

# Brackish Resources Aquifer Characterization System

May 4, 2011



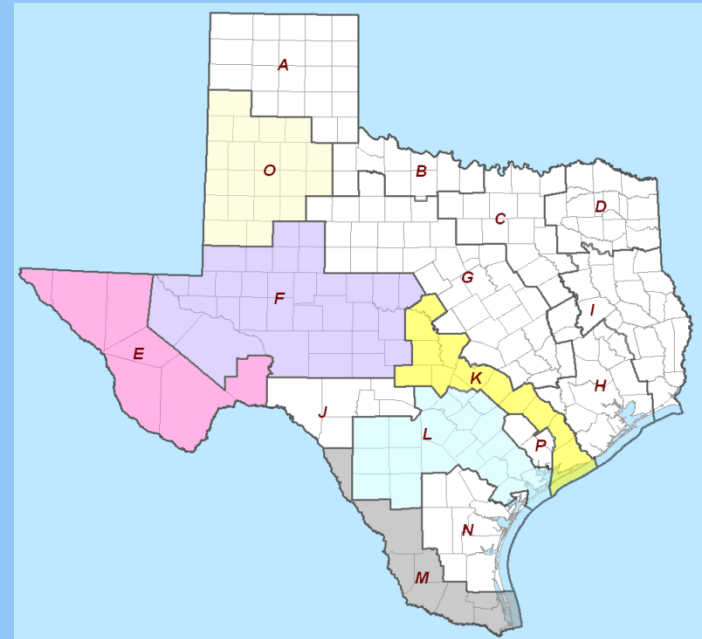
John E. Meyer P.G.  
Matthew R. Wise P.G.  
Sanjeev Kalaswad, Ph.D., P.G.

Texas Water Development Board  
Water Science and Conservation  
Innovative Water Technologies

# State and regional water planning

## *Water for Texas 2007*

- Consider and evaluate all potentially feasible water management strategies
- Brackish groundwater desalination
  - Develop 175,000 acre-feet/year by 2060
  - 6 regions recommended strategy



Texas Water Development Board

## BRACS Goals

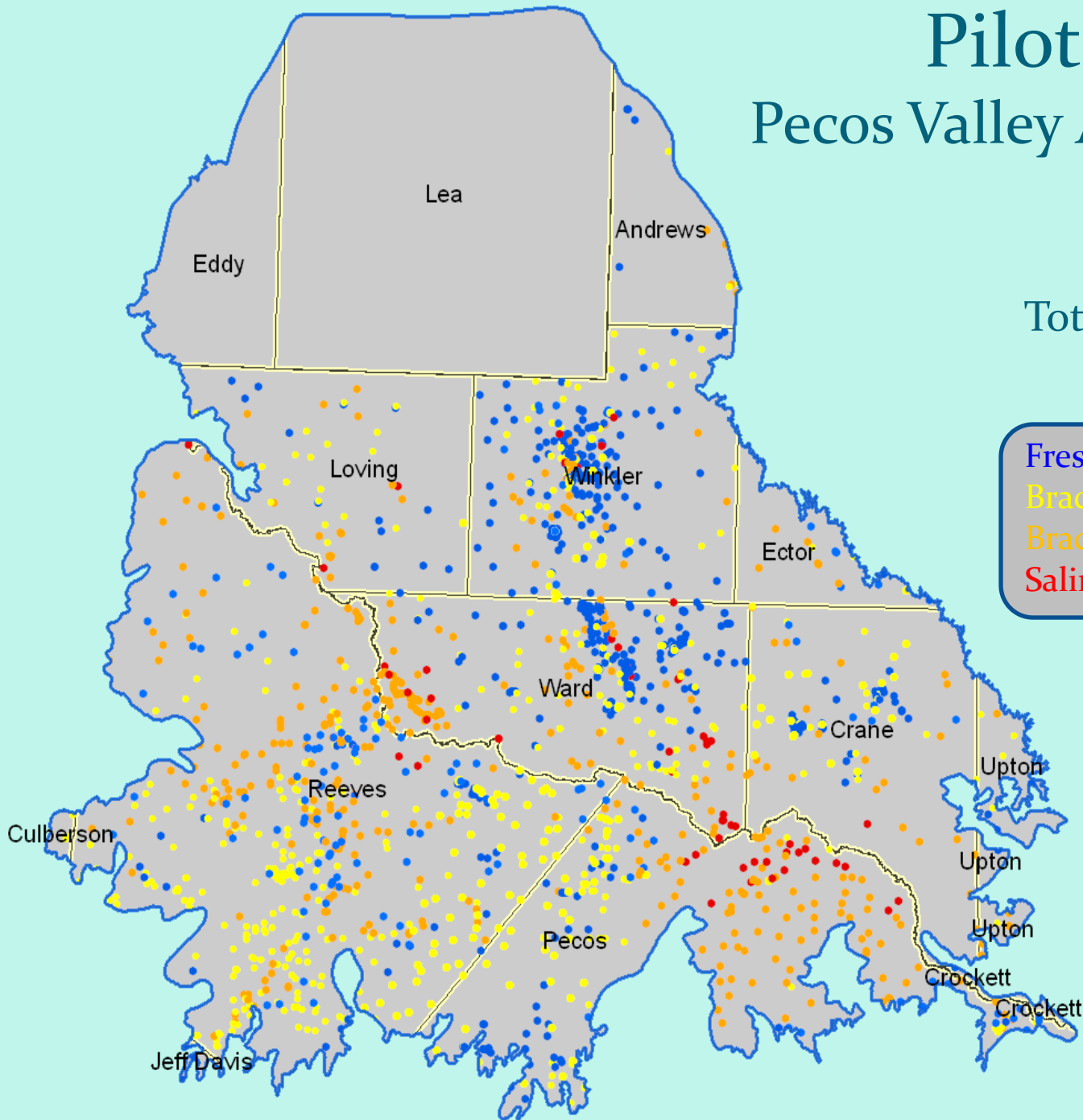
- Map aquifers to 10,000 mg/L total dissolved solids
- Map key desalination parameters (for example: silica, iron, ...)
- Estimate aquifer properties
- Estimate volumes of brackish groundwater
- Build replicable numerical groundwater flow models
- Collect well logs (water, oil/gas) for interpretation
- Build datasets (database, GIS) of project information
- Implement techniques to assess brackish groundwater
- Disseminate information

