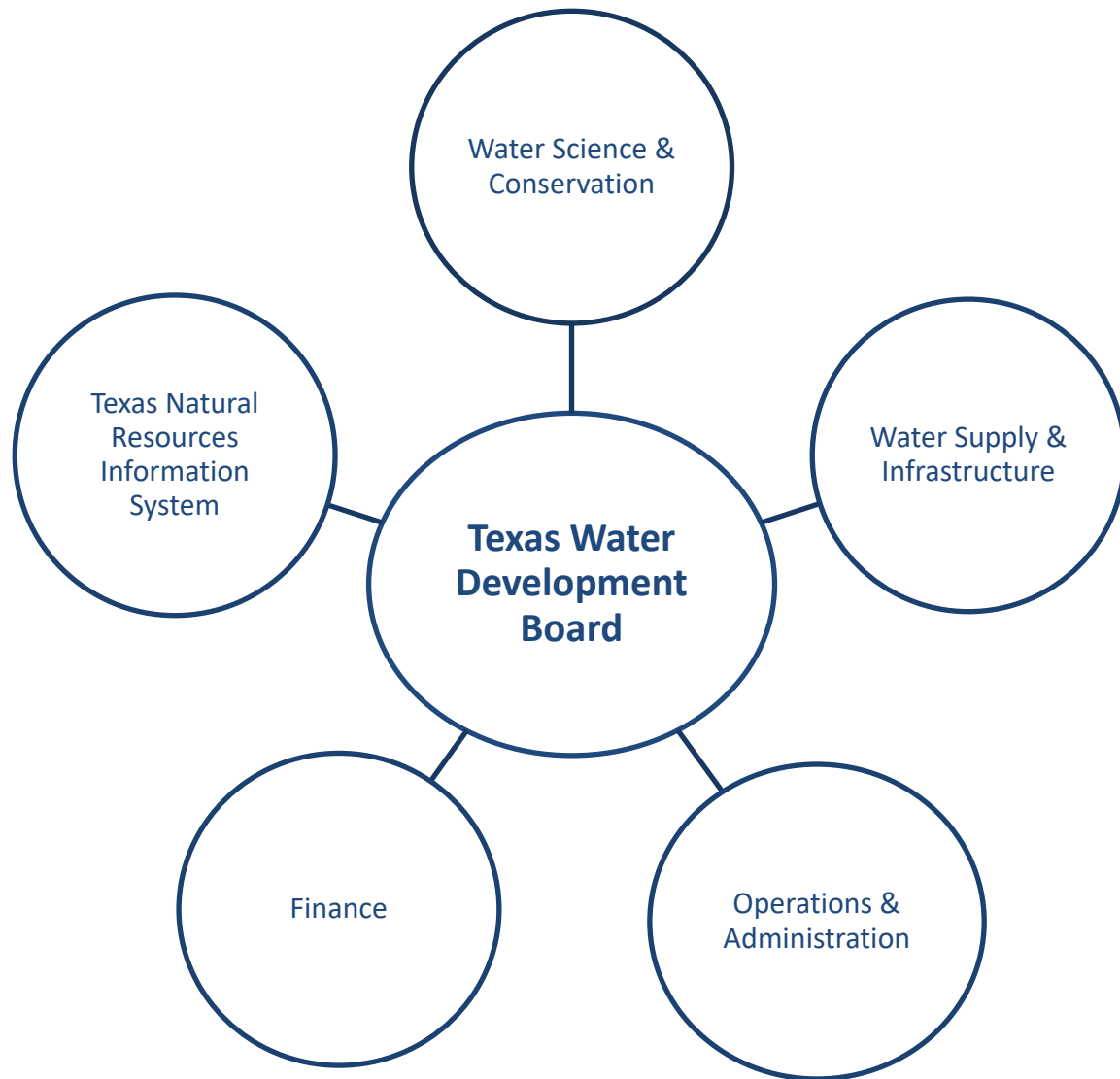
Unless specifically noted, this presentation does not necessarily reflect official Board positions or decisions.

