

Groundwater 101 Workshop

Presented by TWDB
Groundwater Staff:

- Larry French, Director, Groundwater Division
- Janie Hopkins, Manager, Groundwater Monitoring Section
- Bryan Anderson, Team Lead, Groundwater Data Team
- Rima Petrossian, Manager, Groundwater Technical Assistance Section
- Cindy Ridgeway, Manager, Groundwater Availability Modeling Section

Welcome, Introductions		L. French
Texas Groundwater Basics	Science and Data	L. French
Groundwater Monitoring and Data		J. Hopkins
Water Data Interactive		B. Anderson
Break		
Groundwater Management	Management and Planning Tools	R. Petrossian
Groundwater Availability Modeling		C. Ridgeway
Groundwater Availability and New Topics		L. French
Open Discussion/Q&A		All

Groundwater and Aquifers

Larry French, P.G.

Director

Groundwater Division

What is an aquifer?

Dirt and rocks

- an aquifer is geologic media that can yield economically usable amounts of water.

Depends on
who's using it

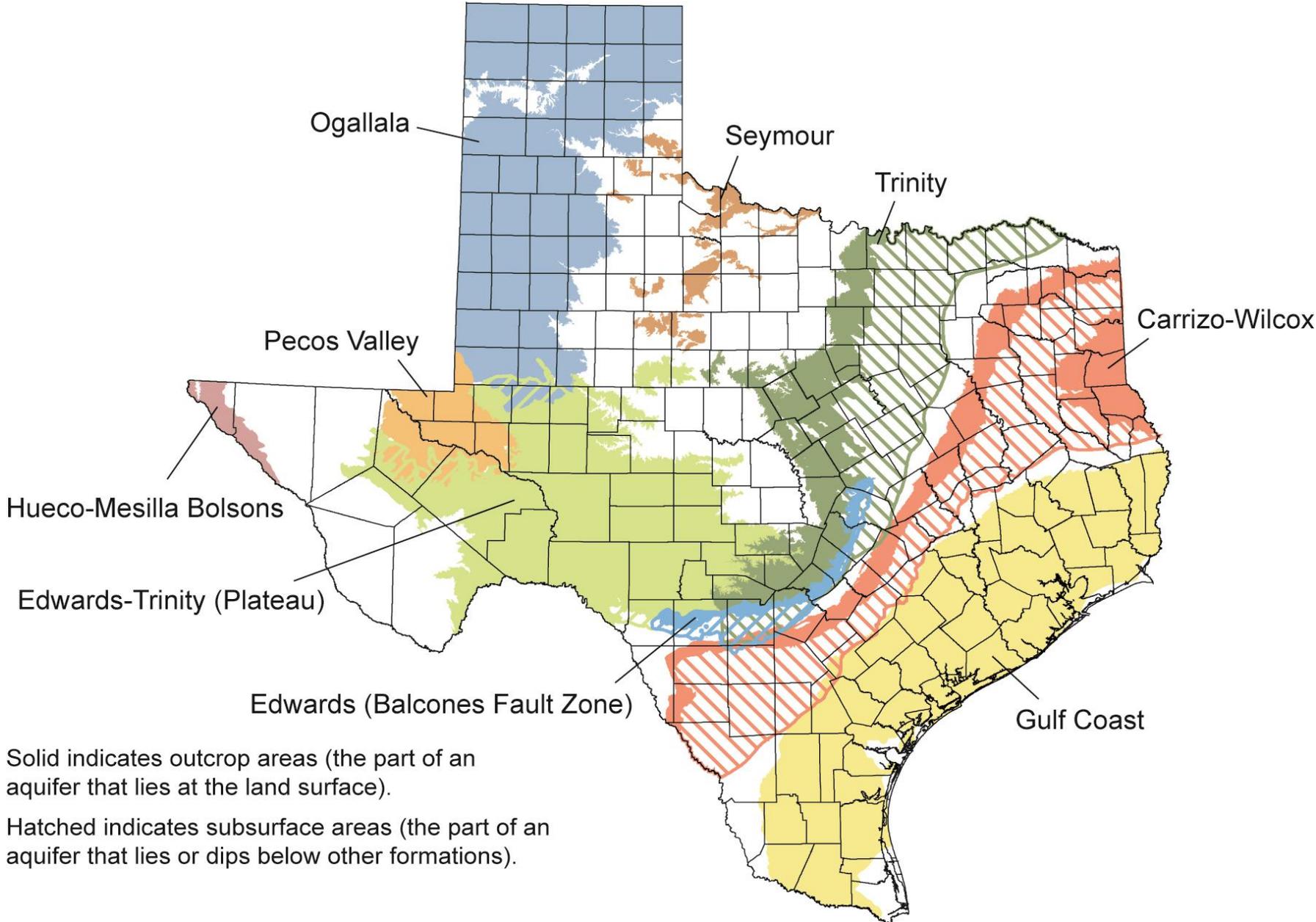


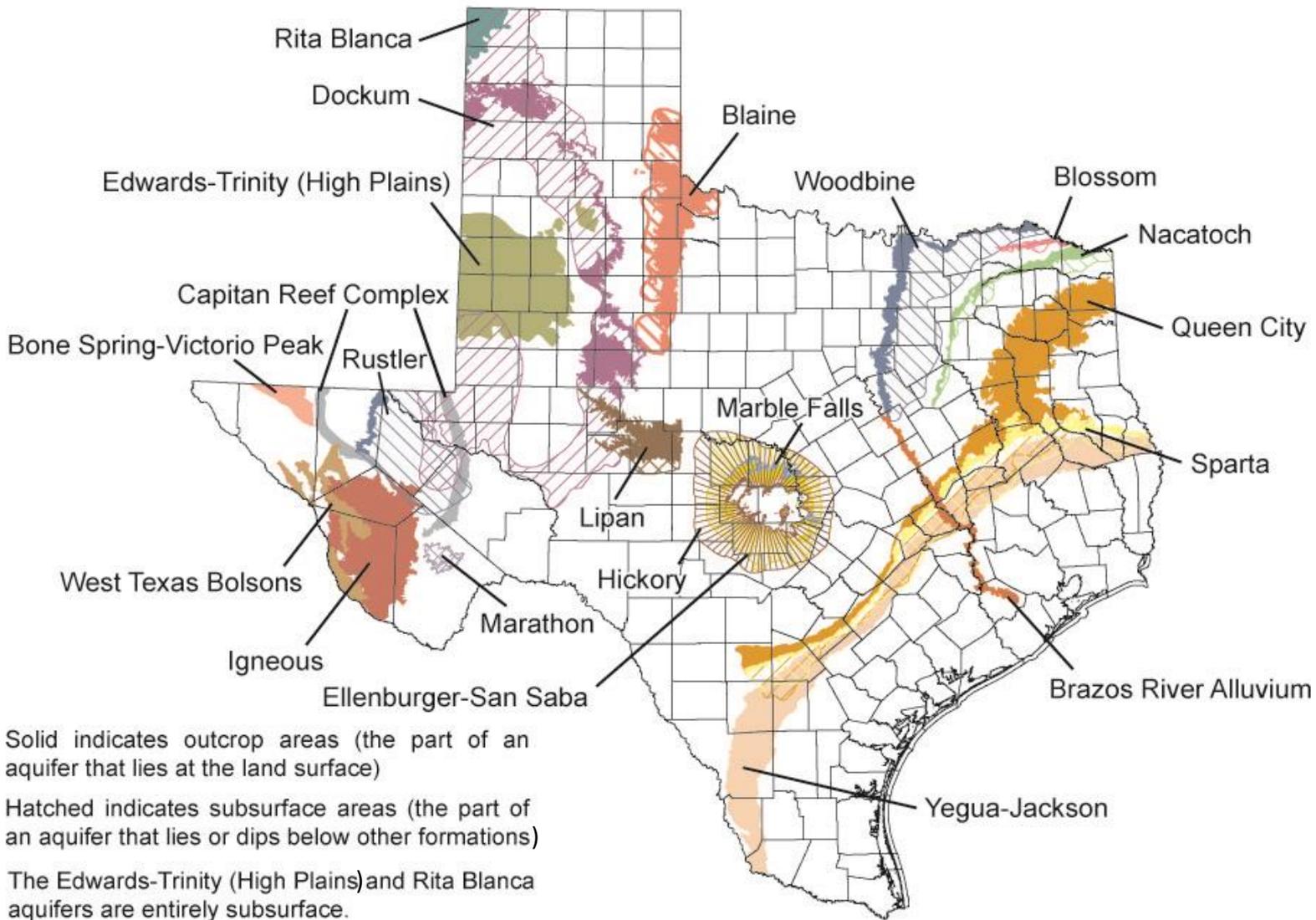




Groundwater and Texas

- 62 percent of the 13.7 million acre-feet of water used in 2014
- 76 percent of groundwater is used for irrigation
- Cities and domestic users accounted for 18 percent of groundwater use
- Groundwater provides more than one-third of water used by cities





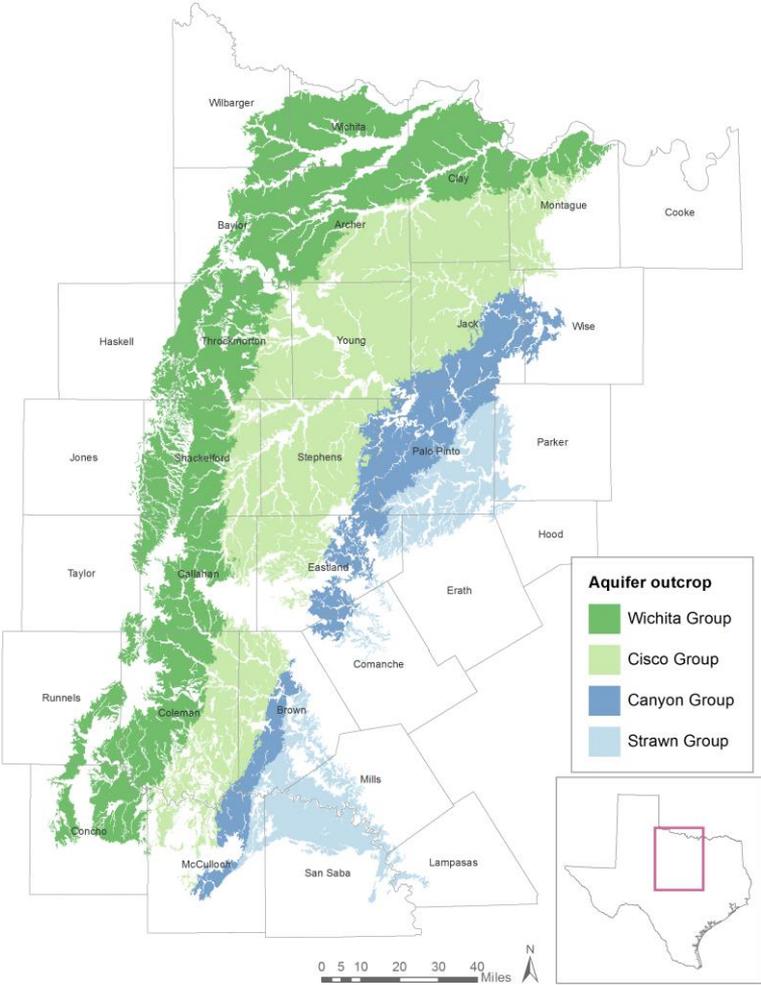
Solid indicates outcrop areas (the part of an aquifer that lies at the land surface)

Hatched indicates subsurface areas (the part of an aquifer that lies or dips below other formations)

The Edwards-Trinity (High Plains) and Rita Blanca aquifers are entirely subsurface.

George and others, 2011

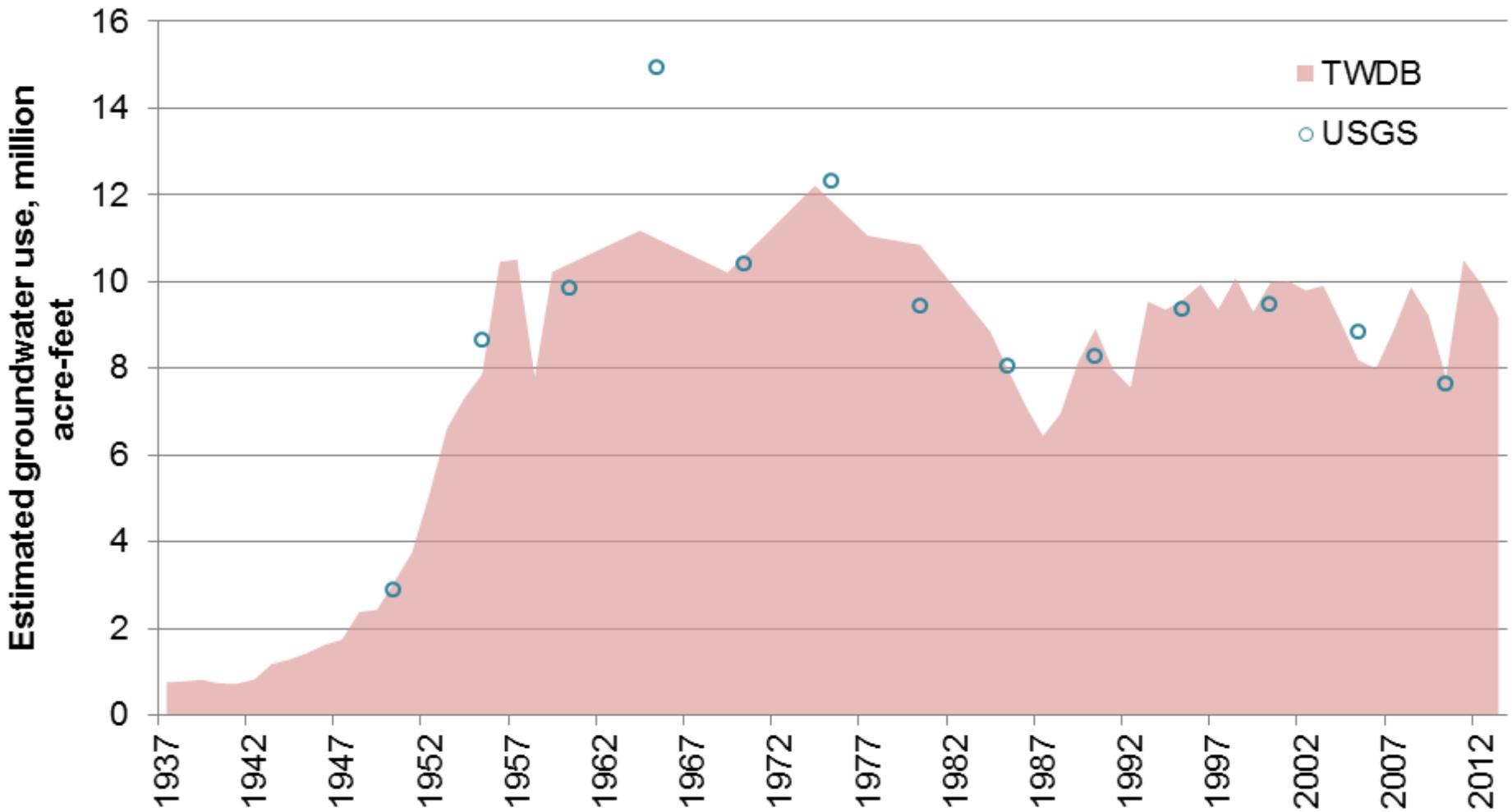
A new (minor) aquifer may be born!