# Pilot Study

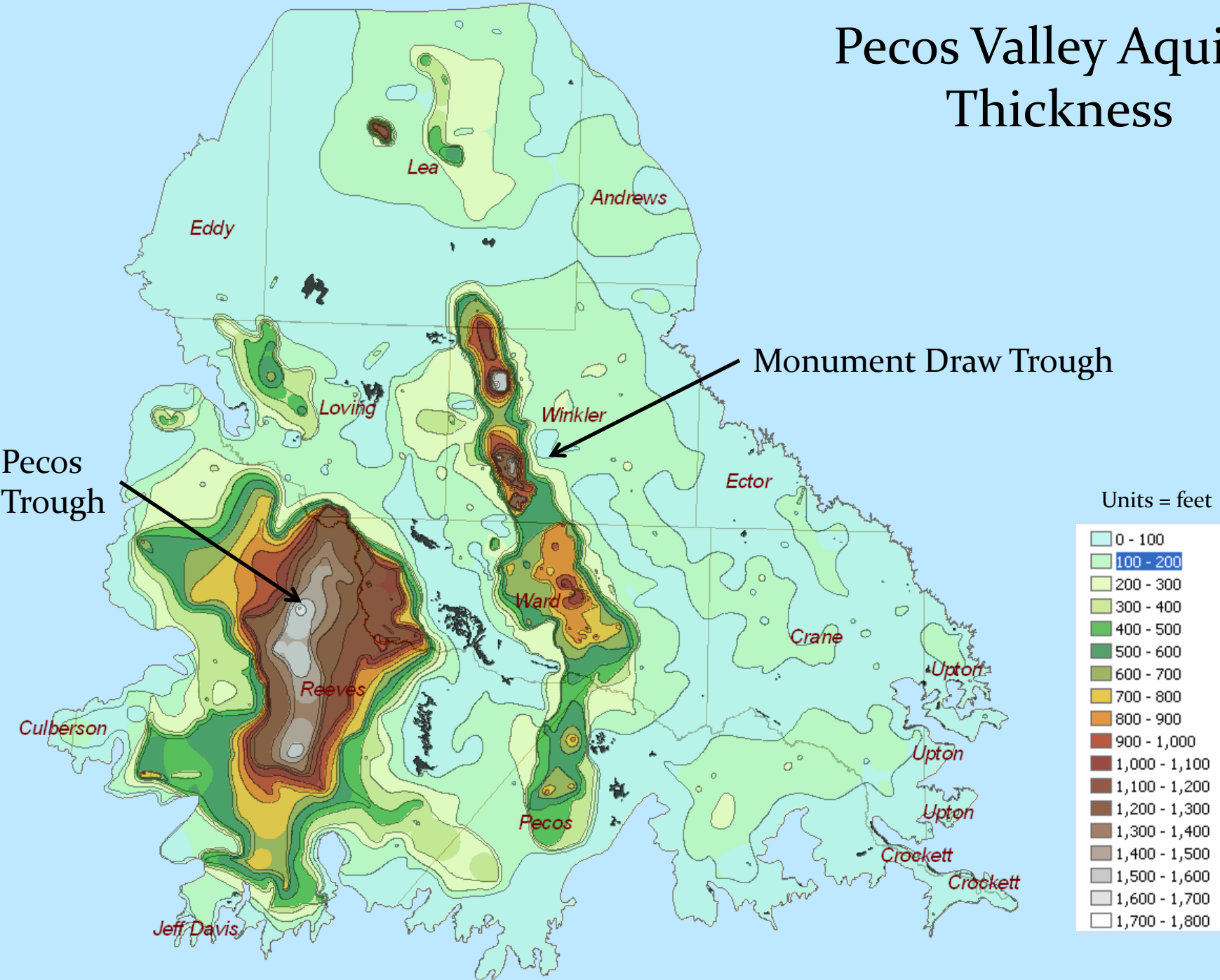
## Pecos Valley Aquifer Region