Texas Water Development Board

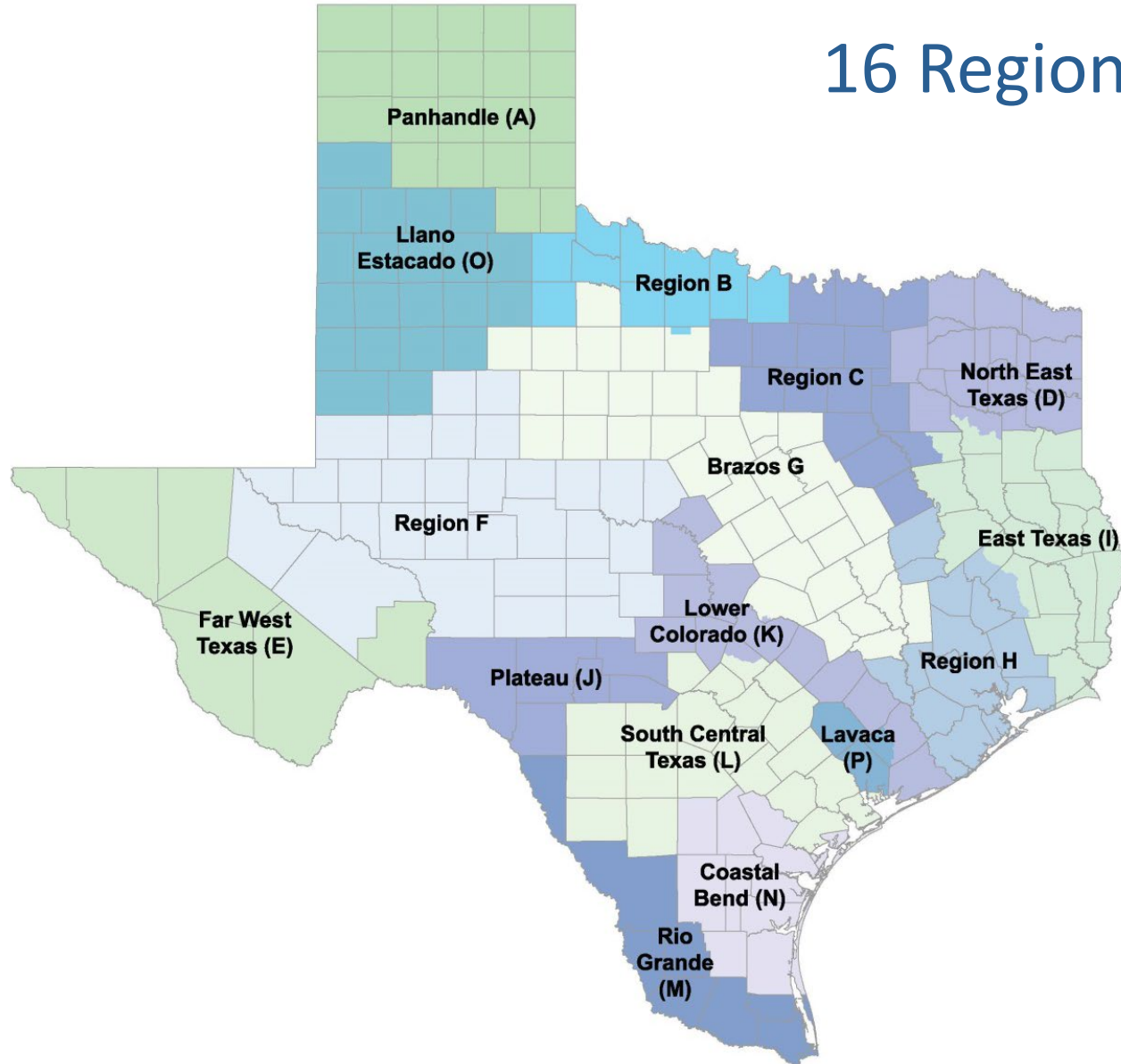


www.twdb.texas.gov

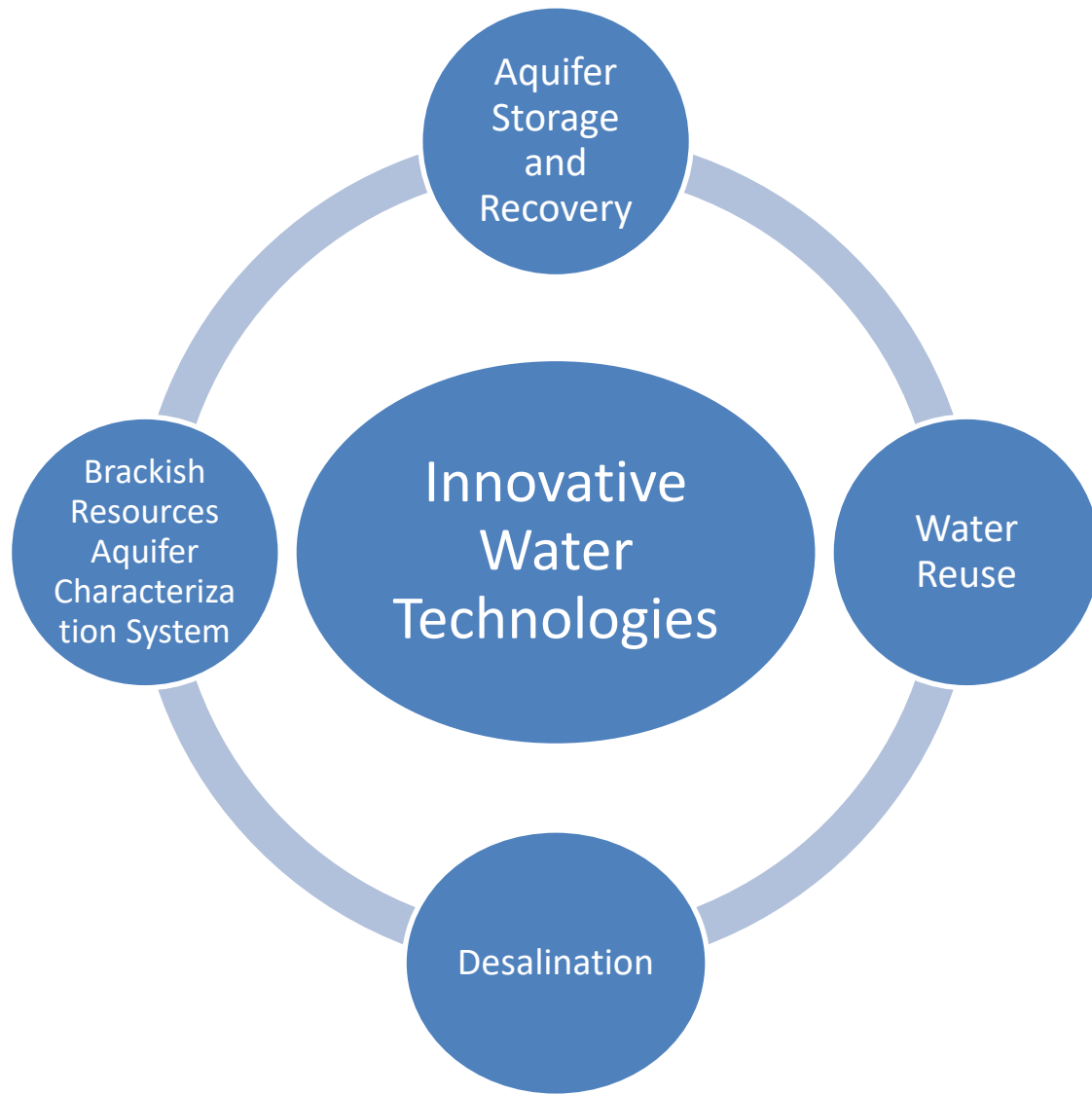




16 Regional Water Planning Areas



- Bottom up approach
- State Water Plan every five years
- Working on 2022 State Water Plan

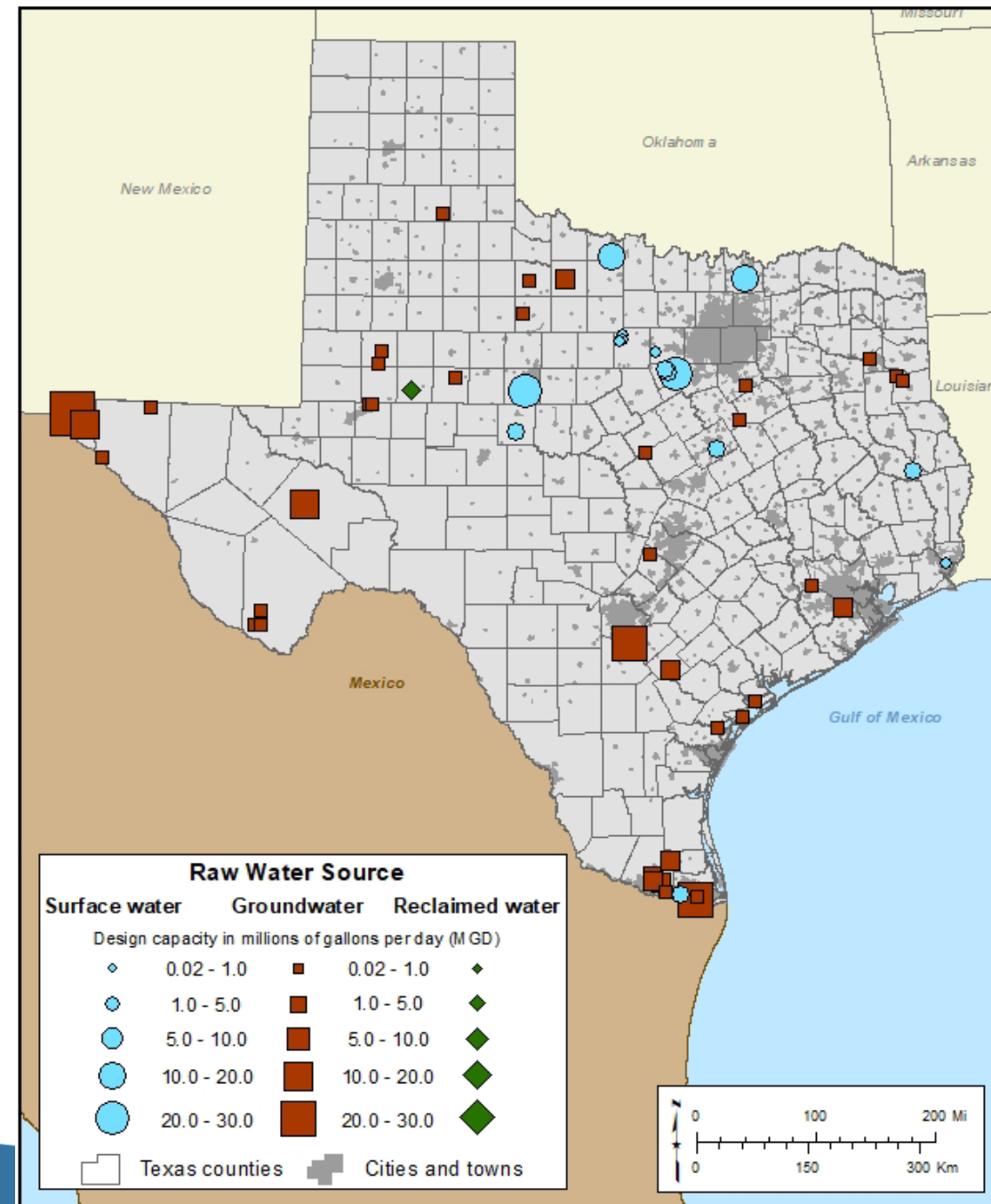


Mission is to advance the development of alternative water supplies in Texas.

- Participate in research and demonstration projects needed to advance technology
- Develop publications and educational materials
- Disseminate information to the public through presentations, active participation in organizations, and other outreach activities.

Desalination Program

- Created in 2002 to initially cover seawater desalination and in 2004 added brackish groundwater desalination.
- Funded \$3.2 million for 5+ seawater desalination studies
- Funded \$2.1 million for 11 brackish groundwater desalination studies



Desalination process

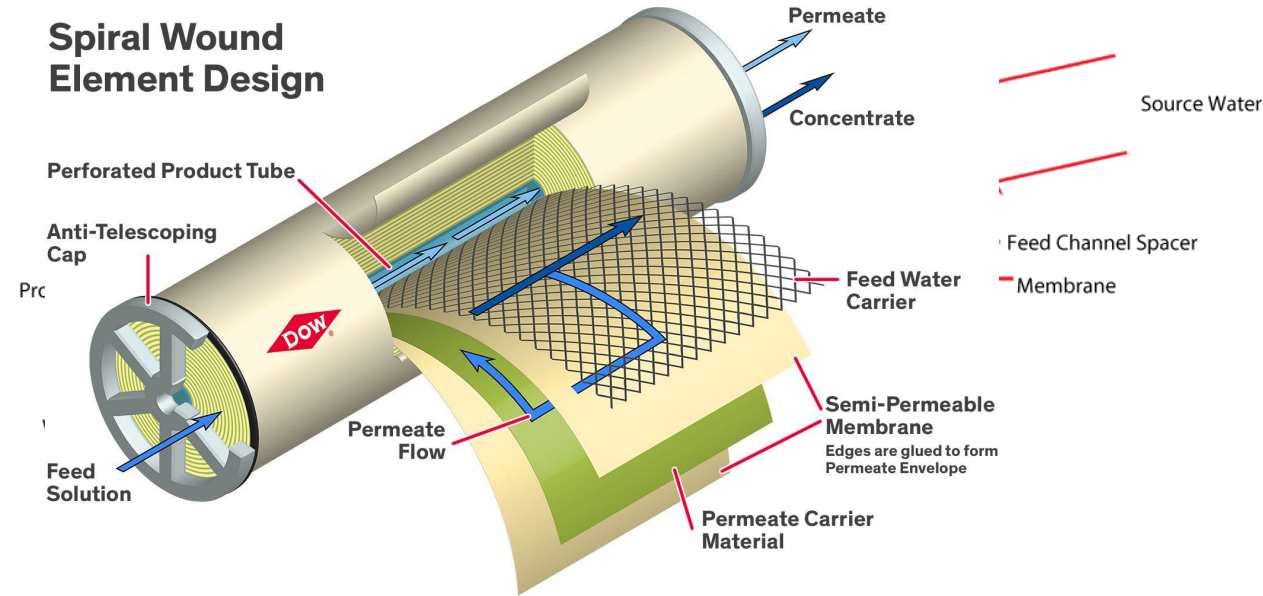
- Process of removing dissolved salts from brackish water (surface water, brackish groundwater, and seawater)

