

Brackish Resource Aquifer Characterization System

October 20, 2010



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Texas Water Development Board
Water Science and Conservation
Innovative Water Technologies



TWDB Innovative Water Technologies

Desalination of
surface and
groundwater

Brackish
Groundwater
Characterization

Rainwater and
Stormwater
Harvesting

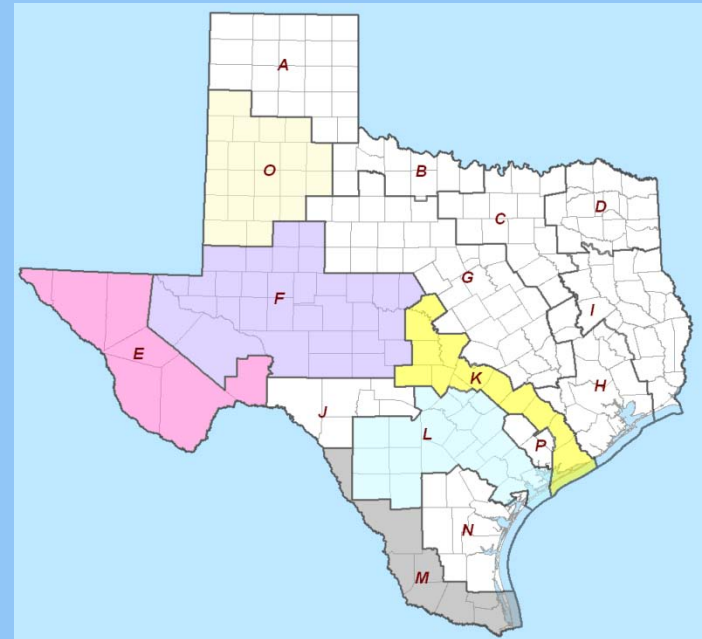
Wastewater
Re-use

Aquifer Storage
and Recovery

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



Brackish Groundwater in Texas

- 1956: USGS Water Supply Paper 1365, Saline-Water Resources in Texas
- 1959: Texas Legislature appropriated \$20,000 to study scaling problems in desalination
- 1965: The potential contribution of desalting to future water supply in Texas (TWDB and USDOJ Office of Saline Studies)
- 1972: TWDB Report 157, A survey of the subsurface saline waters of Texas
- 1973: H. P. Burleigh, TWDB Executive Director, testimony before Congress : “Continued Federal Support of Desalination Research and Development”
- 2003: Brackish Groundwater Manual for Regional Water Planning Groups
- 2005, 2007, 2009: Texas Legislature appropriates funds for brackish groundwater desalination demonstration projects

BRACS Goals

- Extend the 2003 TWDB study:
 - map aquifers to 10,000 mg/L Total Dissolved Solids
 - map key desalination parameters (for example, silica)
 - estimate aquifer properties
 - estimate volumes of water
 - build replicable numerical groundwater flow models
 - collect well logs (water, oil/gas) for interpretation
- Assist regional water planning groups
- Collect and disseminate information to be used for site-specific brackish groundwater projects