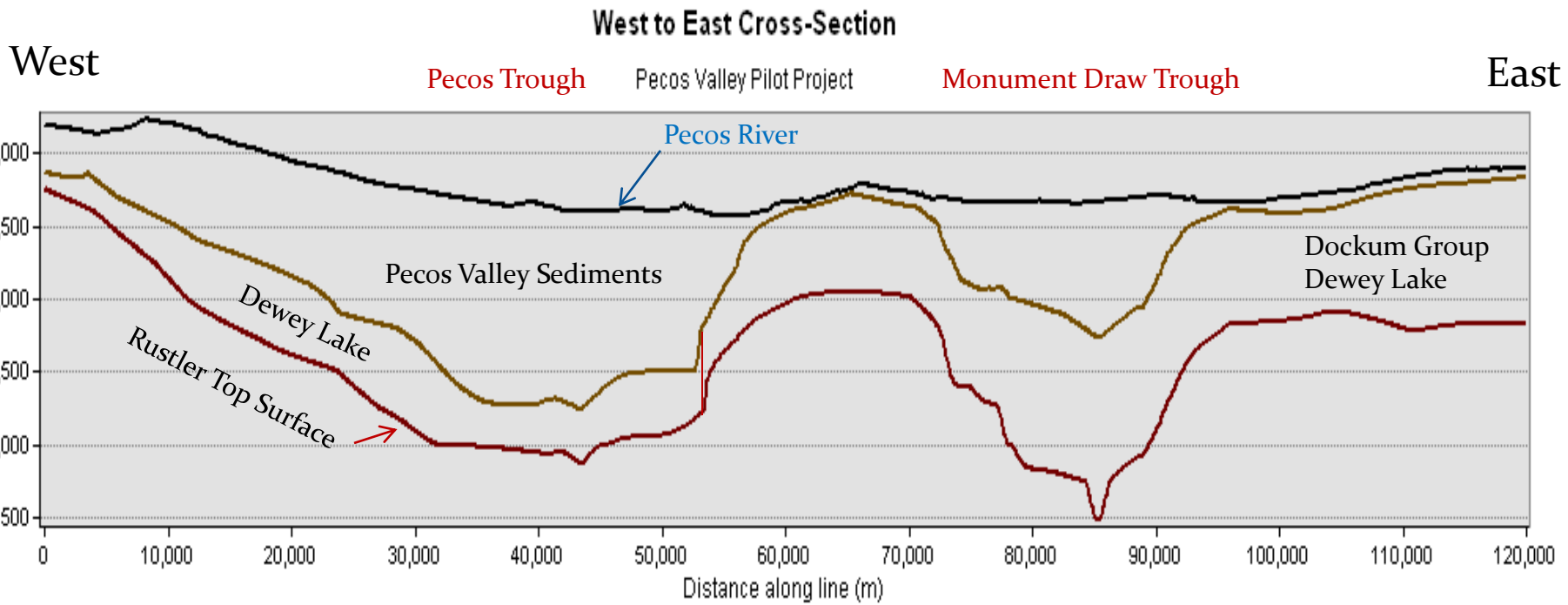
Wells with  
Total Dissolved Solids  
(mg/L)