Groundwater Salinity Classification	Salinity Zone Code	Total Dissolved Solids Concentration (milligrams per liter)	
Fresh	FR	0 to 1,000	
Slightly Saline	SS	1,000 to 3,000	← Most Major/Minor Aquifer Mapped Limit
Moderately Saline	MS	3,000 to 10,000	
Very Saline	VS	10,000 to 35,000	← Seawater
Brine	BR	Greater than 35,000	

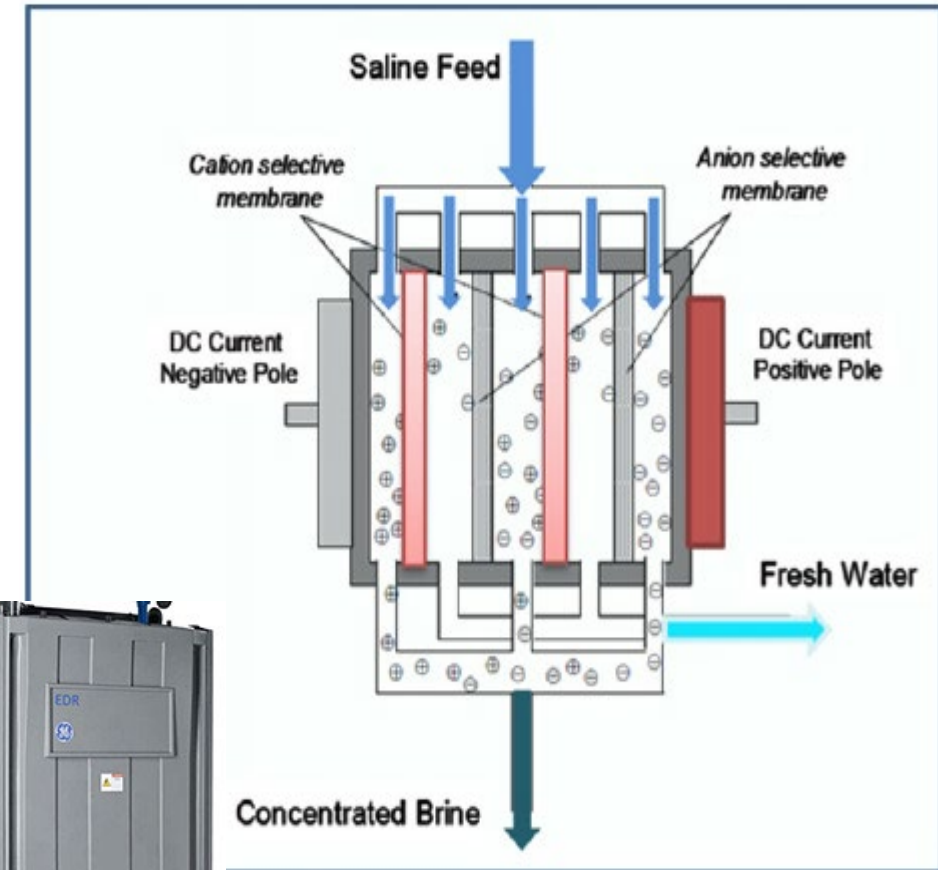
modified from Winslow and Kister (1956) USGS WSP 1365