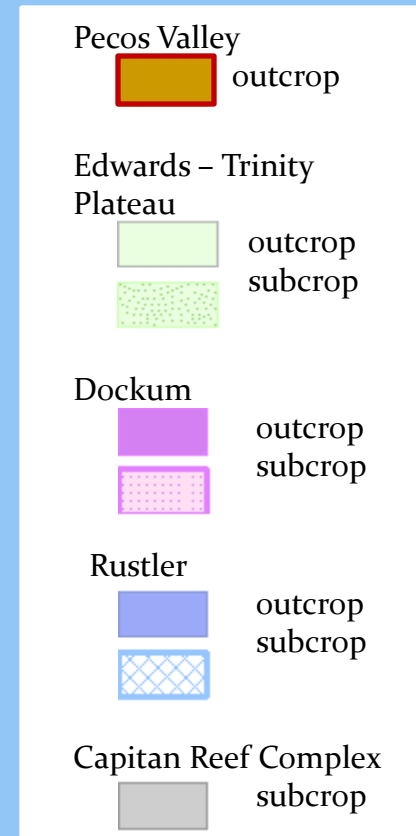
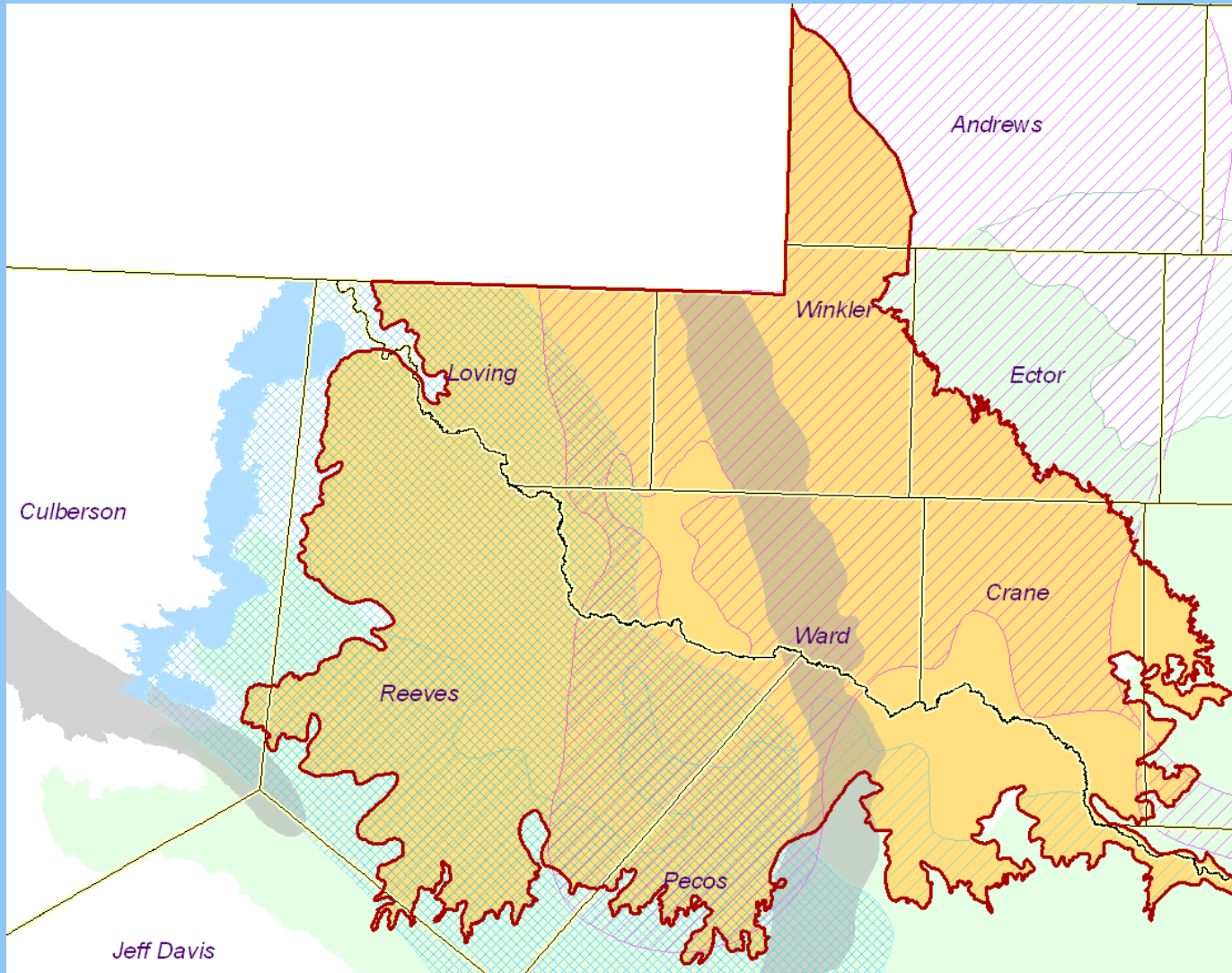
Tasks

- Convene a Technical Resource Panel
- Brackish Groundwater Pilot Study: Pecos Valley Aquifer, West Texas
- Collect information to support brackish groundwater analysis
 - Digital Geological Bibliography of Texas to focus on articles on brackish portions of aquifers in Texas
 - Geophysical Well Logs across Texas for Resistivity/Stratigraphic Analysis
 - Assessment of Groundwater Modeling Approaches to Brackish Aquifers, using Variable Density Modeling