Fresh	0 - 1,000
Brackish	1,000 - 3,000
Brackish	3,000 - 10,000
Saline	> 10,000



# Pecos Valley Aquifer Thickness

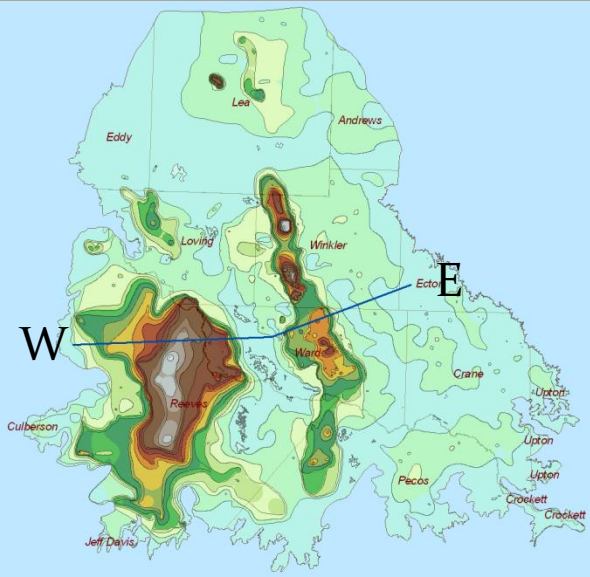




BRACS: Pecos Valley Pilot Project

April 4, 2011

(Vertical Exaggeration x 25)



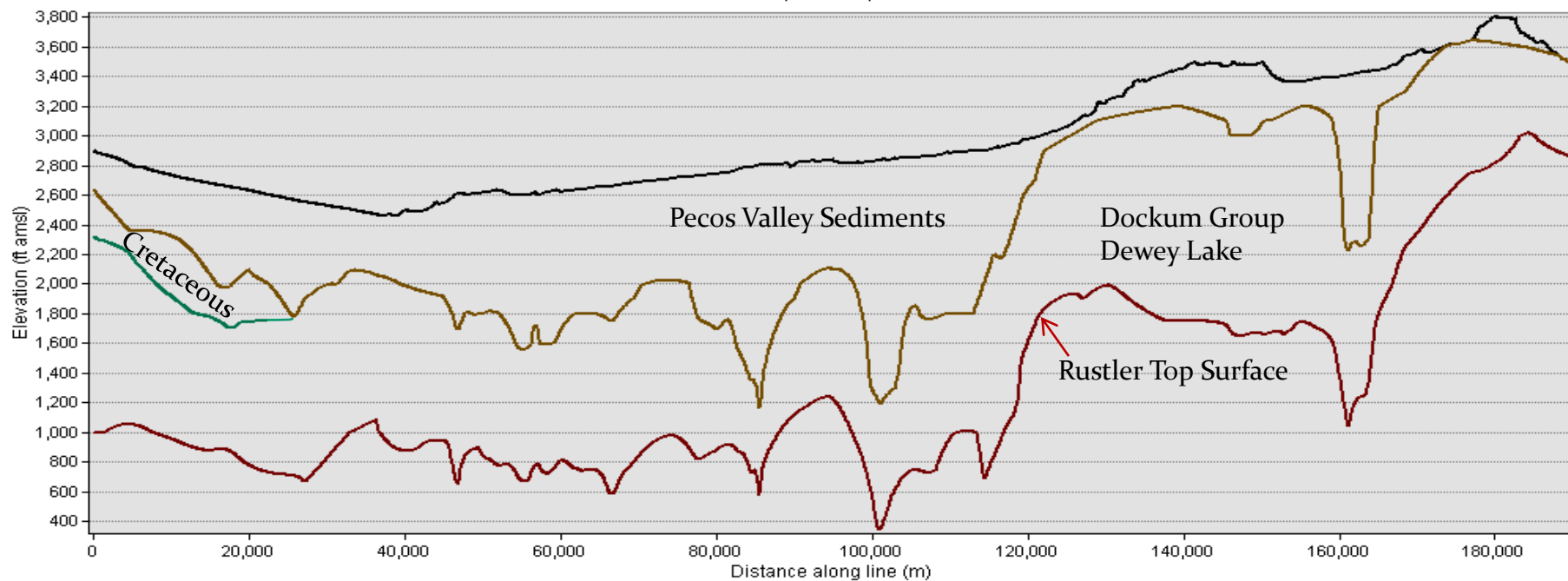
Cross-section across both troughs

South

### South to North Cross-Section

North

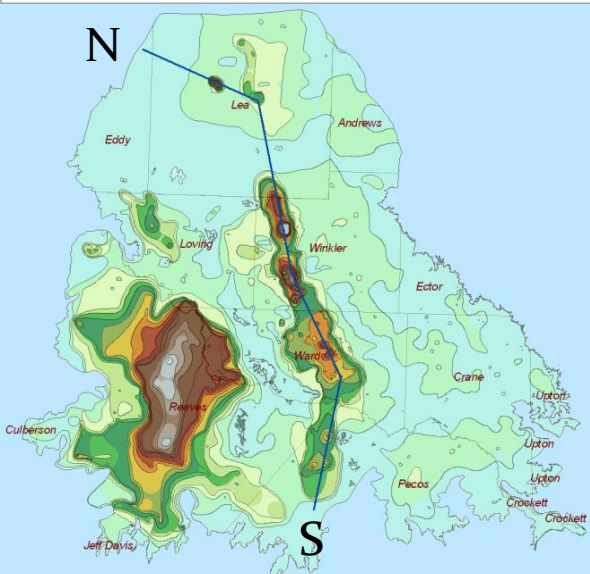
Pecos Valley Pilot Project



BRACS: Pecos Valley Pilot Project

April 4, 2011

(Vertical Exaggeration x 50)