Desalination technologies

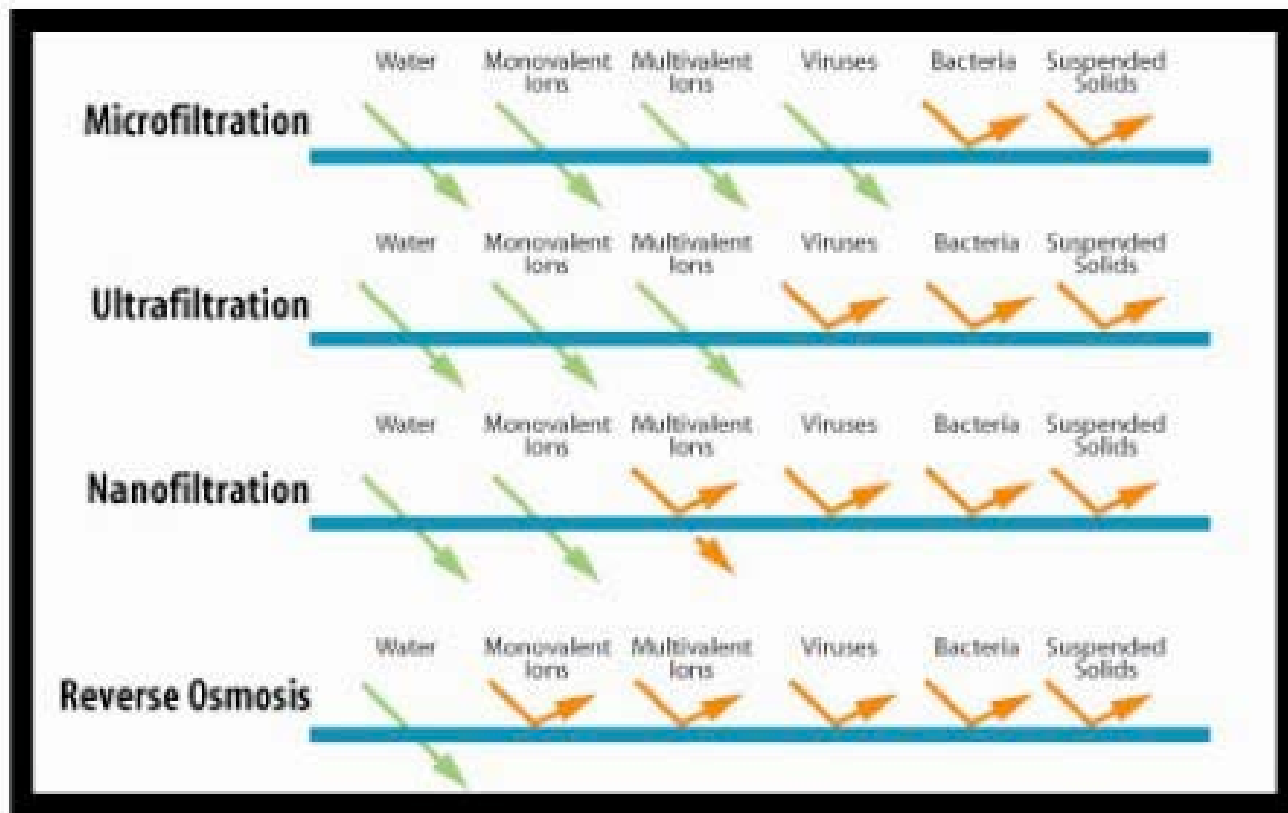
- Reverse osmosis



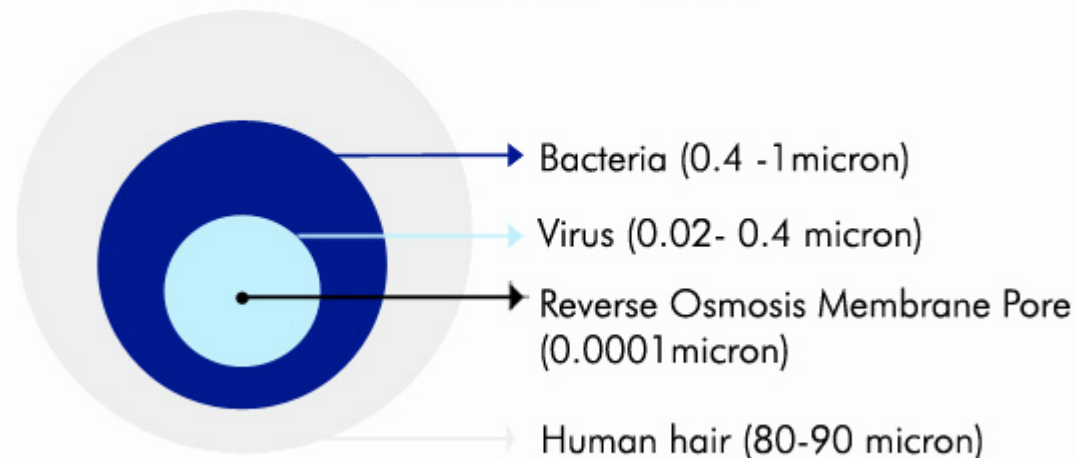
- Electrodialysis-reversal



Membranes



REVERSE OSMOSIS MEMBRANE PORE SIZE COMPARISON CHART

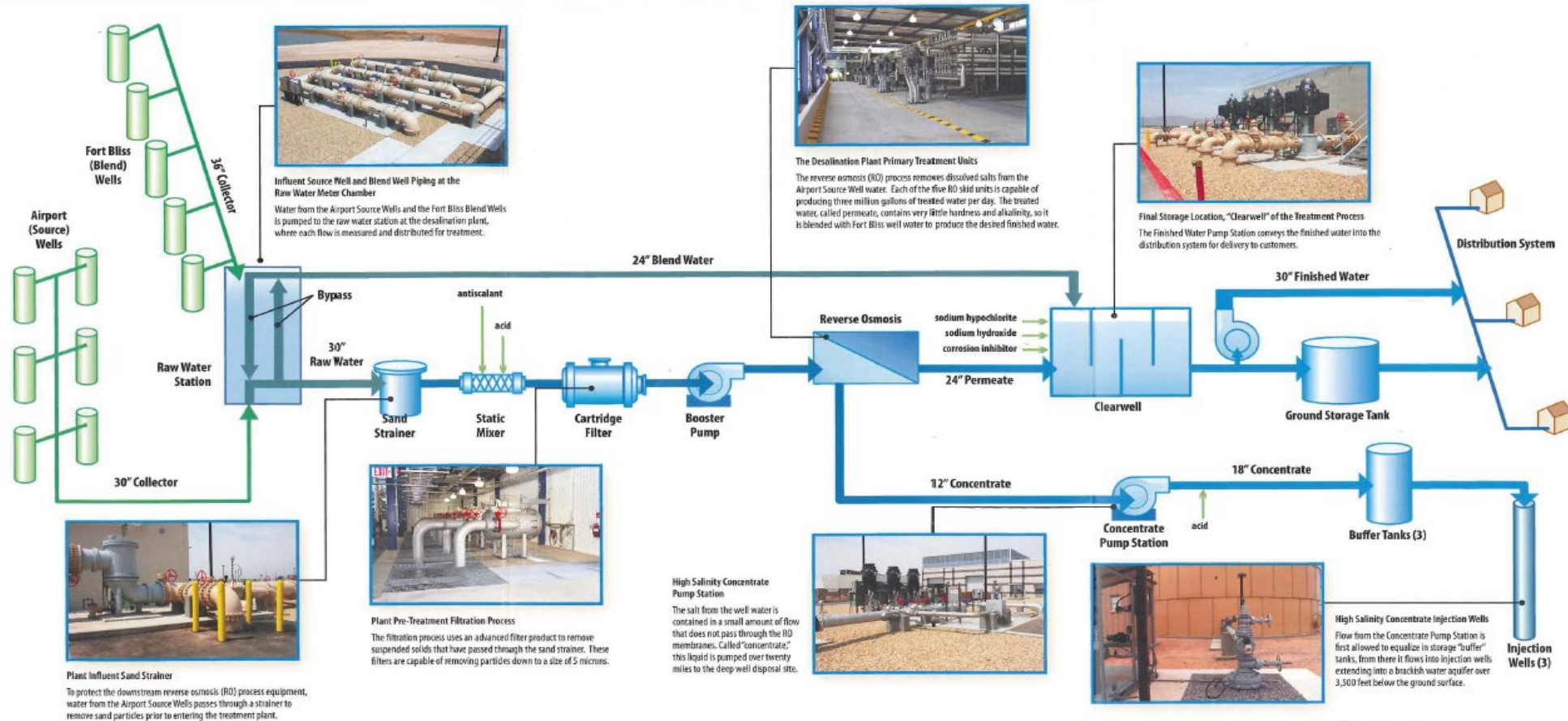


Source:

Source: Safe Drinking Water Foundation
(<https://www.safewater.org/fact-sheets-1/2017/1/23/ultrafiltrationnanoandro>)

Example of desalination plant diagram

Kay Bailey Hutchison Desalination Plant



Desalination Plant Database

- Initially developed in 2005 via contract
- Updated in 2009/2010 by TWDB staff
- Updated in 2015/2016 by TWDB staff and made interactive
- Updated in 2020 by TWDB intern
- Municipal desalination plants with a capacity ≥ 0.025 million gallon per day
- Self reported surveys

Desalination Plant Database - Viewer

WATER DATA Interactive | Groundwater | Layers | Base Maps | Help | Disclaimer | Texas Water Development Board

Find address: [input field]

- TWDB Groundwater
- Brackish Groundwater
- Submitted Driller's Reports**
 - Well Reports
 - Plugging Reports
 - Desalination Plants**
 - Surface Water
 - Groundwater
 - Other

Desalination Plant

Desalination Plant Report:	View Report
Plant Name:	Veolia Water Treatment Plant (Idle)
County:	Jefferson
Plant Production - Design:	0.245
Water Source:	Surface Water
Raw Water Total Dissolved Solids (mg/L):	No Data
Operational Status:	Idle
Process Type(s):	Reverse Osmosis

Pointer - DMS: 38° 55' 49.34" N 101° 51' 28.12" W || DD: 38.930371 -101.857812

Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS

Desalination Plant Database



Desalination Plants

Home **Desal Plants** Desalination Website

Desalination Plants: 49

[Apply Filters](#)

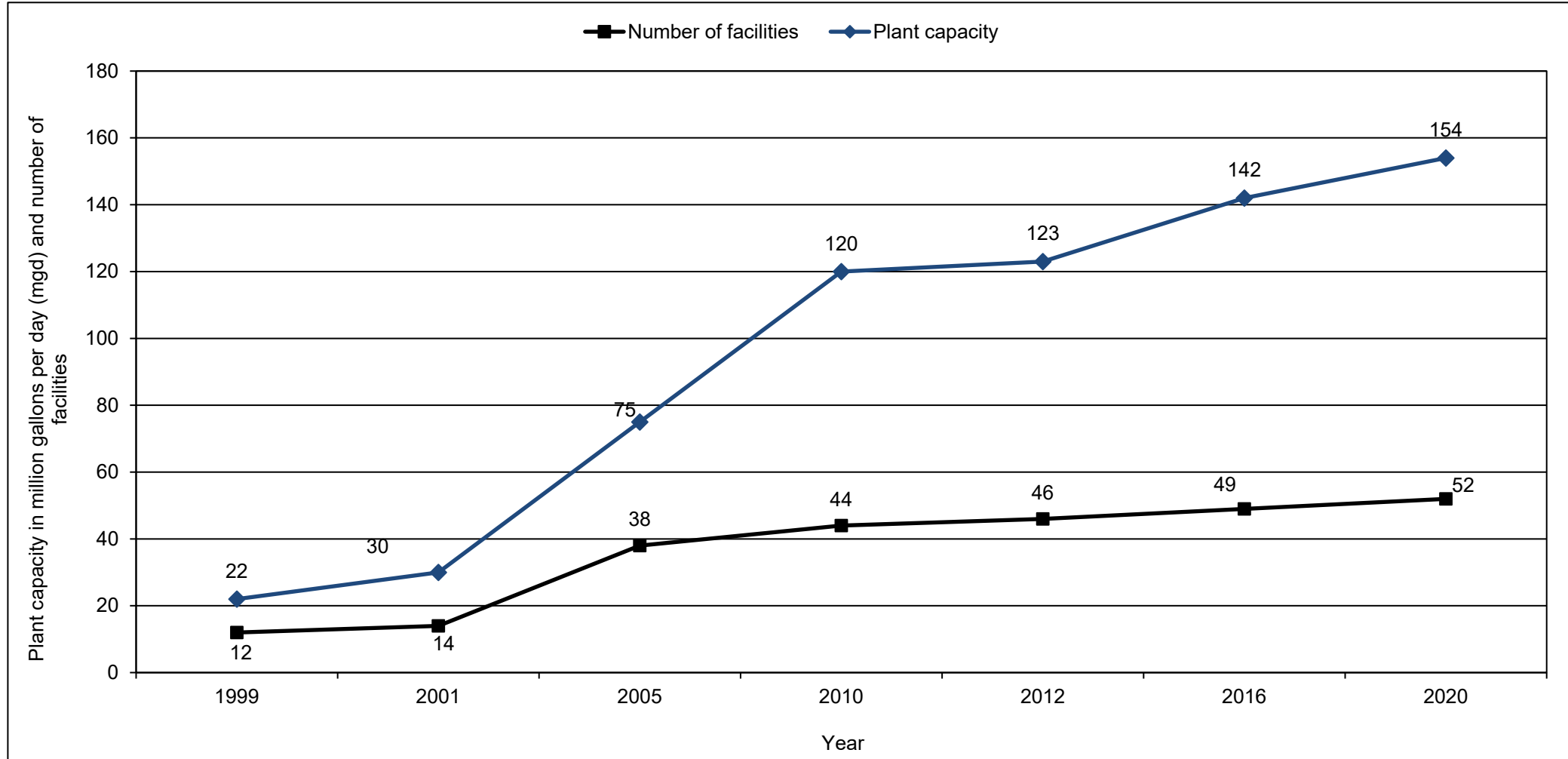
[Reset Filters](#)

	<u>Plant Name</u>	<u>County</u>
	<i>Plant Name</i>	<i>County</i>
View Report	Big Bend Motor Inn	Brewster
View Report	Bob Elder Water Treatment Plant	Parker
View Report	Brazos Regional Public Utility Agency/Surface Water Advanced Treatment System	Hood
View Report	City of Abilene (Hargesheimer Treatment Plant)	Taylor
View Report	City of Bardwell	Ellis
View Report	City of Bayside	Refugio
View Report	City of Beckville	Panola
View Report	City of Benjamin	Knox
View Report	City of Brady	McCulloch
View Report	City of Clarksville City	Gregg
View Report	City of Evant	Coryell
View Report	City of Fort Stockton Osmosis/Desalination Facility	Pecos
View Report	City of Granbury (Idle)	Hood
View Report	City of Hubbard	Hill
View Report	City of Kenedy	Karnes
View Report	City of Los Ybanez (Idle)	Dawson
View Report	City of Robinson Reverse Osmosis Surfacewater Treatment Plant	McLennan
View Report	City of Rule	Haskell
View Report	City of Seadrift	Calhoun
View Report	City of Seymour	Baylor
View Report	City of Sherman	Grayson
View Report	City of Tatum	Rusk