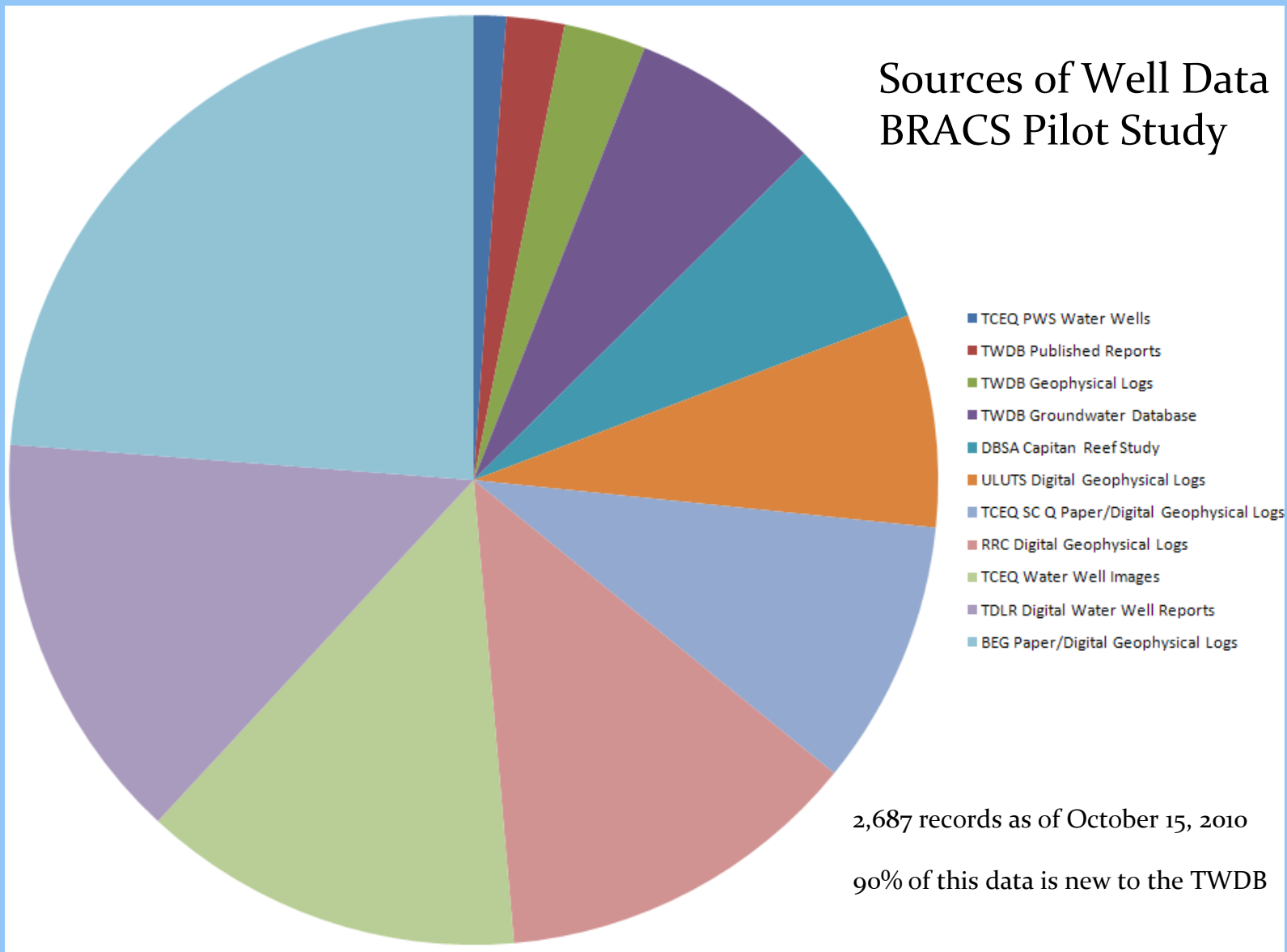
Technical Resource Panel

- Assist TWDB staff with developing a firm technical foundation for the Brackish Resource Aquifer Characterization System
- Consists of State, Federal, Private representatives interested in Brackish Resources of Texas
- First meeting held in February, 2010