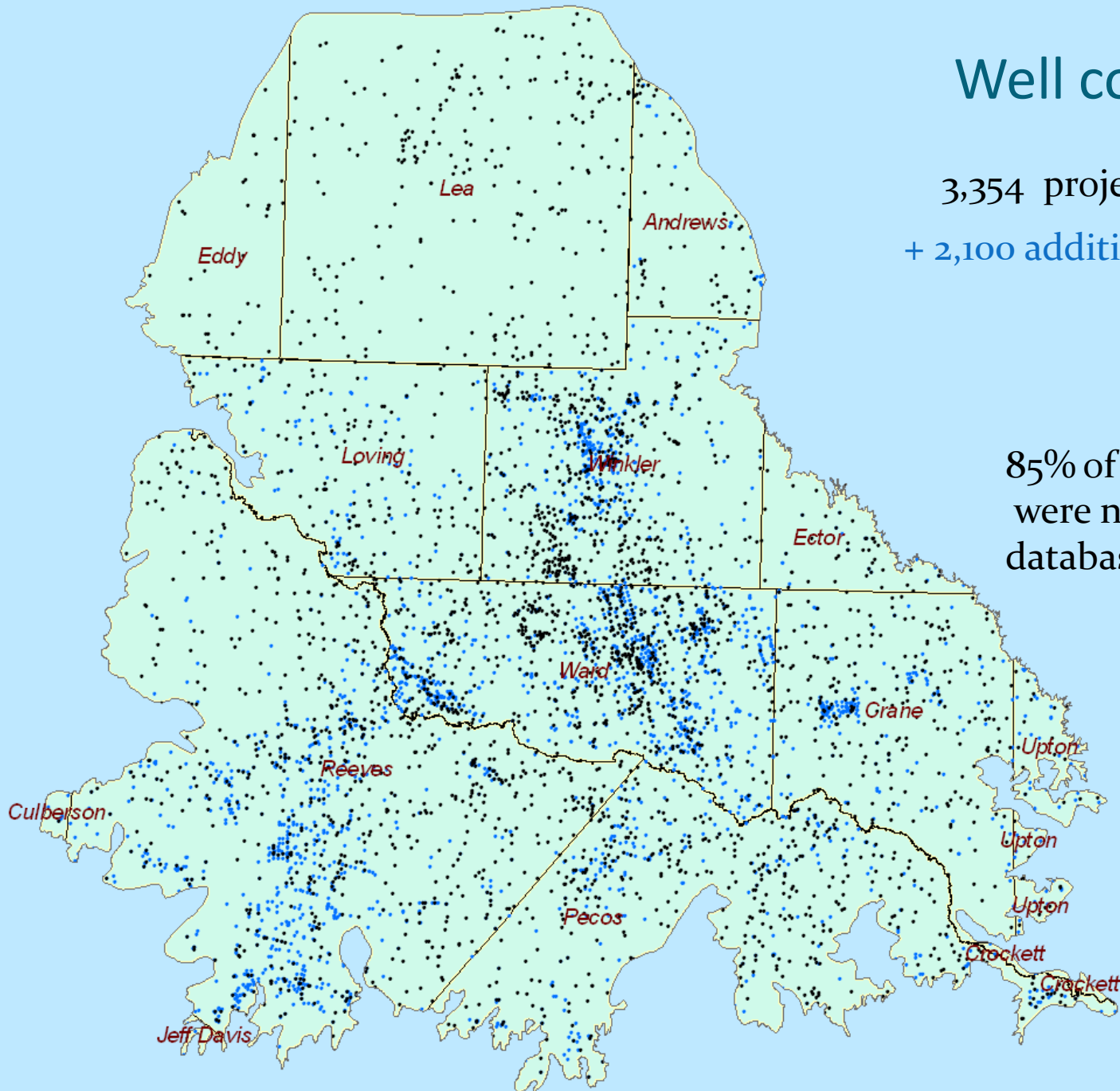


# Cross-section along length of Monument Draw Trough

# Well control

3,354 project wells  
+ 2,100 additional TWDB wells

85% of the project wells  
were not in the TWDB  
database.