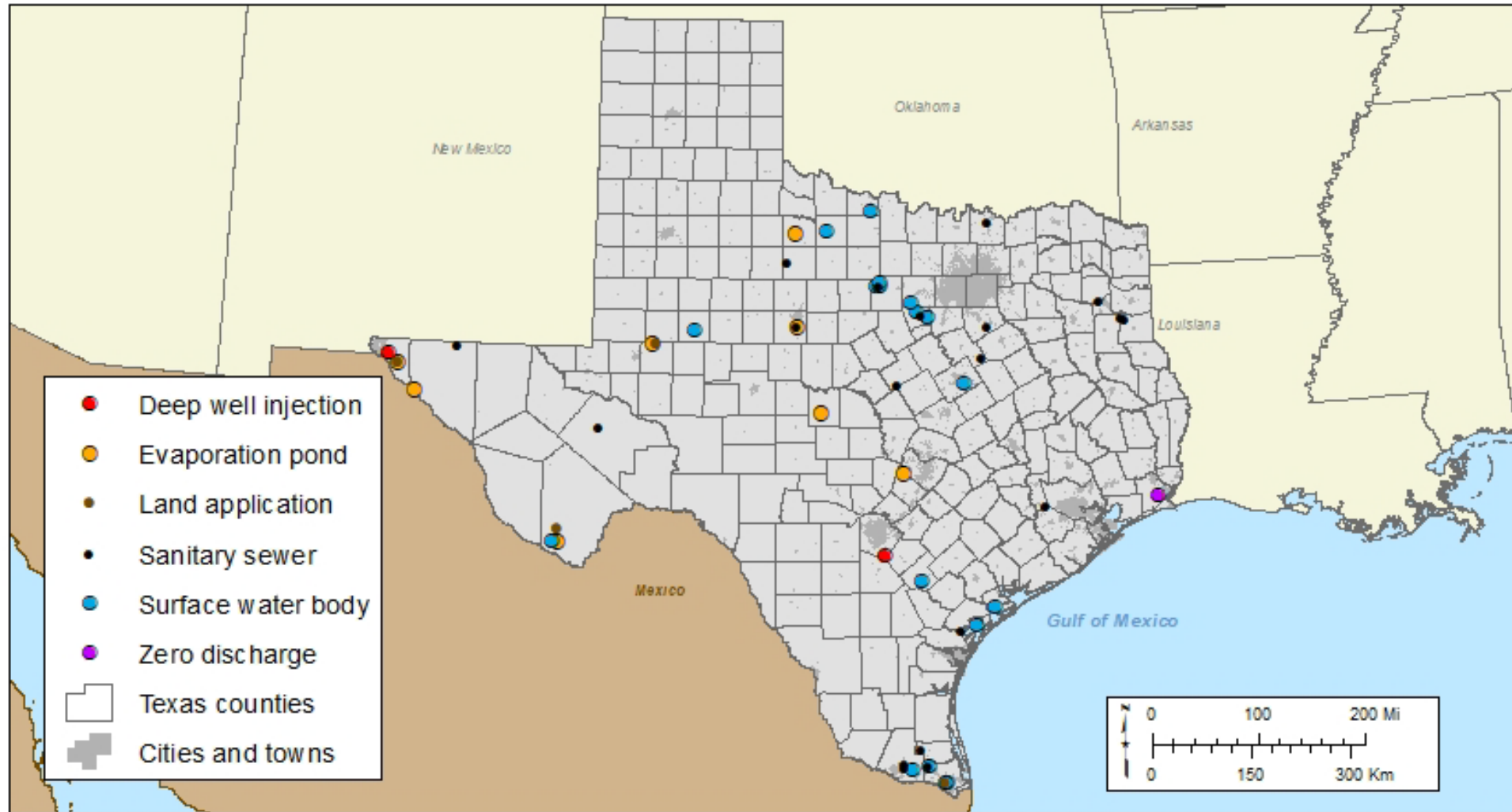
<https://www.twdb.texas.gov/>



Desalination growth in Texas



Concentrate disposal methods

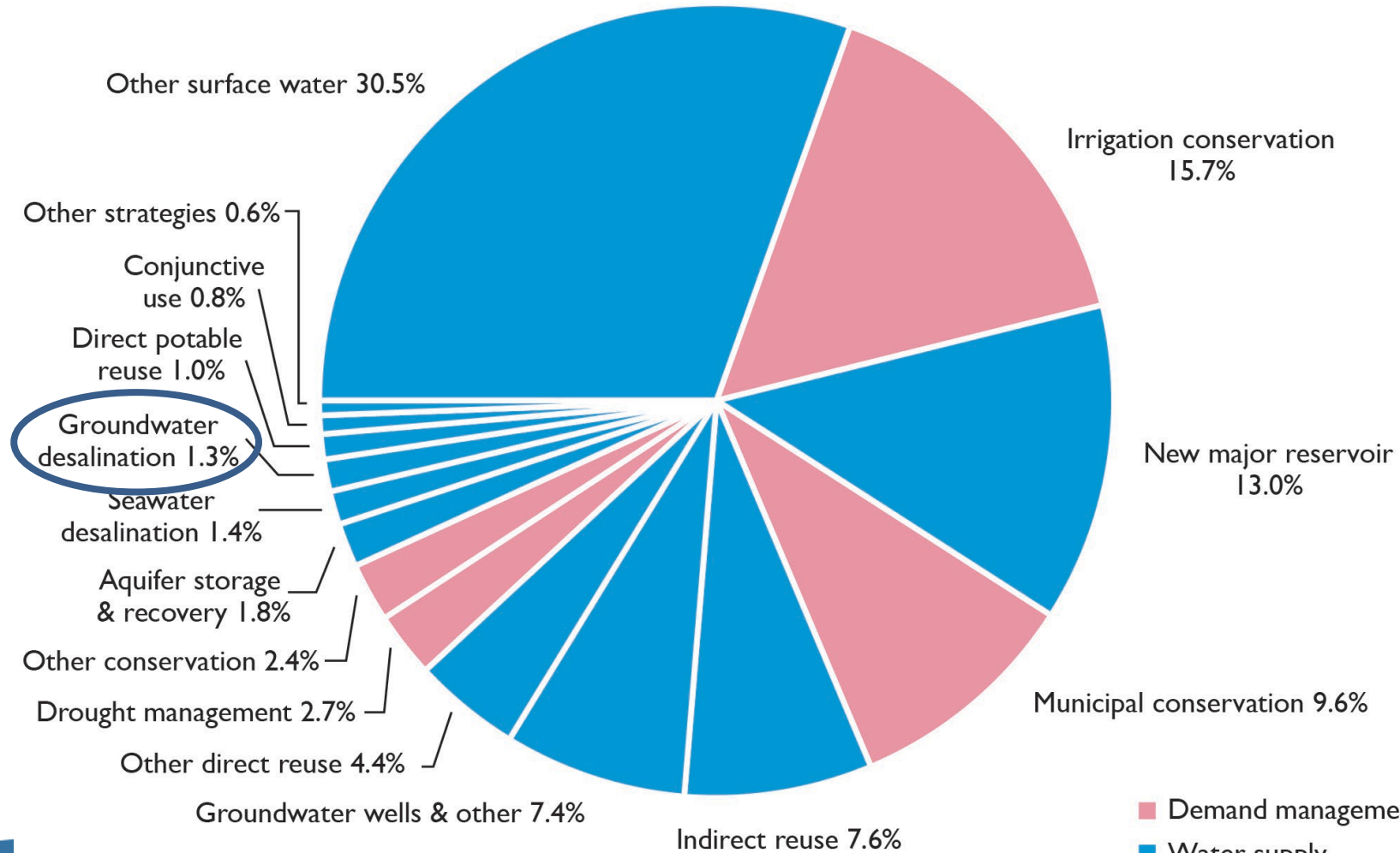


Challenges to concentrate disposal

- High costs
- Access to land and surface water body
- Salinity and volume limitations
- Permitting process
- Environmental issues