Pilot Study: Pecos Valley Aquifer, West Texas

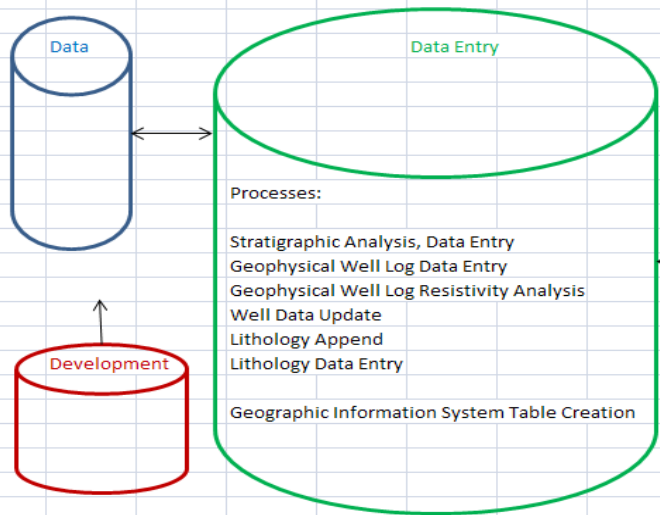


Collect Available Data

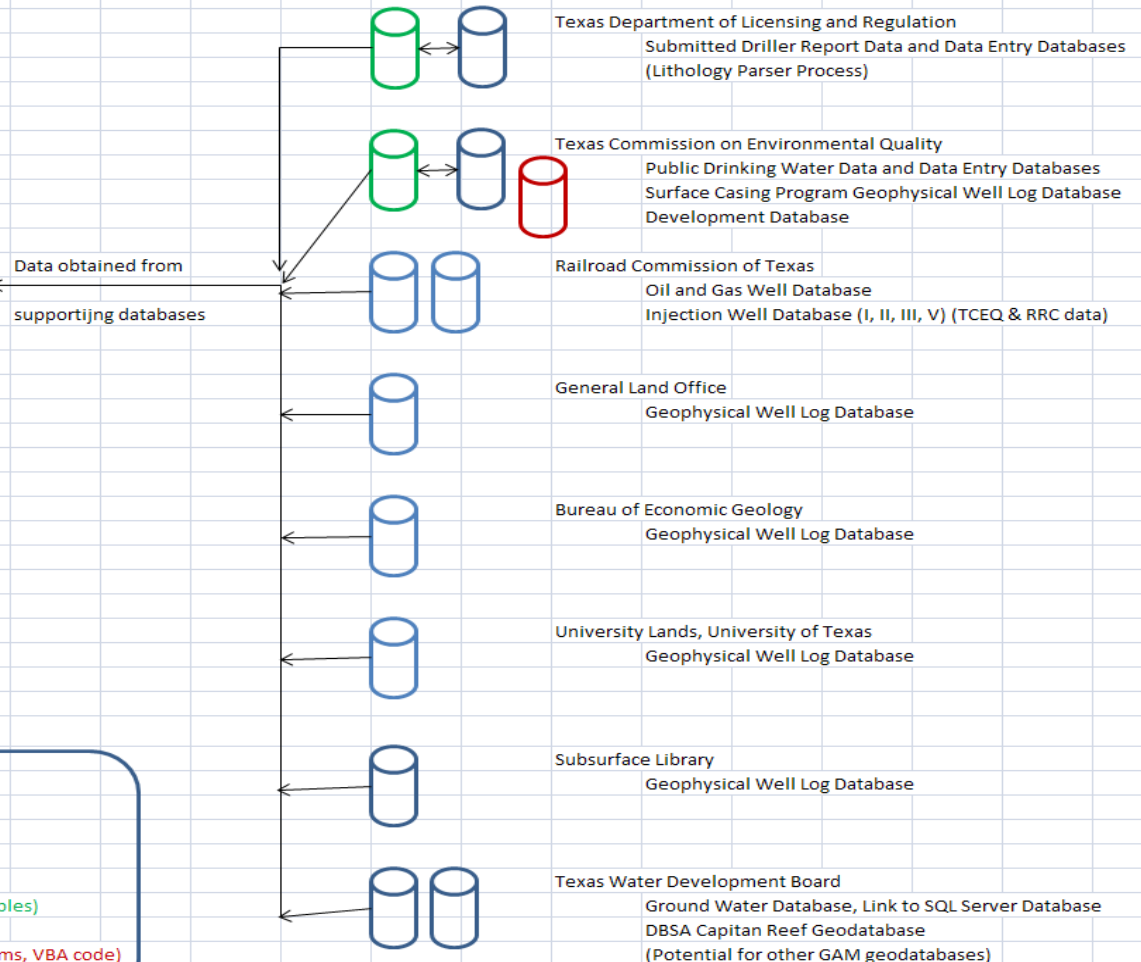


A relational database system was developed to manage all of the project data

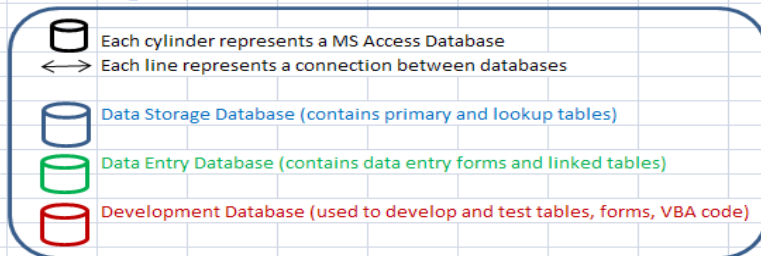
BRACS Project Databases



Supporting Databases



Legend

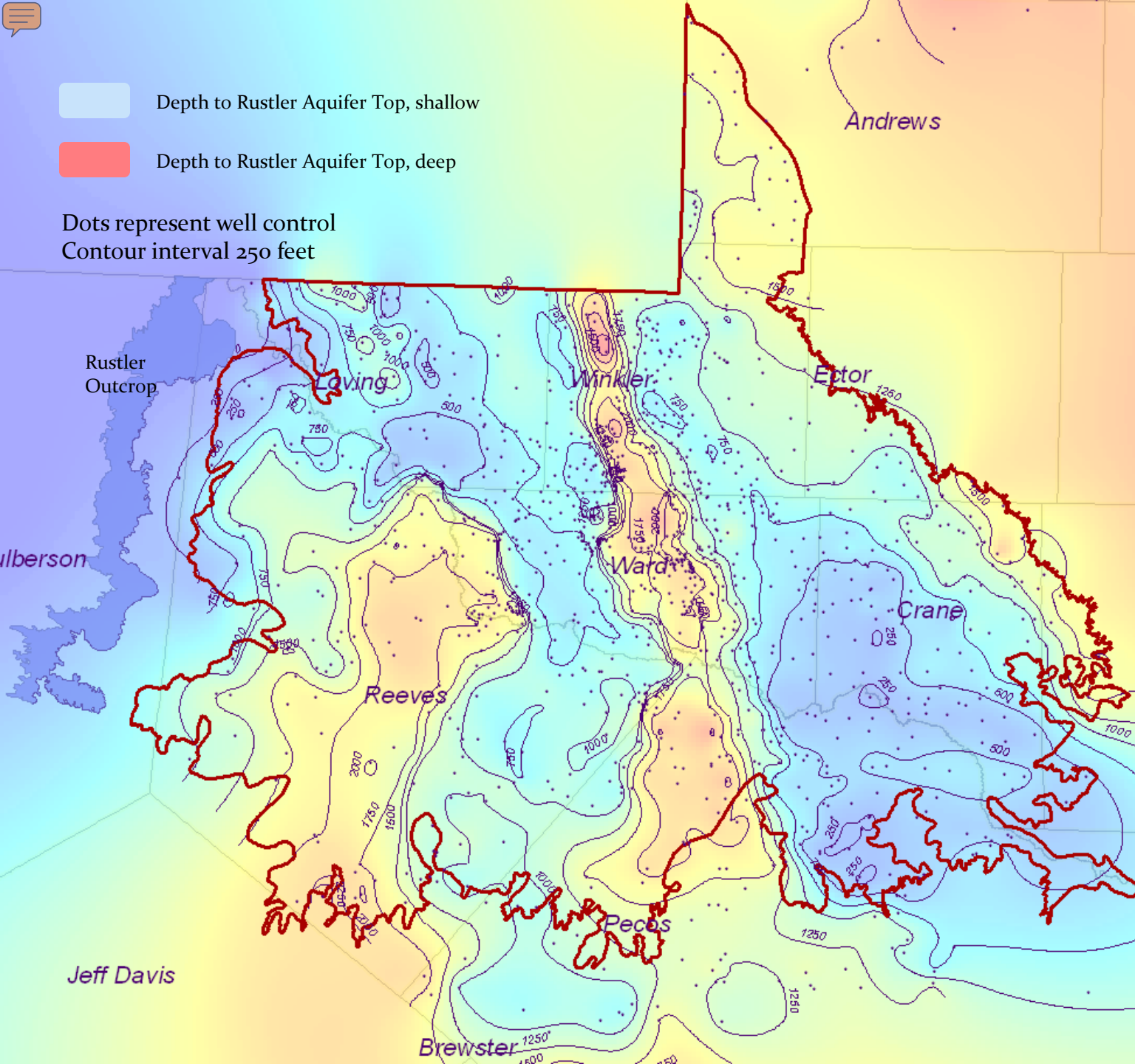