# Geophysical Well Logs and Water Well Reports Provide:

frmWell\_Lithology\_DE

2509    API Number 4249532576    State Well Number 0    Owner ENERGEN RESOURCES CORPORATION    Drill Date 10/20/1996  
 Track Number 0    Water Source    Well Number UNIVERSITY 47-21 3    Depth Total 7300  
 Q Number    Source of Well Data ULUTS Digital Geophysical Logs

### Lithologic Description

Record Number	Geologic Pick	Top Depth Bottom Depth Thickness	Lithologic Description Source of Data Initials Last Change	
5	Lithologic	0 80	No Record	
		80	GEOPHYSICAL WELL LOG	JEM 3/7/2011
6	Lithologic	80 170	Sand	
		90	GEOPHYSICAL WELL LOG	JEM 3/7/2011
7	Lithologic	170 297	Clay	
		127	GEOPHYSICAL WELL LOG	JEM 3/7/2011
8	Lithologic	297 532	Sand	
		235	GEOPHYSICAL WELL LOG	JEM 3/7/2011
9	Lithologic	532 752	Sand and Clay	
		220	GEOPHYSICAL WELL LOG	JEM 3/7/2011
10	Lithologic	752 810	SAND	
		58	GEOPHYSICAL WELL LOG	JEM 3/7/2011
11	Lithologic	810		

### Stratigraphic Description

Record Number	Geologic Pick	Top Depth Bottom Depth Thickness	Stratigraphic Description Source of Data Initials Last Change	
1	Stratigraphic	0 1330	Pecos Valley Alluvium	
		1330	GEOPHYSICAL WELL LOG	JEM 3/7/2011
2	Stratigraphic	1330	Dockum Group	
			GEOPHYSICAL WELL LOG	JEM 3/7/2011
3	Stratigraphic		Dewey Lake Redbeds	
		1792	GEOPHYSICAL WELL LOG	JEM 10/22/2010
4	Stratigraphic		Rustler Formation	
			GEOPHYSICAL WELL LOG	JEM 8/30/2010
*				

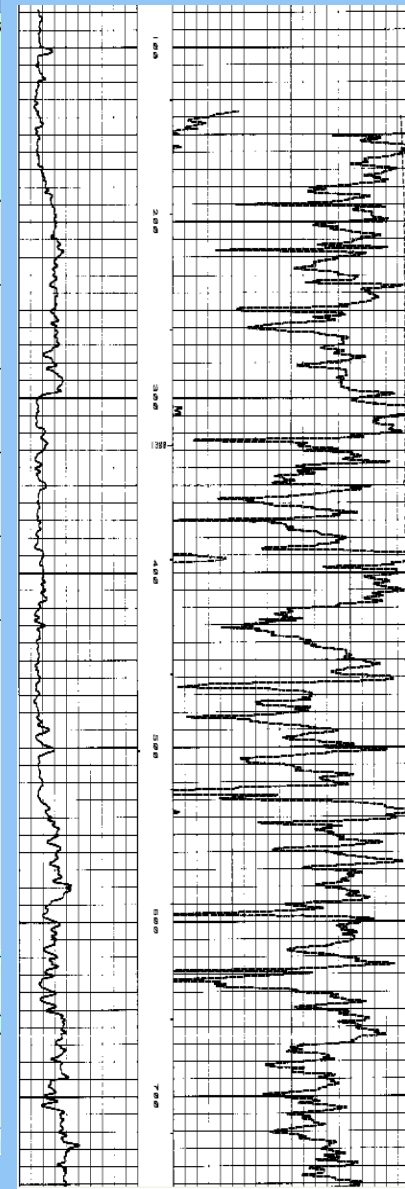
Add First Record
Add Next Record
Complete Last Record
Add BLANK Record

Geophysical Well Log Hyperlinks

NMOSE POD HYP

JEM <G:\BRACS\GeophysicalLogs\4249532576.tif>  
 MRW <F:\BRACS\GeophysicalLogs\4249532576.tif>