Recommended Water Management Strategies by 2070 in 2017 State Water Plan

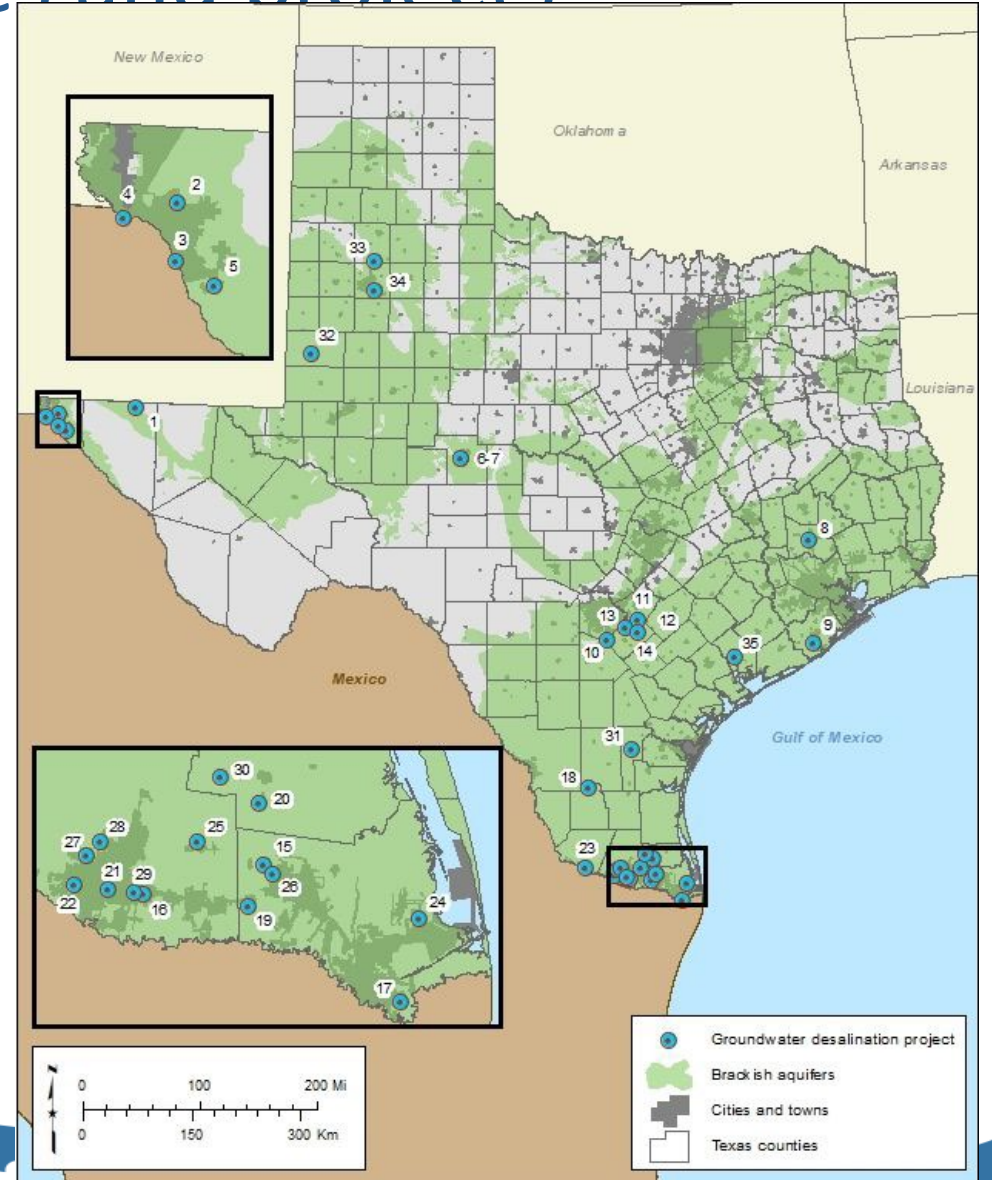
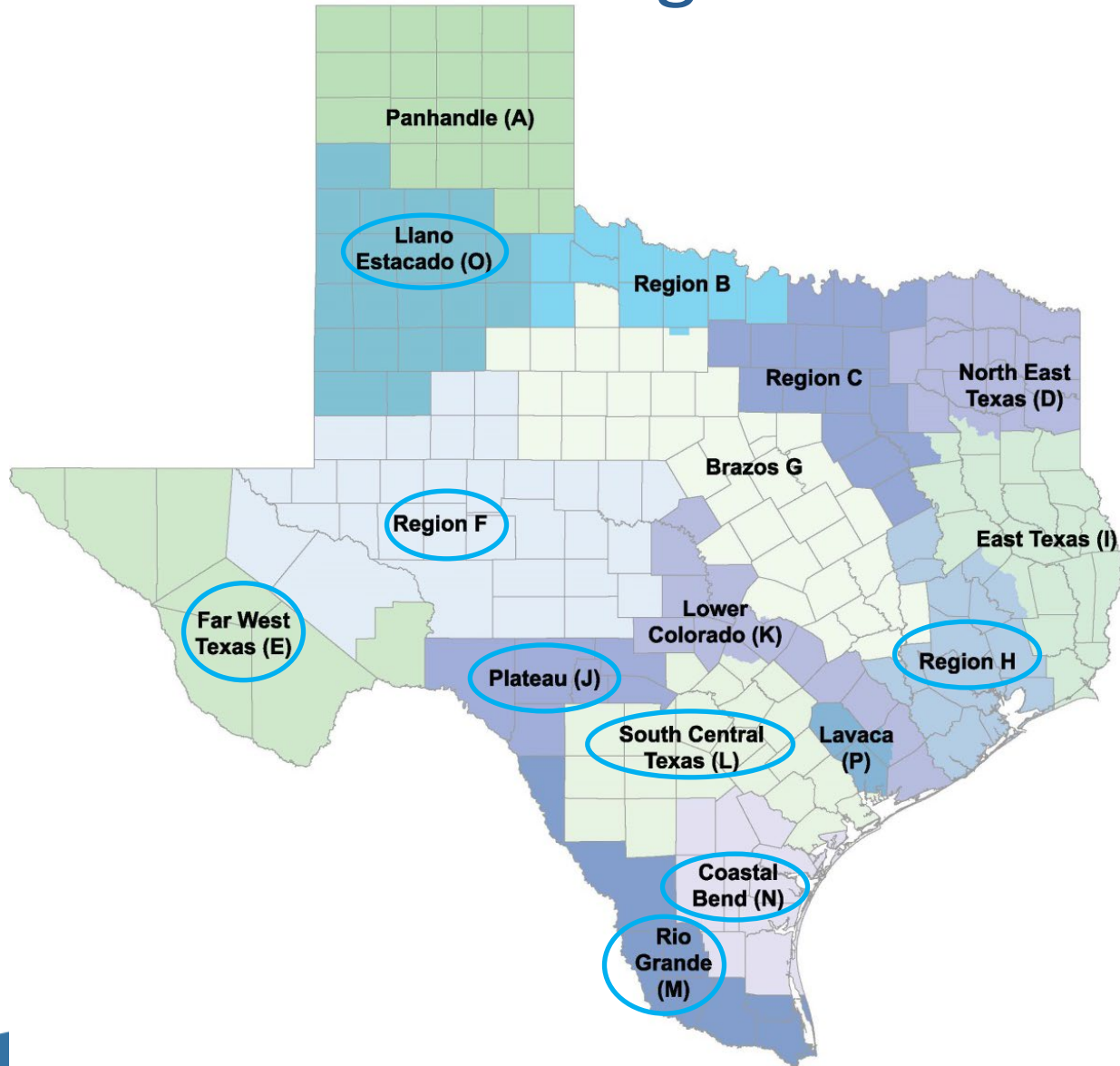
~111,000
acre-feet/year