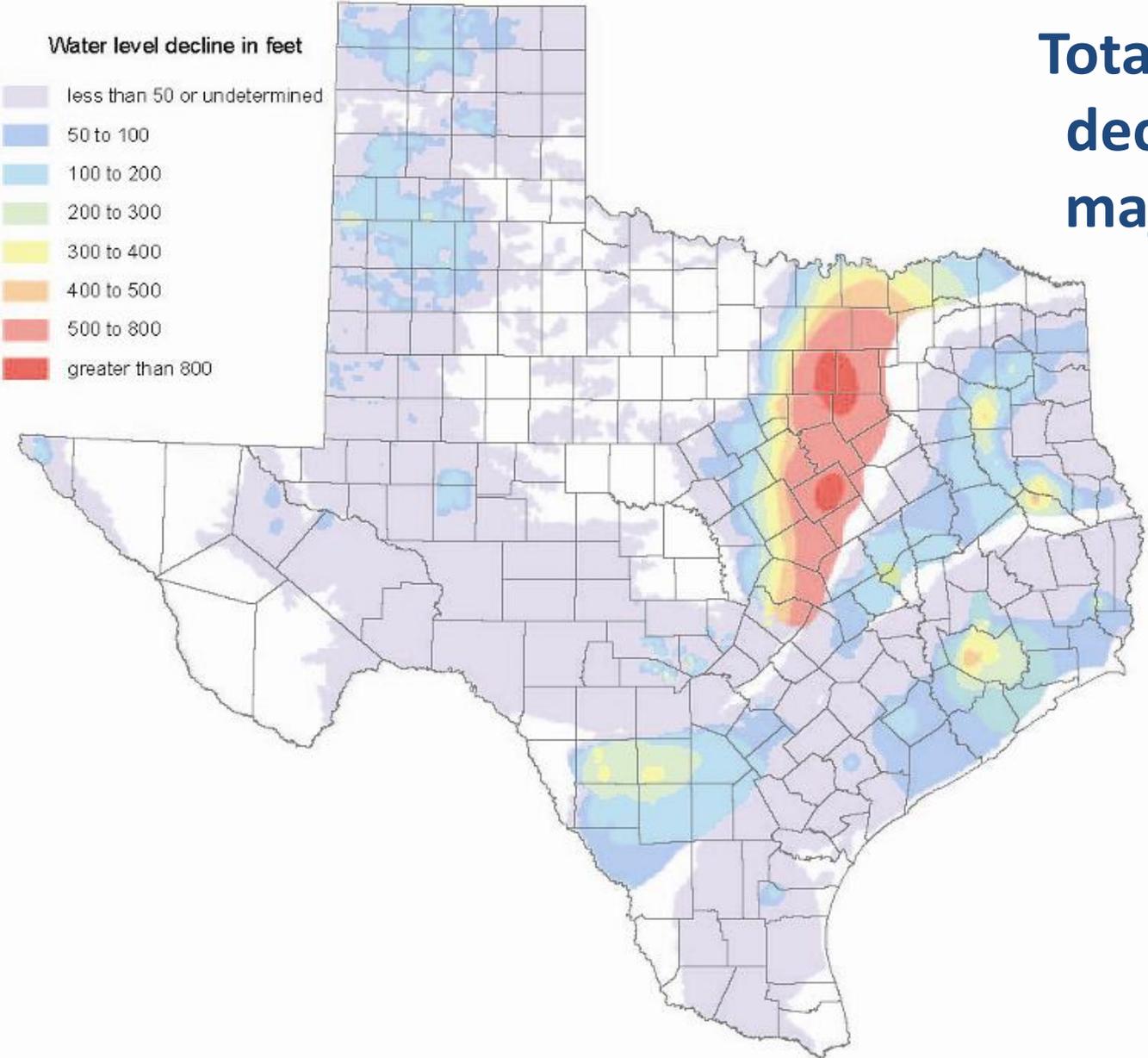
How much groundwater?

Total estimated quantity of fresh and brackish to saline groundwater in Texas aquifers is 16.8 billion acre-feet.