Depth to Rustler Aquifer Top, shallow

Depth to Rustler Aquifer Top, deep

Dots represent well control
Contour interval 250 feet

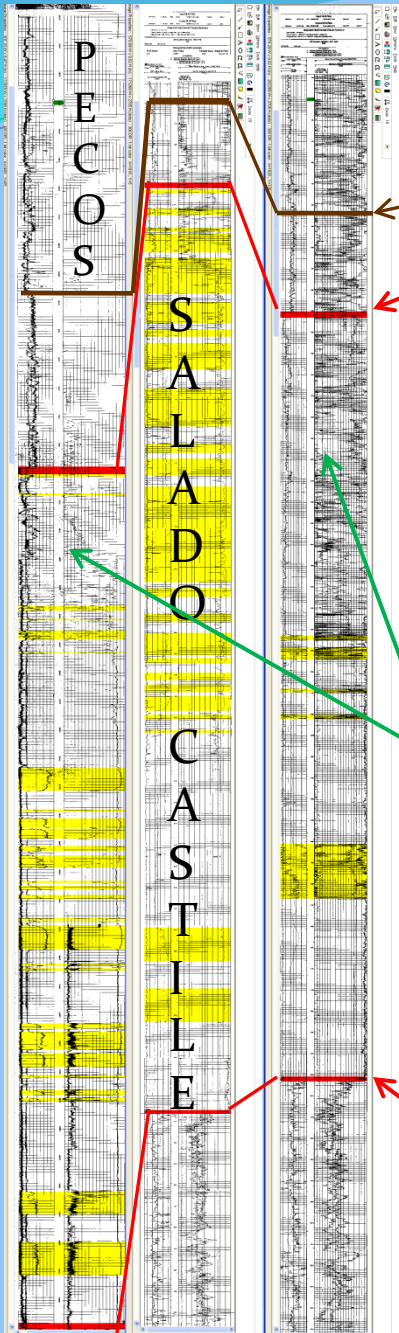


Rustler Aquifer Top

> 2,000 feet of relief

> 1,215 geophysical well logs

Cross Section Showing the Salado Formation Halite Ridge



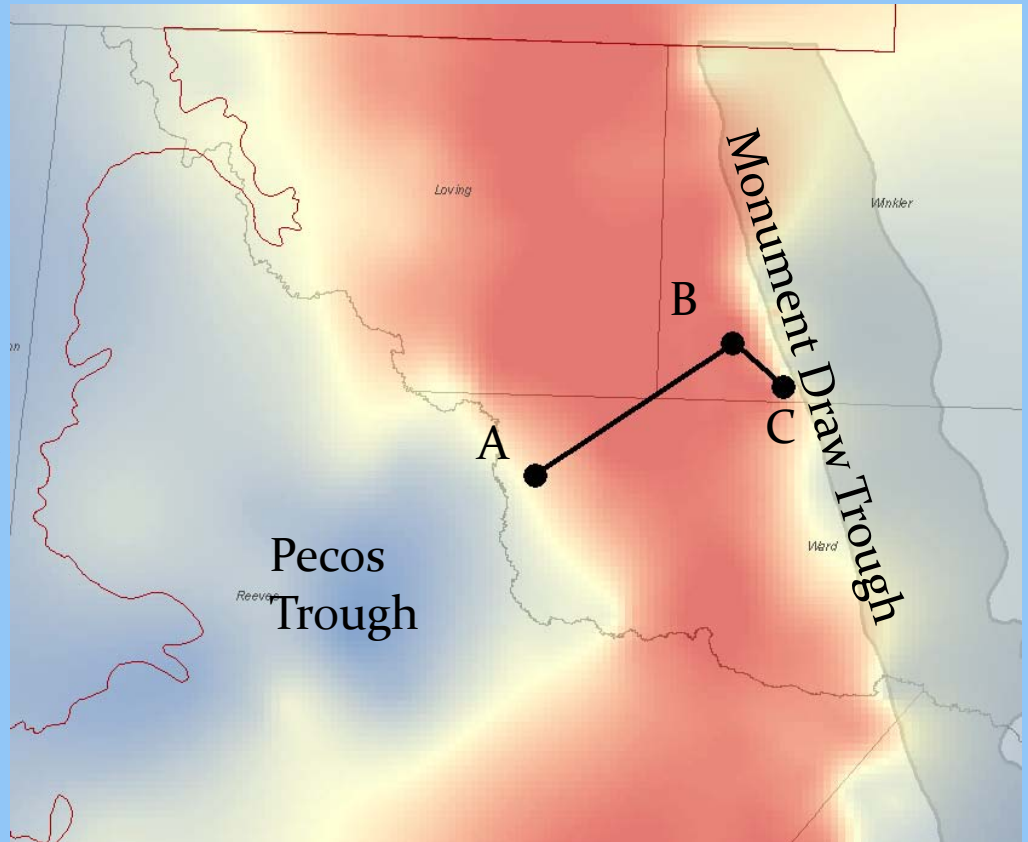
Pecos Valley Base

Rustler Top

Yellow represents Halite