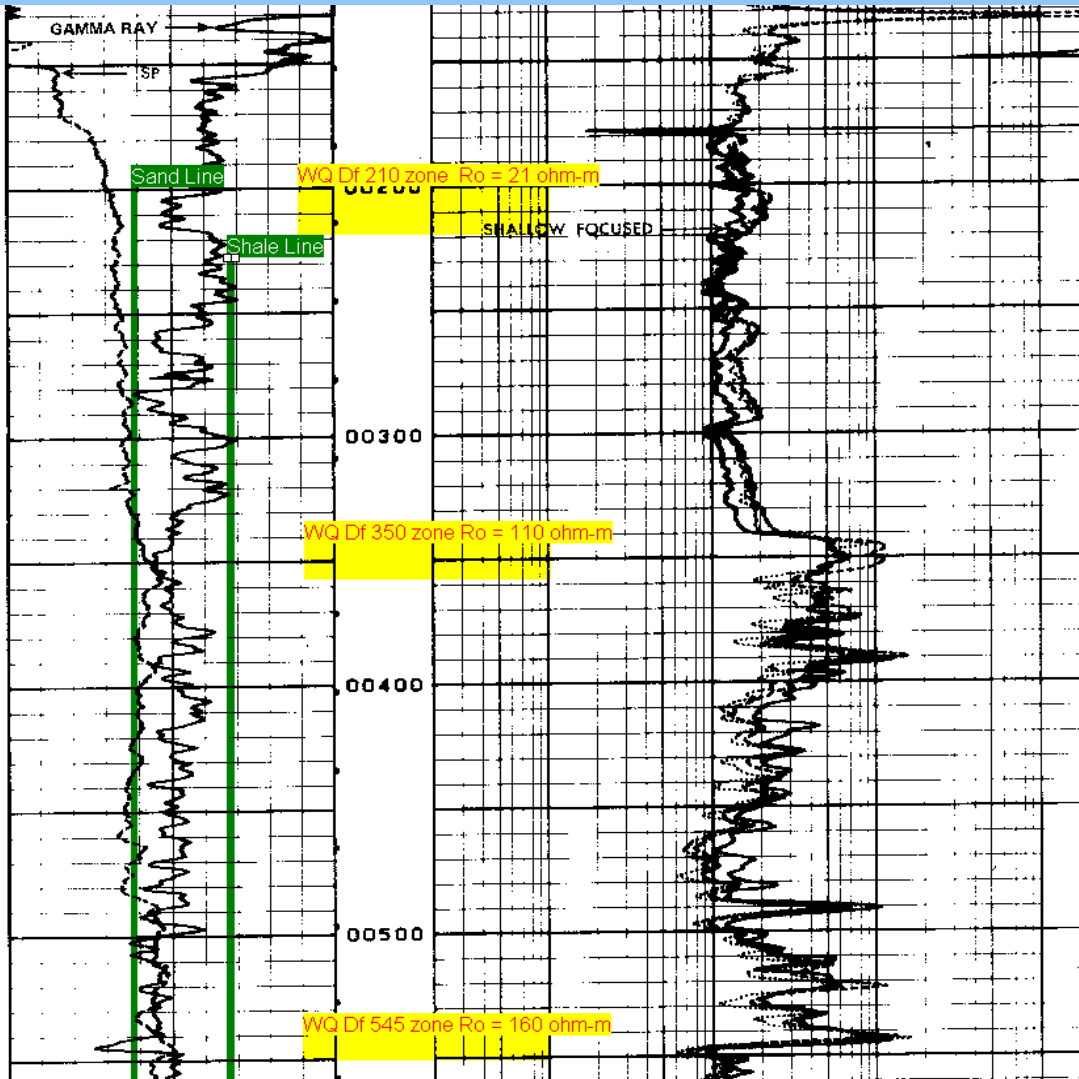
Record: 1 of 1    No Filter    Search



# Desalination parameters of interest

Physical Parameters	Chemical Parameters		
	Cations (mg/L)	Anions (mg/L)	Other Chemical Parameters
Conductivity (mS/cm)	As <sup>3+</sup>	Cl <sup>-</sup>	Alkalinity (mg/L as CaCO <sub>3</sub> )
pH	As <sup>5+</sup>	F <sup>-</sup>	Boron (mg/L)
Silt density index	Ba <sup>2+</sup>	HCO <sub>3</sub> <sup>-</sup>	Dissolved oxygen concentration (mg/L)
Temperature (°C)	Ca <sup>2+</sup>	NO <sub>2</sub> <sup>-</sup> -N	H <sub>2</sub> S (mg/L)
Turbidity (NTU)	Cu <sup>2+</sup>	NO <sub>3</sub> <sup>-</sup> -N	Hardness (mg/L as CaCO <sub>3</sub> )
	Fe <sub>3</sub> <sup>+</sup>	SO <sub>4</sub> <sup>2-</sup>	Pesticides(mg/L)
	K <sup>+</sup>		Radionuclides (pCi/L) Uranium (µg/L)
	Mg <sup>2+</sup>		Silica (mg/L)
	Mn <sup>2+</sup>		TDS (mg/L)
	Na <sup>+</sup>		
	NH <sub>4</sub> <sup>+</sup> -N		
	Ni <sup>2+</sup>		
	Zn <sup>2+</sup>		

# Determining resistivity values for calculating TDS



Can use:

Spontaneous Potential (SP)

Resistivity Tools:

Induction

Laterolog

Resistivity

Electric

Lateral

# Calculation of TDS from geophysical well logs

Load method-specific log values and correction factors; automate the analysis

TWDB Water Science and Conservation Innovative Water Technologies Brackish Resources Aquifer Characterization System

Well Id: 1376  
GL Number: 844  
Depth Formation (Df): 530  
Thickness Lithologic Unit: 30