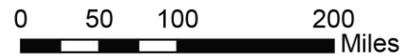
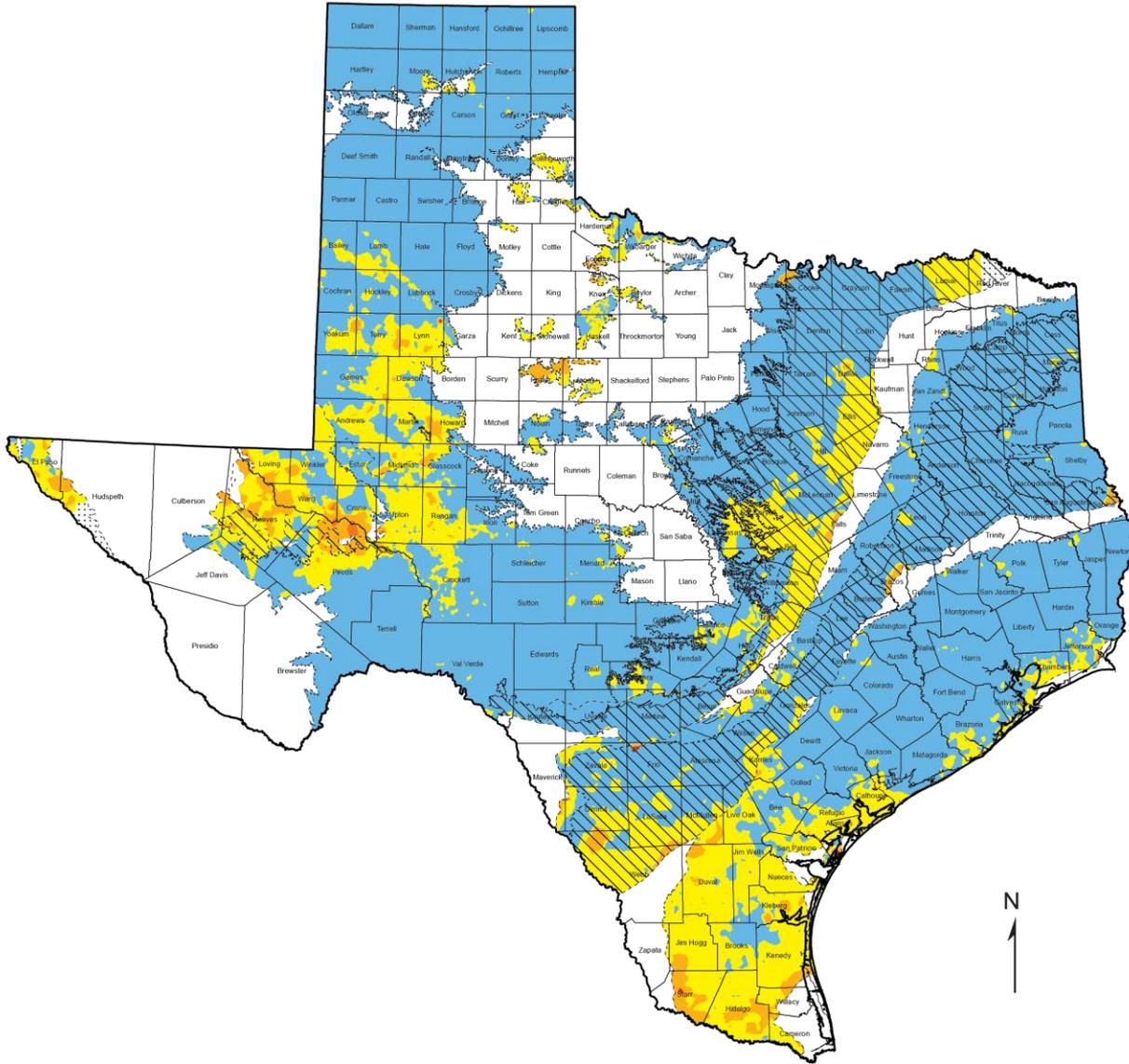
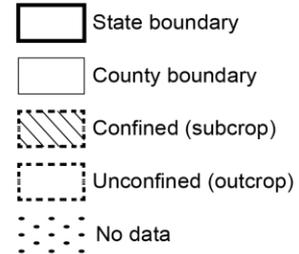
- Major aquifers - 12.6 billion acre-feet
- Minor aquifers - 4.24 billion acre-feet



Total water level declines in the major aquifers



Total Dissolved Solids (milligrams per liter)



Groundwater Monitoring Programs

Janie Hopkins, P.G.
Groundwater Monitoring Manager

Texas Water Development Board

Mission:

“Sustainable and affordable water for Texas”

- Grants and loans
- Water planning
- Data collection

TWDB monitoring goals & uses

- To determine groundwater-level trends
- To publish near real-time levels on-line
 - Drought triggers
 - Local groundwater management
- Regional groundwater management
- Model development & calibration
- To establish and characterize naturally occurring, baseline groundwater quality and any changes that may have occurred over time

TWDB monitoring networks



- 200+ automatic water level recorder wells
- 7,500 water level network wells
- 1,200 – 1,600 water quality network wells & springs (4-year cycle)



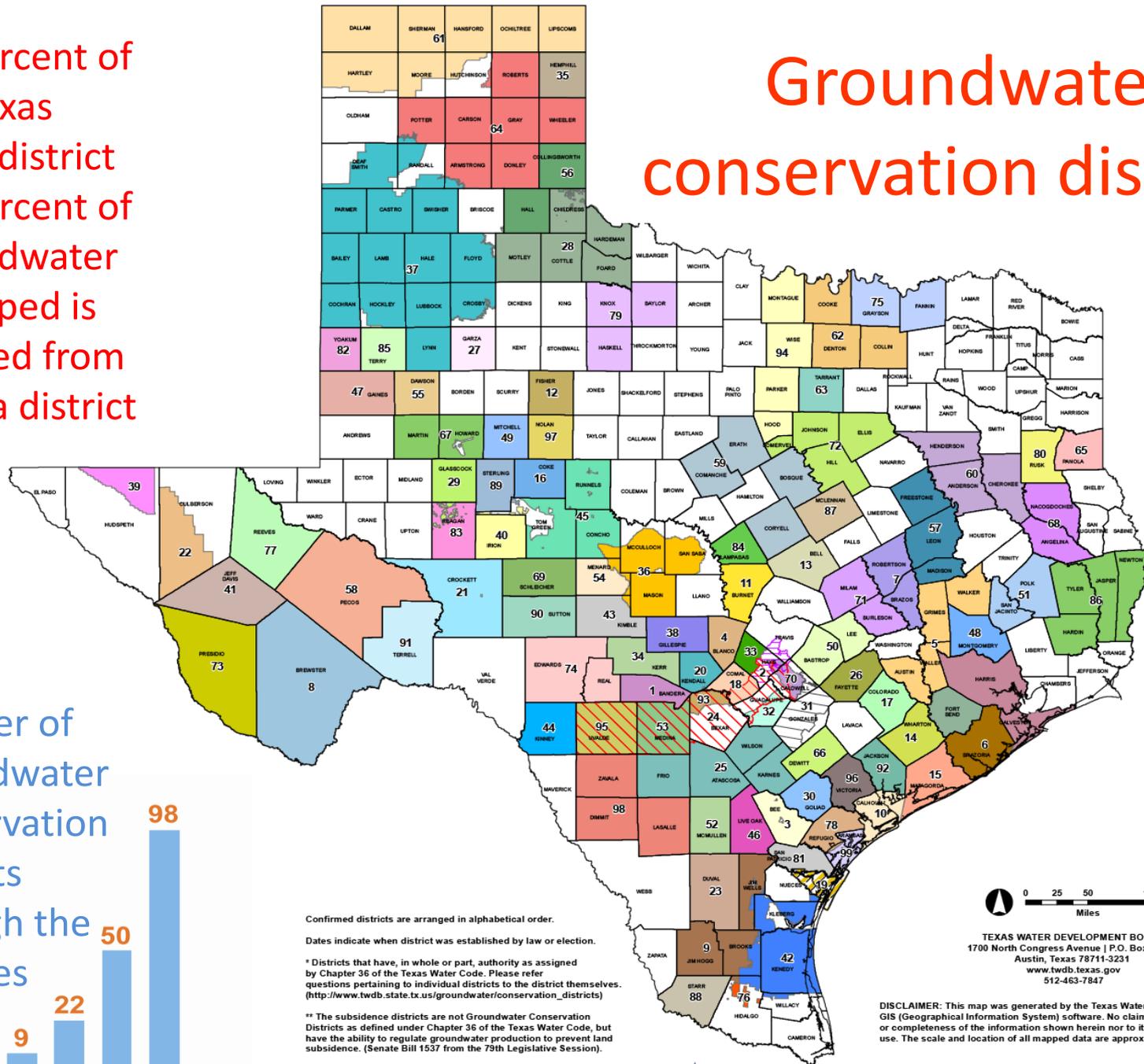
- Wells are completed in 9 major, 21 minor, and several undesignated or local aquifers
- Representative number of wells per county, per aquifer determined by amount pumped