■ Demand management
■ Water supply



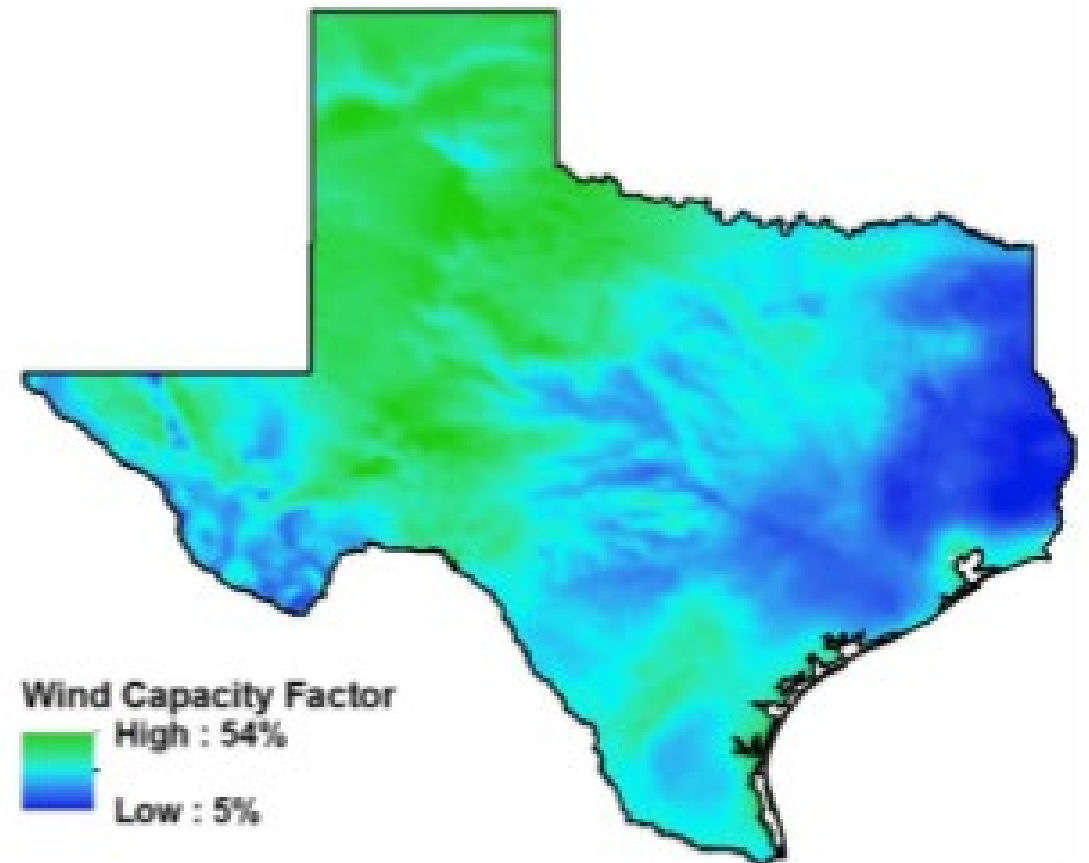
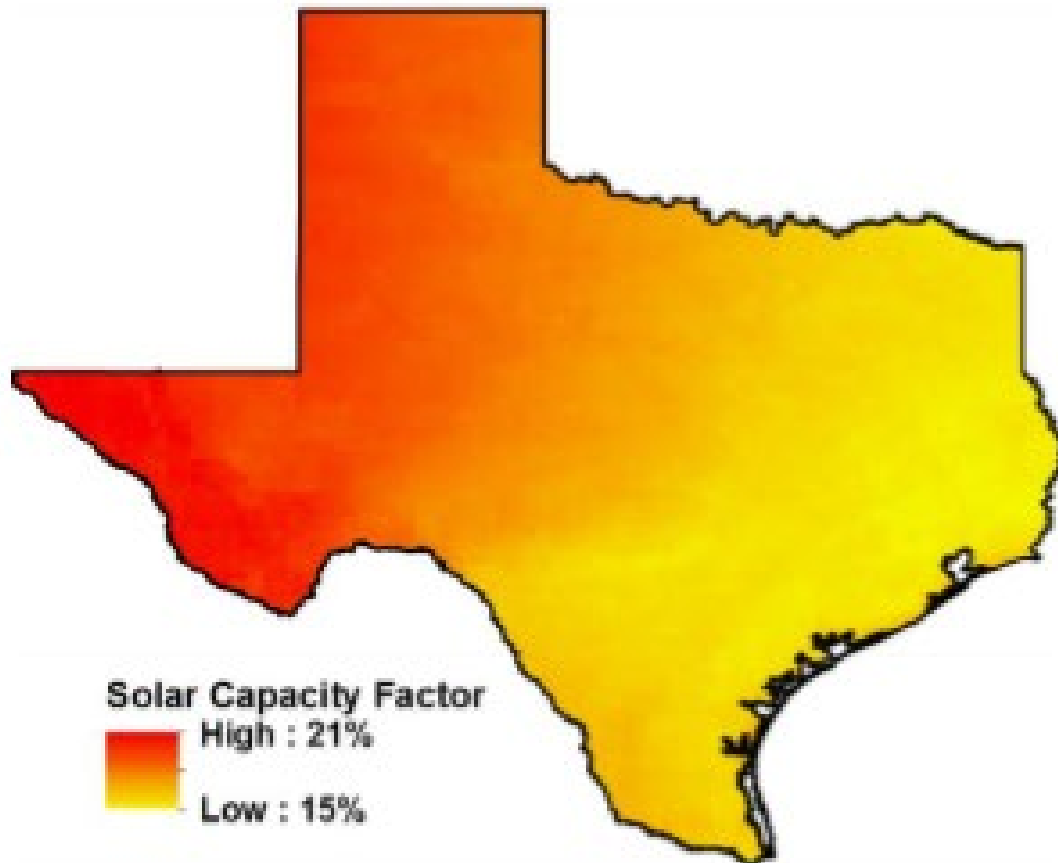
Groundwater desalination recommended water management strategies and projects



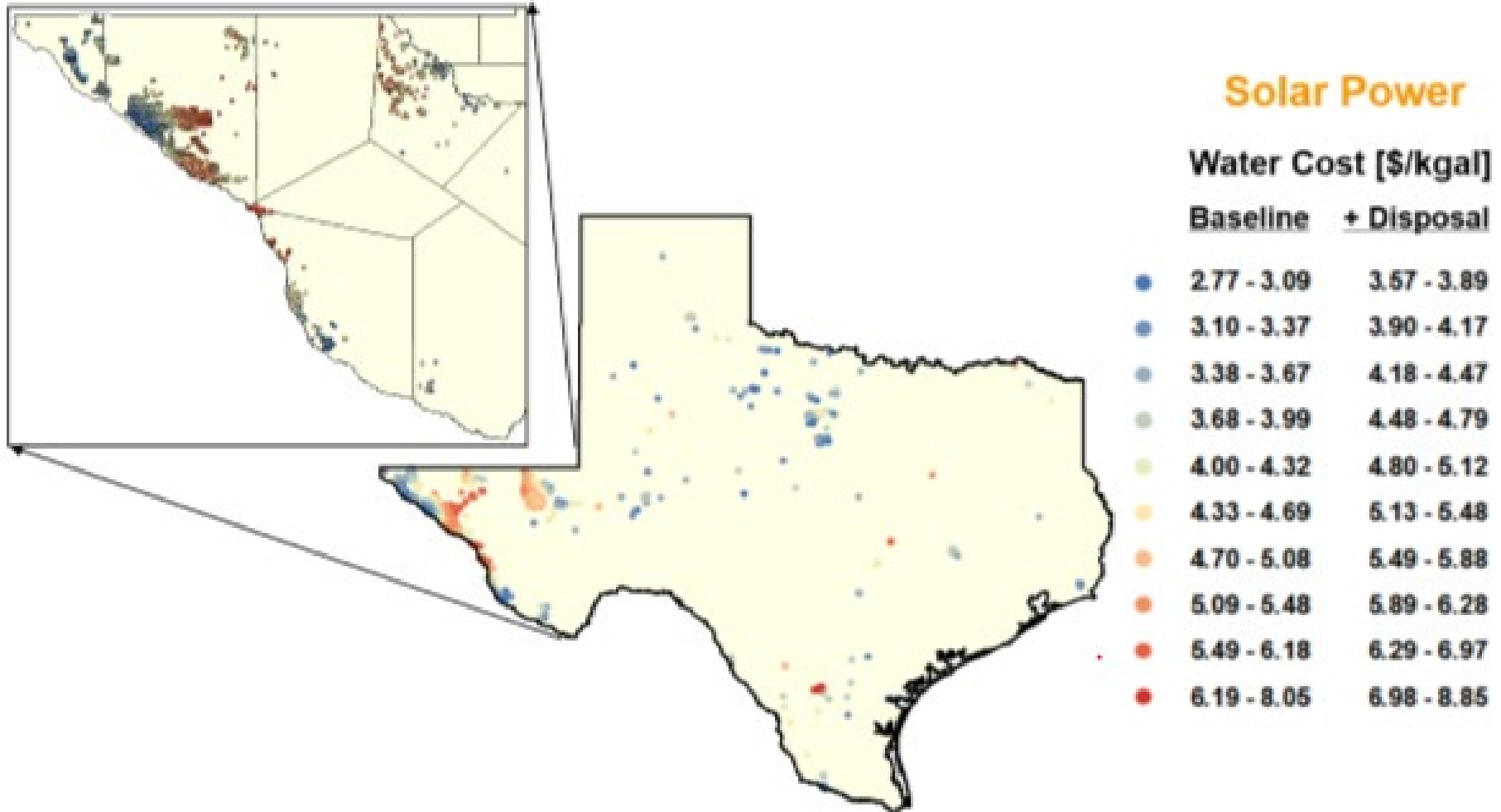
Technical and Economic Potential of Desalting Brackish Groundwater on Texas State Lands Using Solar/Wind

- Senate Bill 991 passed by 85th Texas Legislature (2015)
- General Land Office conduct a study regarding the use of wind or solar power to desalinate brackish groundwater
- GLO contracted Webber Energy Group at The University of Texas at Austin
- TWDB provided data and technical assistance