Salado halite dissolved to form solution troughs

Base Castile Evaporites

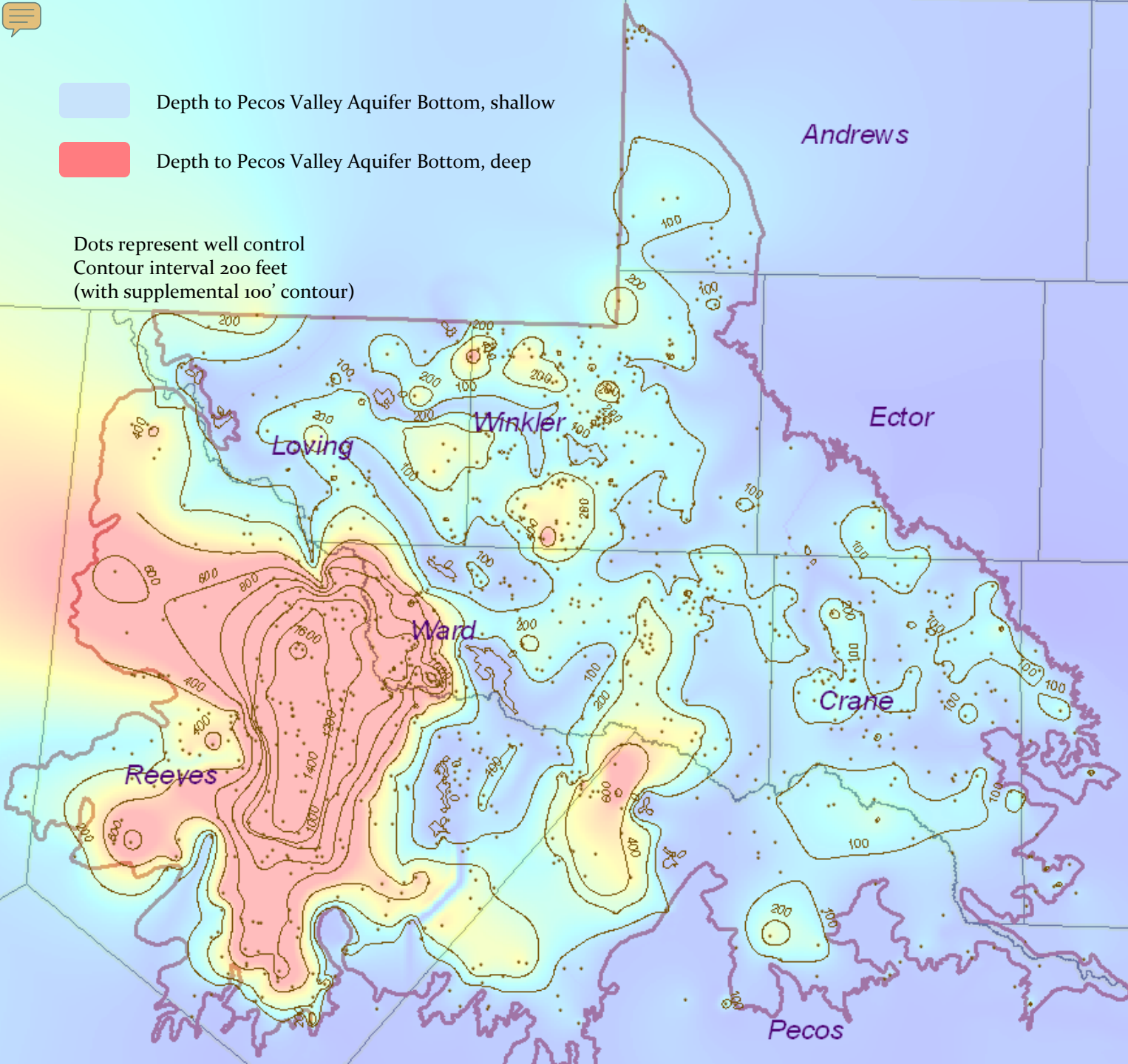


Thickness of Castile, Salado, Rustler Blue (thin) to Orange (thick)



-  Depth to Pecos Valley Aquifer Bottom, shallow
-  Depth to Pecos Valley Aquifer Bottom, deep

Dots represent well control
Contour interval 200 feet
(with supplemental 100' contour)