Types of wells monitored: irrigation, stock, domestic, public water supply, & unused (water levels only)

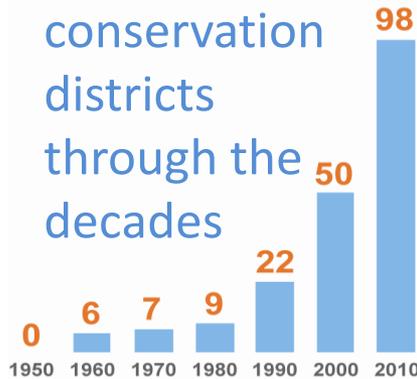


~60 percent of Texas has a district
 ~90 percent of groundwater pumped is pumped from inside a district

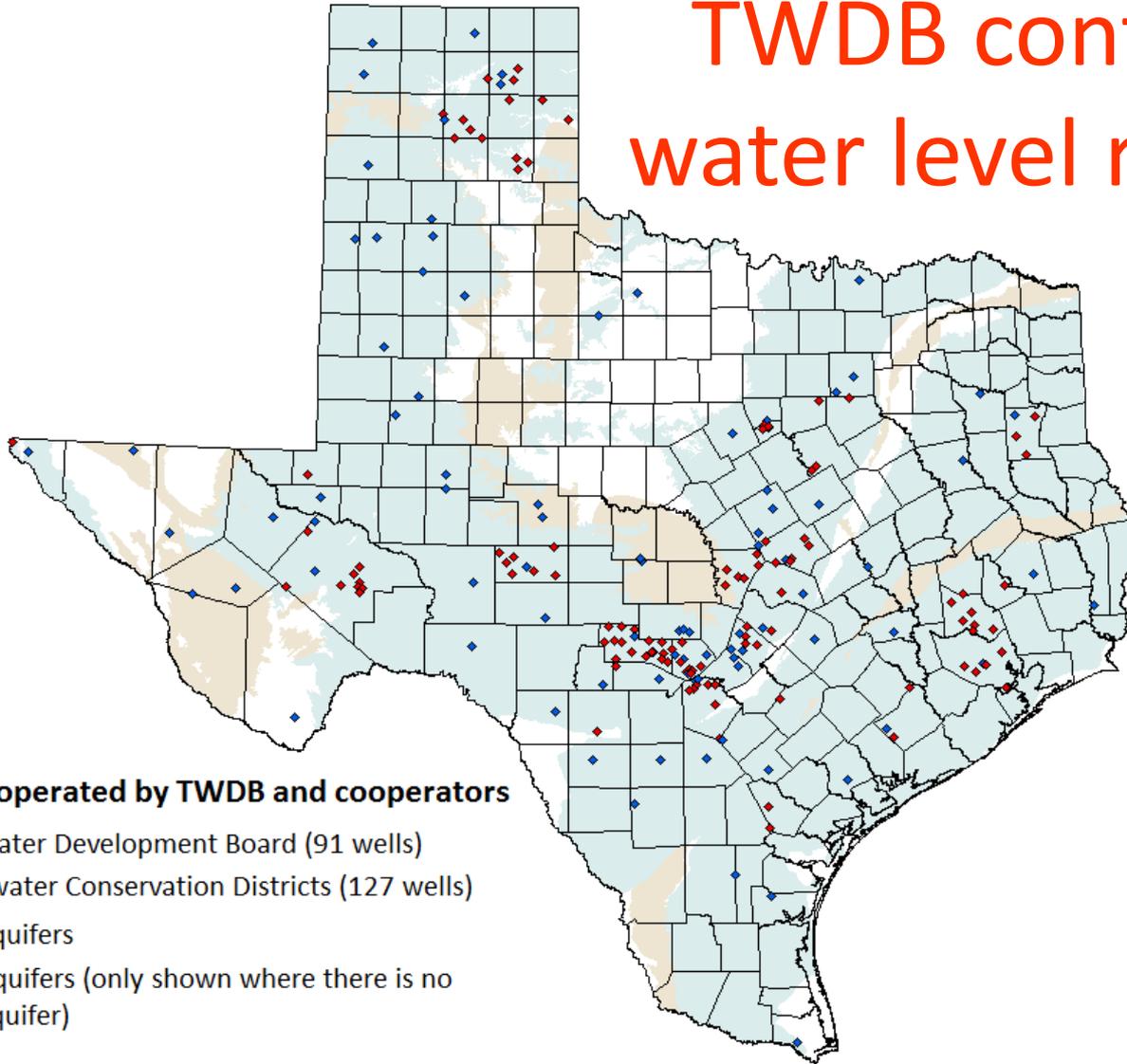
Groundwater conservation districts



Number of groundwater conservation districts through the decades



TWDB continuous water level recorders



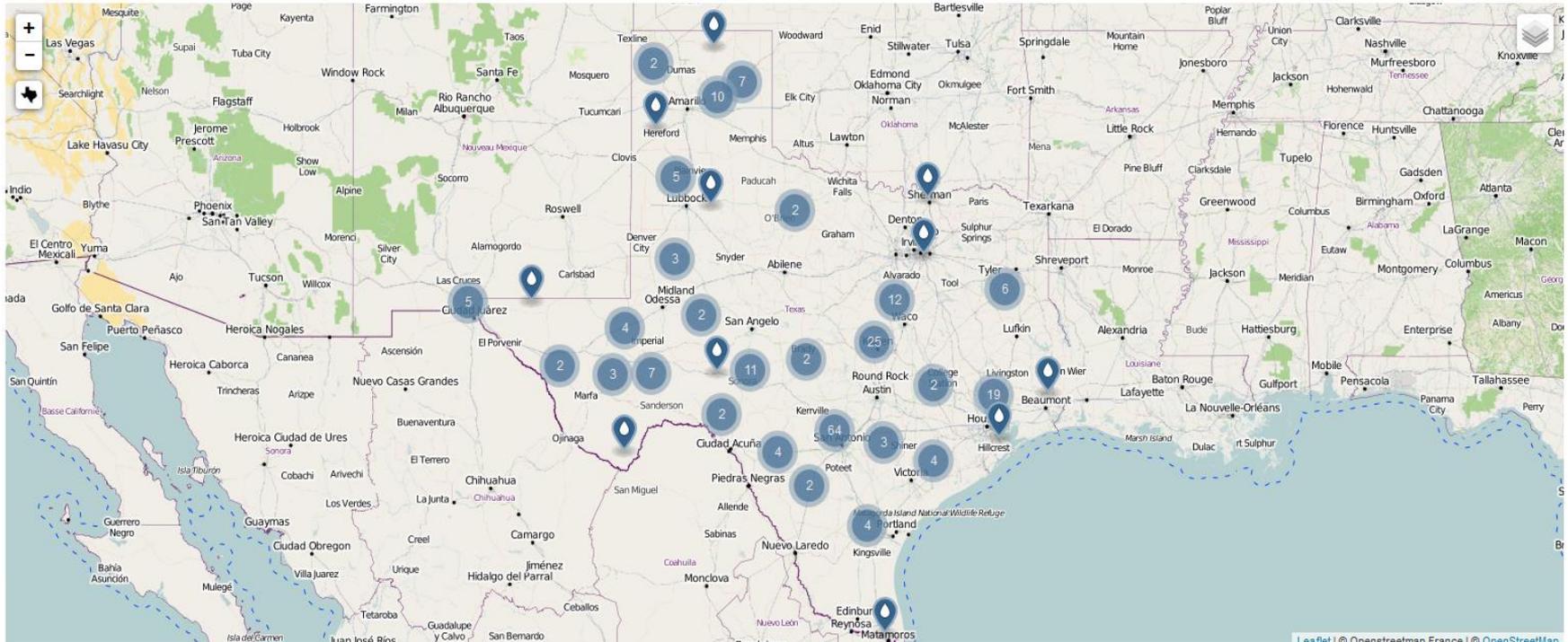
Recorder sites operated by TWDB and cooperators