BRACS Geophysical Log Analysis for TDS Calculations

White Field: fill in  
Blue Field: Auto Loaded  
Gray Field: Calculated by CPU

Buttons: SP Method, Mean Ro, Alger - Harrison, Rwa Method, Estepp

Initials: JEM

TDS Interpreted: 3428  
Consensus TDS Method: SP Method

Ts: 63 Dt: 1015  
Tf: 69.2660 Rmf: 1.7  
Tbh: 75 Rmf Tf: 1.546213

Remarks: High sulfate water in the Pecos Valley Aquifer, Reeves County, Tx

TDS Method: SP Method  
Rwe: 2.010062 Rw: 2.211068 Rw75: 2.042024 Cw: 4897.101 TDS: 3428  
Initials: JEM

Geophysical Log Used: SPONTANEOUS POTENTIAL

**Correction Factors**

SP: 8  
Rxo: 0  
Ro: 0  
Rxo / Ro:   
m: 0  
Source m: N/A  
Porosity: .0  
Source Porosity: N/A

70.21238 K (Temperature): SP Method  
1.1 Rwe Rw: Sp, Alger Harrison, and Rwa Minimum Methods  
1 Rmf: SP and Alger Harrison Methods  
0.7 ct: Many Methods  
99 Invasion Zone: Alger Harrison Method  
1 m correction factor: Estepp Method high anion waters  
1 Ro: Mean Ro Method

Mean Ro Nomograph

Chart: N/A  
Remarks: N/A

Record: 1 of 1

# Brackish groundwater database well locations in WIID

TWDB Brackish Groundwater Database - Windows Internet Explorer

http://wiid.twdb.state.tx.us/ims/wwm\_drl/viewer.htm?DISCL=1&appno=2

TWDB Brackish Groundwater Database

TWDB WIID Water Well Data

Wells in TWDB Brackish Groundwater Database - Texas

Map Tools: Zoom, Move, Select

[Layers]

- Visible Active
- Brackish
- Groundwater Database
- Groundwater Districts (updated Aug. 2010)
- Major Aquifers
- Minor Aquifers
- Regional Water Planning Areas
- Groundwater Management Areas
- River Basins
- Counties
- Terrain Map

Search by State Well No.

Type a well number  Go

Search by Location

From: All  Go

Type a place name  Go

Disclaimer

TWDB Geographic Information Systems, ©2002

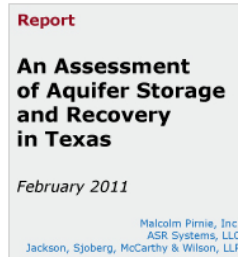
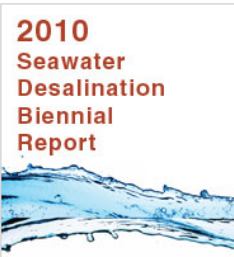
BRACKISH GROUNDWATER DATABASE

Rec	WELL_ID	API_NUM	SW_NUM	TRACK_NUM	WS_NUM	Q_NUM	SOURCE	WELL_NUM	COUNTY	DEPTH_HOLE	DRILL_DATE	OWNER	WELL_TYPE
1	51	4249531102	0	0			ULUTS Digital Geophysical Logs	University 21-36 2	WINKLER	8524	12/13/1979	Monsanto Oil Corporation	Oil or Gas
2	53	4249532486	0	0			ULUTS Digital Geophysical Logs		WINKLER	0			Oil or Gas
3	54	4249532712	0	0			ULUTS Digital Geophysical Logs		WINKLER	0			Oil or Gas
4	55	4249532554	0	0			ULUTS Digital Geophysical Logs	University 38-21 No. 1	WINKLER	7214	08/08/1996	Ensearch Exploration Inc.	Oil or Gas

WIID: Water Information Integration & Dissemination

# Summary

- The 2003 Brackish Groundwater Manual indicated the estimated total volume of brackish groundwater in: Texas : > 2.7 billion acre-feet.  
Pecos Valley Aquifer: > 116 million acre-feet.
- 32 Texas water treatment plants use reverse osmosis to treat brackish groundwater.
- Each aquifer is different and techniques of analysis will need to fit data available.
- August 31, 2011 is the deadline for:
  - the Pecos Valley Aquifer pilot study;
  - statewide digital geophysical well log collection;
  - digital geological bibliography of Texas;
  - report on the applicability of variable density modeling to brackish aquifers.
- Future plans: Evaluate all aquifers in Texas with potential for brackish resource



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- ★ [BRACS](#)
- ★ [Desalination](#)
- ★ [Rainwater Harvesting](#)
- ★ [Water Reuse](#)

## 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.

# Questions?

[john.meyer@twdb.state.tx.us](mailto:john.meyer@twdb.state.tx.us)