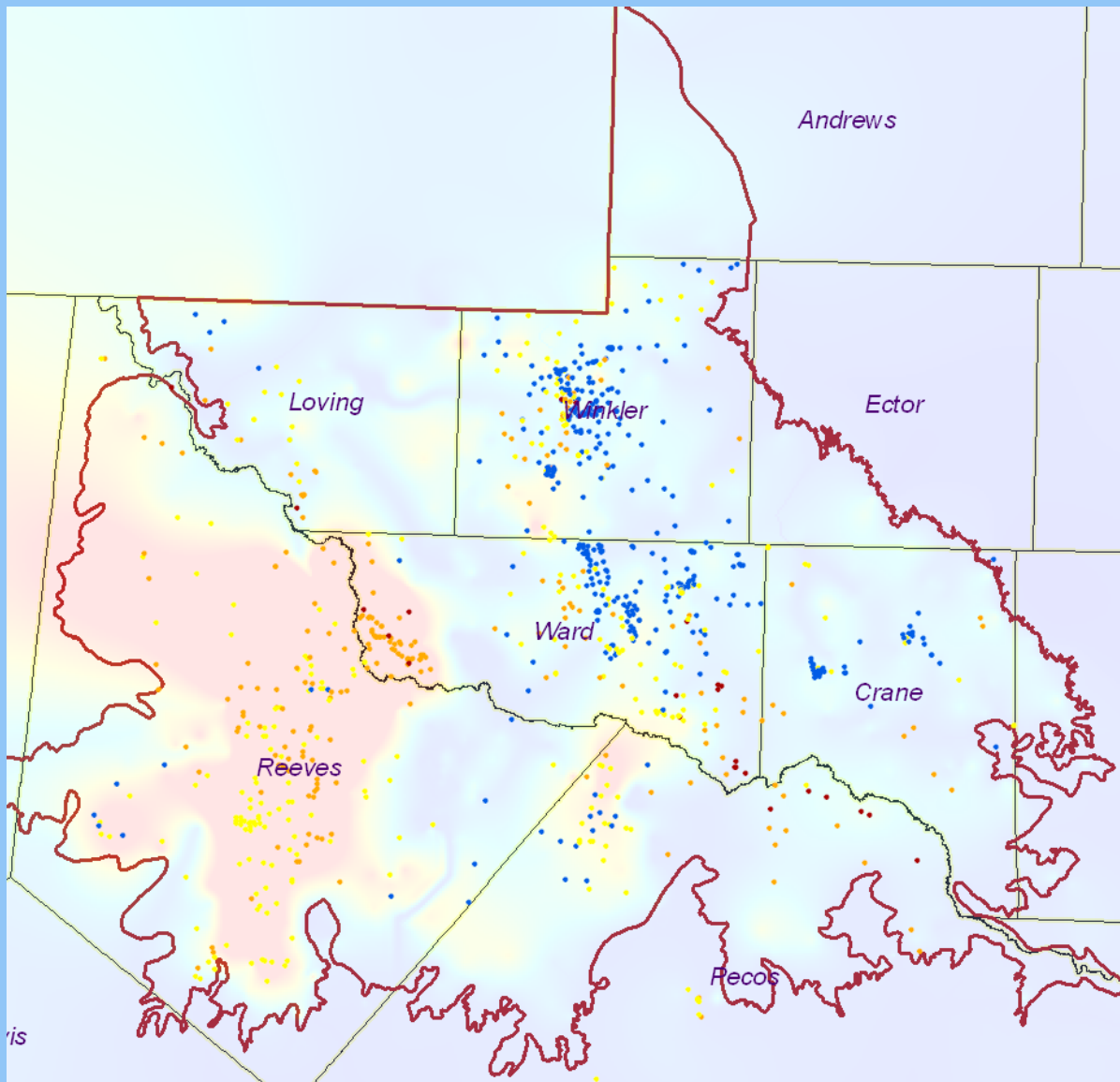
Pecos Valley Aquifer Base

> 1,600 feet of relief

> 1,025 well logs to date

Pecos Valley Aquifer

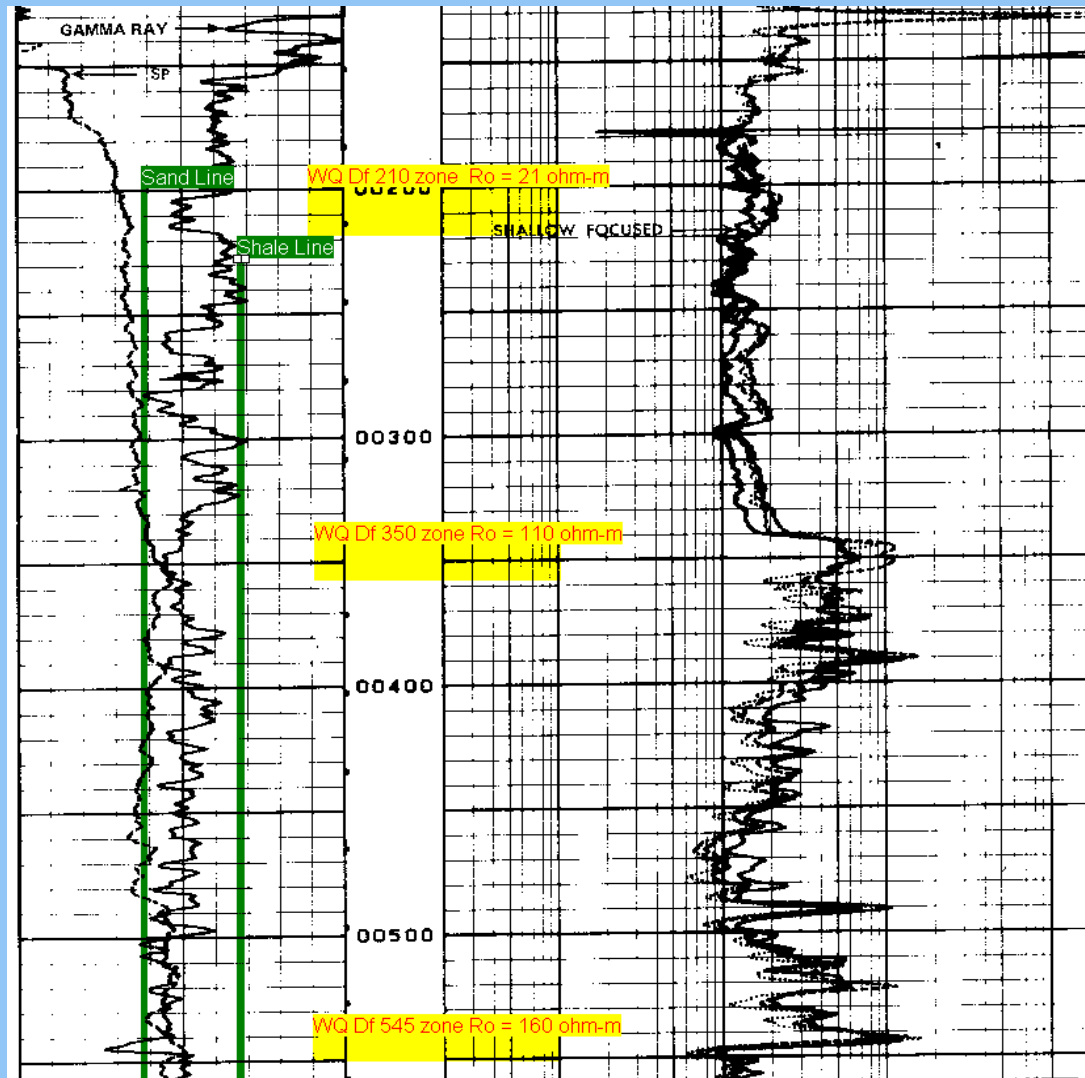
TDS



Total Dissolved Solids Distribution (mg/L)

Blue	0 - 1,000
Yellow	1,000 - 3,000
Orange	3,000 - 10,000
Red	> 10,000

Determining Resistivity Values for Calculating TDS



Calculation of TDS from Geophysical Well Logs

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

Load The New Data
 Close Form

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: Esteppe Method high anion waters
 1 Ro: Mean Ro Method [Mean Ro Nomograph](#)

Chart: N/A
 Remarks: N/A

Record: 1 of 1

Determine “simple” lithologic categories to interpret for aquifer properties

frmWell_Lithology_DE : Form

98 API Number State Well Number 0 Owner Will Fernandes Drill Date 6/22/2001
 Track Number 1497 Water Source Well Number Depth Total 286
 Q Number Source of Well Data TDLR Digital Water Well Reports

Lithologic Description

Record Number	Geologic Pick	Top Depth Bottom Depth Thickness	Lithologic Description Source of Data Initials Last Change
1	LITHOLOGIC	0 5 5	Sand WATER WELL LOG, DRILLER JEM 3/8/2010
2	LITHOLOGIC	5 20 15	Caliche WATER WELL LOG, DRILLER JEM 3/8/2010
3	LITHOLOGIC	20 75 55	Pink sandy shale WATER WELL LOG, DRILLER JEM 3/8/2010
4	LITHOLOGIC	75 200 125	Sand WATER WELL LOG, DRILLER JEM 3/8/2010
5	LITHOLOGIC	200 260 60	Sand & gravel WATER WELL LOG, DRILLER JEM 3/8/2010