- ◆ Texas Water Development Board (91 wells)
- ◆ Groundwater Conservation Districts (127 wells)
- Major aquifers
- Minor aquifers (only shown where there is no major aquifer)

Water Data for Texas

<https://waterdatafortexas.org/groundwater>

Automated Groundwater Level Wells



Additional funding for the TWDB recorder program

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Home Public Businesses Governments Air Land Water

Data and Records Forms Maps Public Notices Publications

You are here: Home / Legal Services / Supplemental Environmental Projects

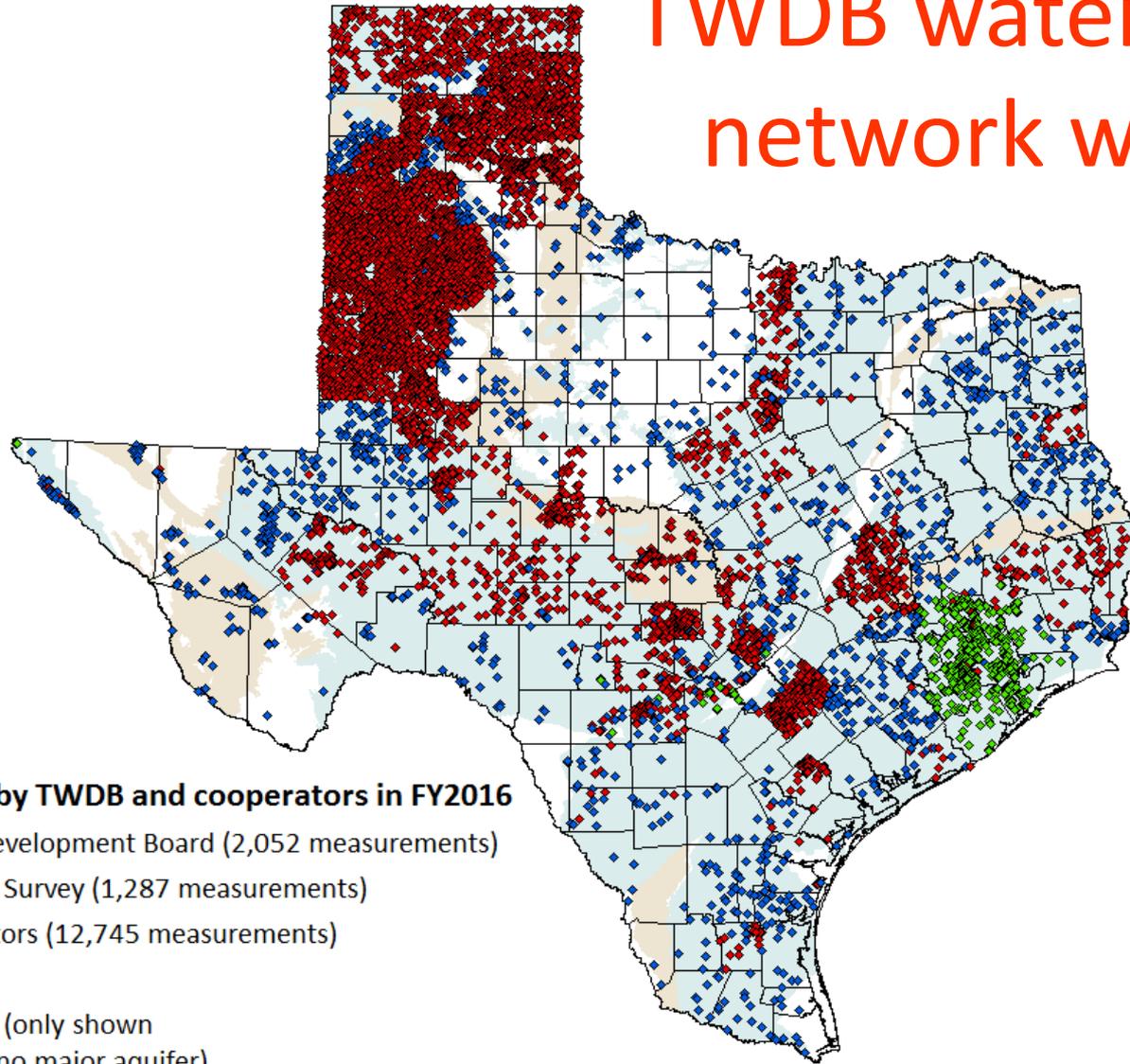
Supplemental Environmental Projects ("SEPs")

SEPs are environmentally beneficial projects that a respondent agrees to undertake in settlement of an enforcement action. Dollars directed to TCEQ-approved environmental projects may be used to offset assessed penalties in enforcement actions.

Questions or Comments: SepReports@tceq.texas.gov

45.	Texas Water Development Board	2014-05 Water-Level Recorder Data in Every Texas County	Extend existing groundwater level monitoring network in every Texas County and make the data available to the public via the Water Data for Texas website. (pdf)	\$500	EAQ, IHW ² , IWD, MLM, MM ³ , PWS, MSW, MWD, PST ⁴ , PWS, WQ, WR	Statewide
46.	University of Texas at Austin Lyndon B. Johnson School of Public Affairs	2013-11 Lower Rio Grande Water Quality Initiative	Assist communities in the Lower Rio Grande region (from the Falcon Dam to the Gulf of Mexico) by working with TCEQ, EPA, Comisión Nacional del Agua, and Comisión Estatal del Agua de Tamaulipas to improve Rio Grande water quality. (pdf)	\$100	EAQ, IHW ² , IWD, MLM, MM ³ , PWS, MSW, MWD, PST ⁴ , PWS, WQ, WR	Andrews, Brewster, Brooks, Cameron, Crane, Crockett, Culberson, Dimmit, Duval, Ector, Edwards, El Paso, Hidalgo, Hudspeth, Jeff Davis, Jim Hogg, Jim Wells, Kenedy, Kinney, Kleberg, Loving, Maverick, Nueces, Pecos, Presidio, Reagan, Reeves, San Patricio, Schleicher, Starr, Sutton, Terrell, Upton, Val Verde, Ward, Webb, Willacy, Winkler, and Zapata