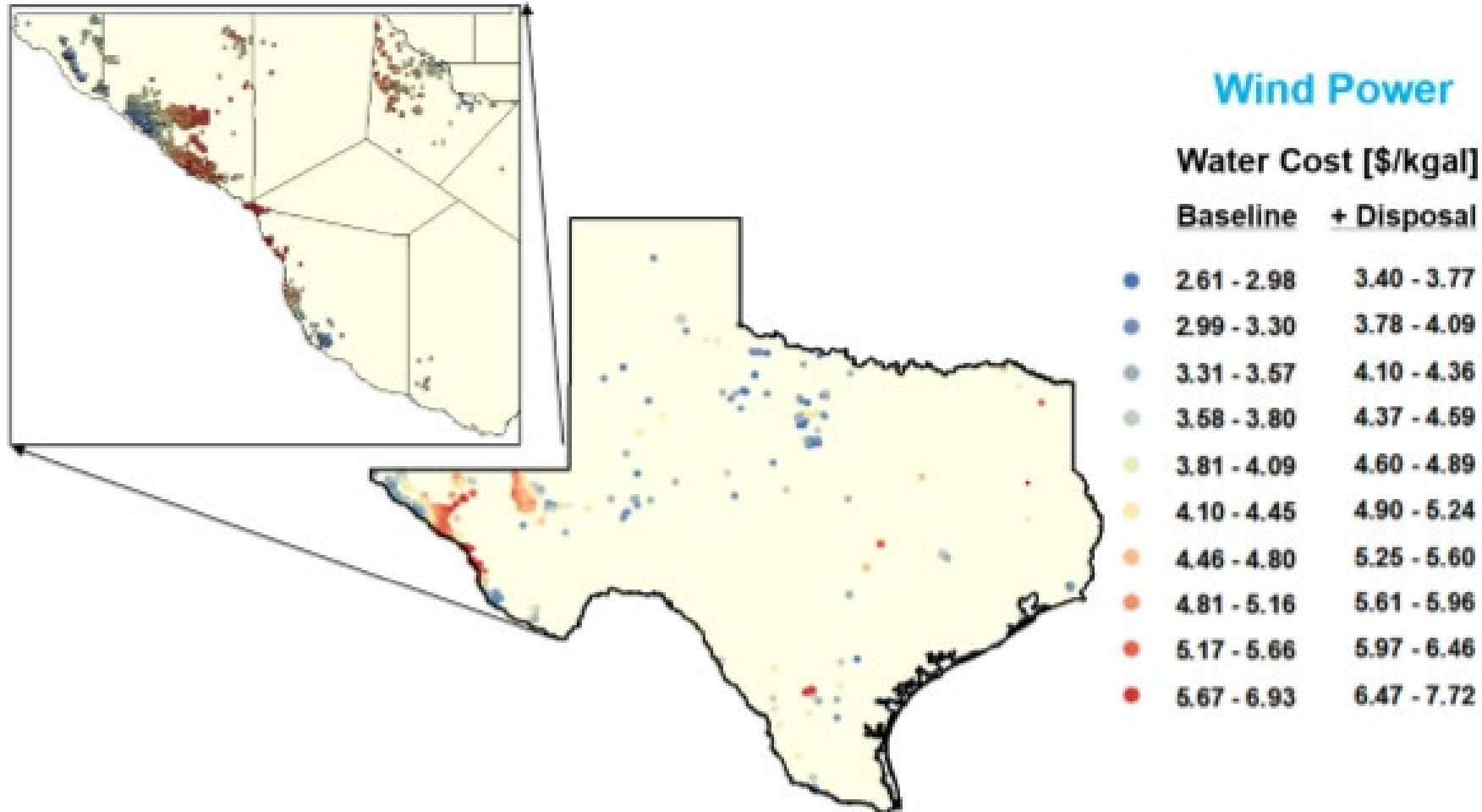
Solar and wind capacity factors across Texas



Groundwater desalination using solar



Groundwater desalination using wind



Technical and Economic Potential of Desalting Brackish Groundwater on Texas State Lands Using Solar/Wind

	Renewable Energy Type	Minimum Desalination Cost [\$/kgal]	Maximum Desalination Cost [\$/kgal]	Average Desalination Cost [\$/kgal]	Number of Sites
All GLO Sites	Solar	3.57	8.85	5.05	1445
	Wind	3.40	7.72	5.01	1445
Down-Selected Sites for Local Economic Viability	Solar	3.66	5.35	3.89	48
	Wind	3.40	5.45	4.24	145

Renewable Energy Type	1 MGD Desalination Cost [\$/kgal]	3 MGD Desalination Cost [\$/kgal]
Solar	3.87	3.14
Wind	4.17	3.21

Integrated Wind-Water Desalination Demonstration Plant for Inland Municipality

- Texas Tech University, National Wind Institute, and Water Resources Center
- Projected located in Seminole, Texas
 - 1800-ft deep well in the Dockum Aquifer,
 - reverse osmosis (RO) system,
 - 50-kW wind turbine, and
 - other related infrastructure to collect and report useful data from the demonstration project.
- Operation began in April 2013 and ended in August 2014

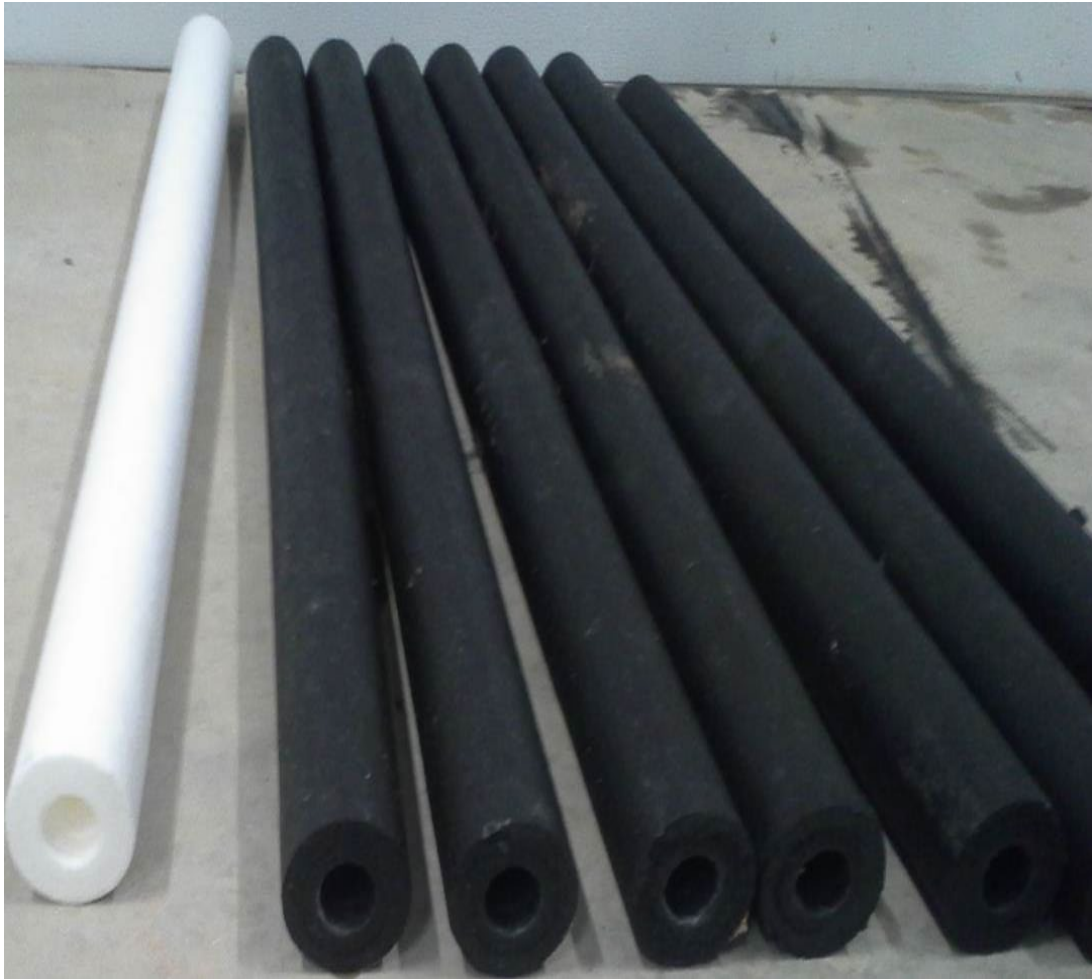
Integrated Wind-Water Desalination Demonstration Plant for Inland Municipality

RO system was 250 day-equivalents and feed water was 8,000 mg/L TDS

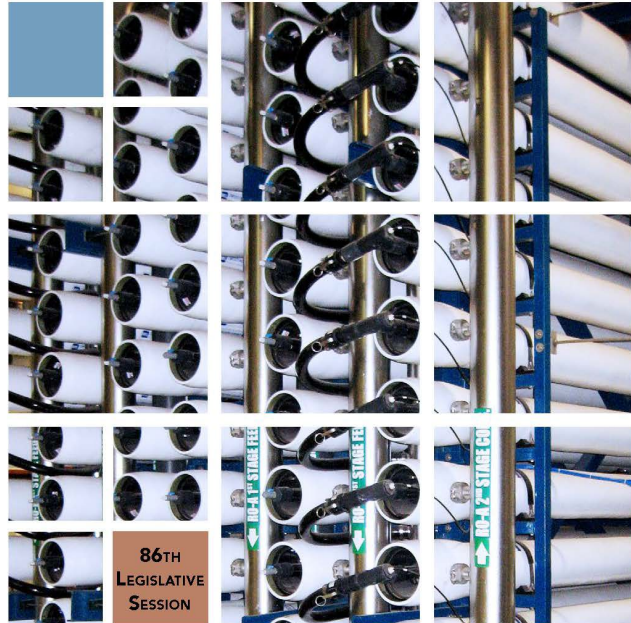
Lessons learned:

- Preferable to have more than one wind turbine
- Coordination efforts were more than expected
- Unplanned fouling of the membrane elements
- Well motor failure, nearby lightning strike impacting the electrical systems, and loss of access to the RO manufacturer





2020 Biennial Report on Desalination



The Future of
Desalination in Texas

2018 BIENNIAL REPORT ON
SEAWATER AND BRACKISH
GROUNDWATER DESALINATION

Texas Water
Development Board

- Ninth report in series
- 18 years of activities toward advancing seawater desalination
- Third report to include brackish groundwater desalination and designating brackish groundwater production zones in aquifers

Questions

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Innovative Water Technologies – Desalination Program
www.twdb.texas.gov/innovativewater/desal/index.asp