6	LITHOLOGIC	260 286 26	Red clay WATER WELL LOG, DRILLER JEM 3/8/2010
*			

Stratigraphic Description

Record Number	Geologic Pick	Top Depth Bottom Depth Thickness	Stratigraphic Description Source of Data Initials Last Change
7	Stratigraphic	0 260 260	Pecos Valley Alluvium Geophysical Log JEM 4/15/2010 Unit > Well Depth ?
8	Stratigraphic	260	Dockum Group Geophysical Log JEM 4/15/2010 Unit > Well Depth ?
*			

Add First Record

Add Next Record

Complete Last Record

Add First Record

Add Next Record

Complete Last Record

Add BLANK Record

Record: 88 of 2667



Summary

- The 2003 Brackish Groundwater Manual indicated the estimated total volume of brackish groundwater in Texas is over 2.7 billion acre-feet.
- 44 water treatment plants in Texas use Reverse Osmosis to treat brackish water.
- The Texas Innovative Water 2010 Seminar held in San Antonio last week showed a tremendous interest in brackish groundwater resources.
- The TWDB through the BRACS project and external contracts is well-poised to provide the information Texas needs to continue development of this resource.
- August 31, 2011 is deadline for the Pecos Valley aquifer pilot study .
- We plan to look at one other area to further define the techniques for interpreting resistivity and SP tools for Total Dissolved Solids.
- Each aquifer is different and techniques of analysis will need to fit data available



Questions ?