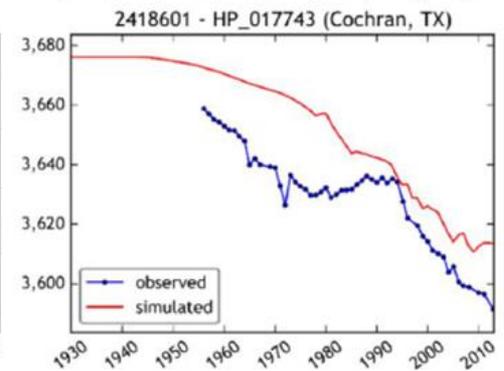
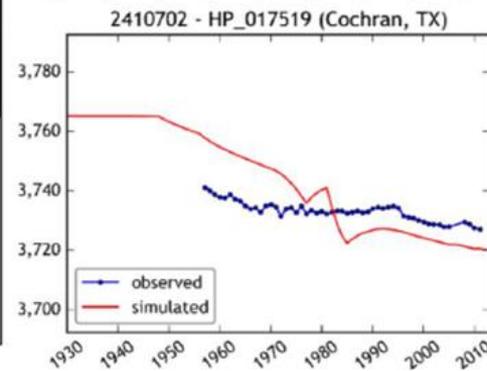
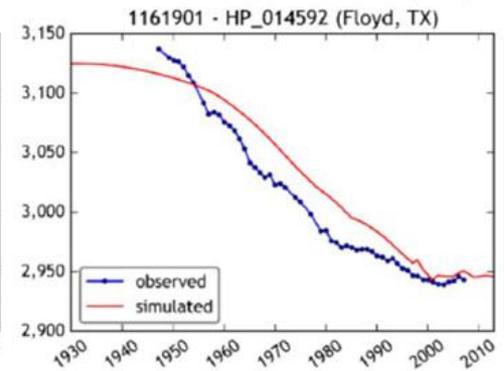
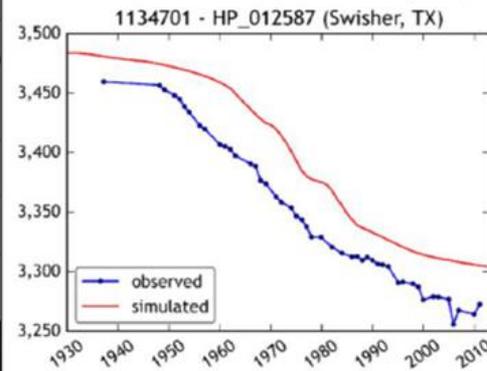
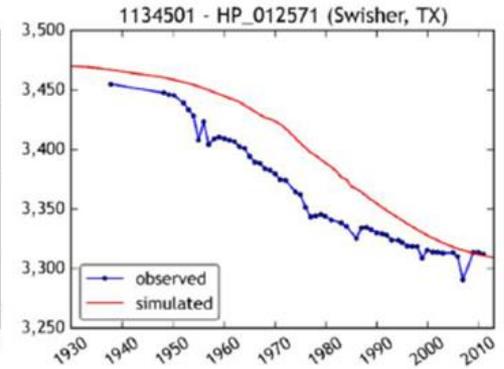
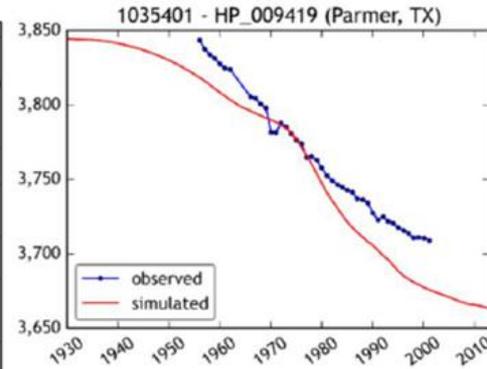
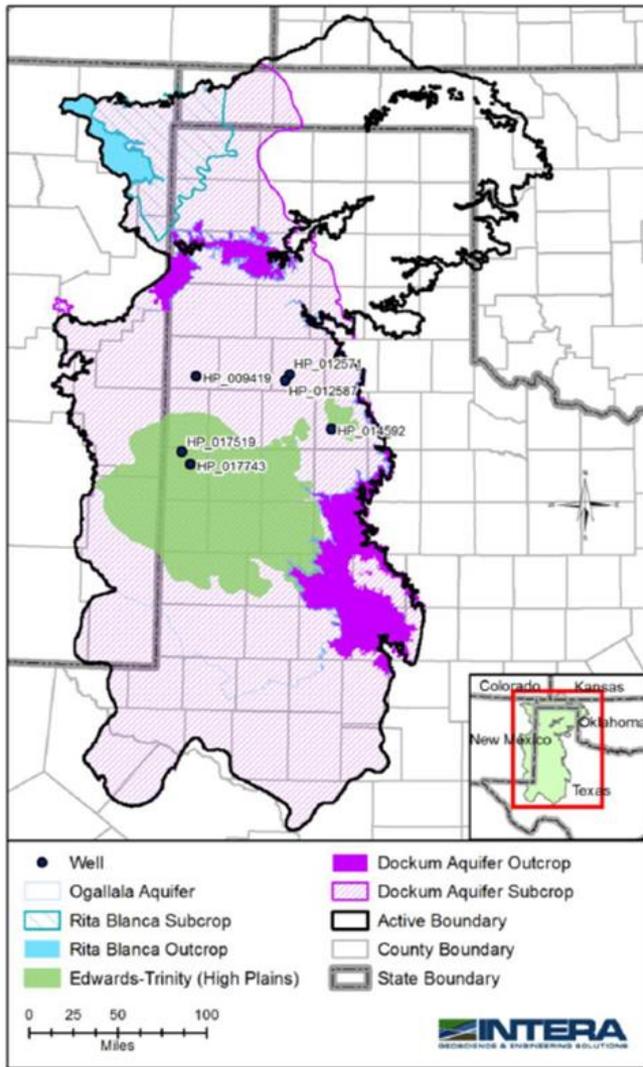
TWDB water level network wells



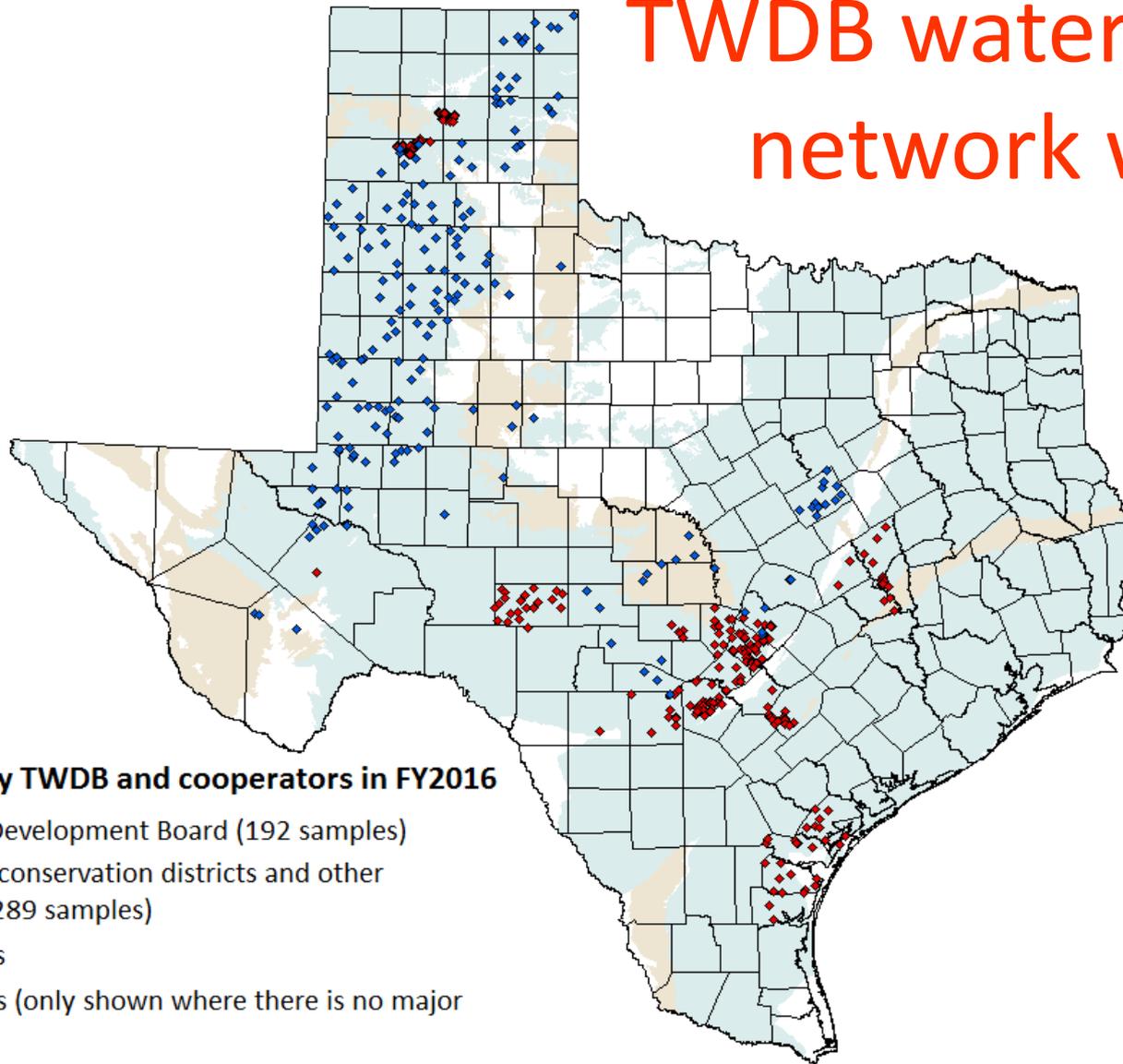
Wells measured by TWDB and cooperators in FY2016

- ◆ Texas Water Development Board (2,052 measurements)
 - ◆ U.S. Geological Survey (1,287 measurements)
 - ◆ Other cooperators (12,745 measurements)
 - Major Aquifers
 - Minor Aquifers (only shown where there is no major aquifer)
- Total wells (6,983)

High Plains (Ogallala) Aquifer Calibration



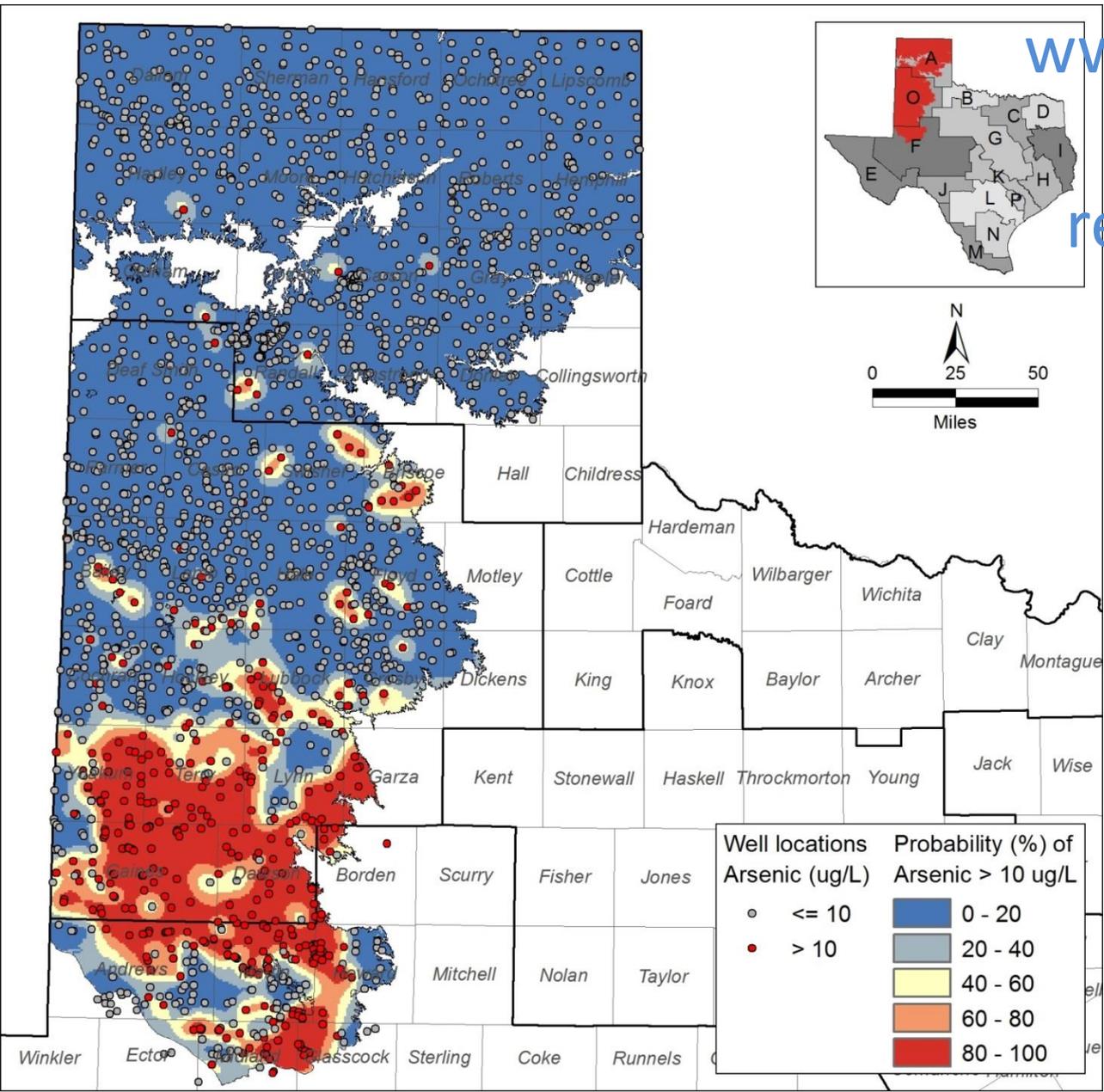
TWDB water quality network wells

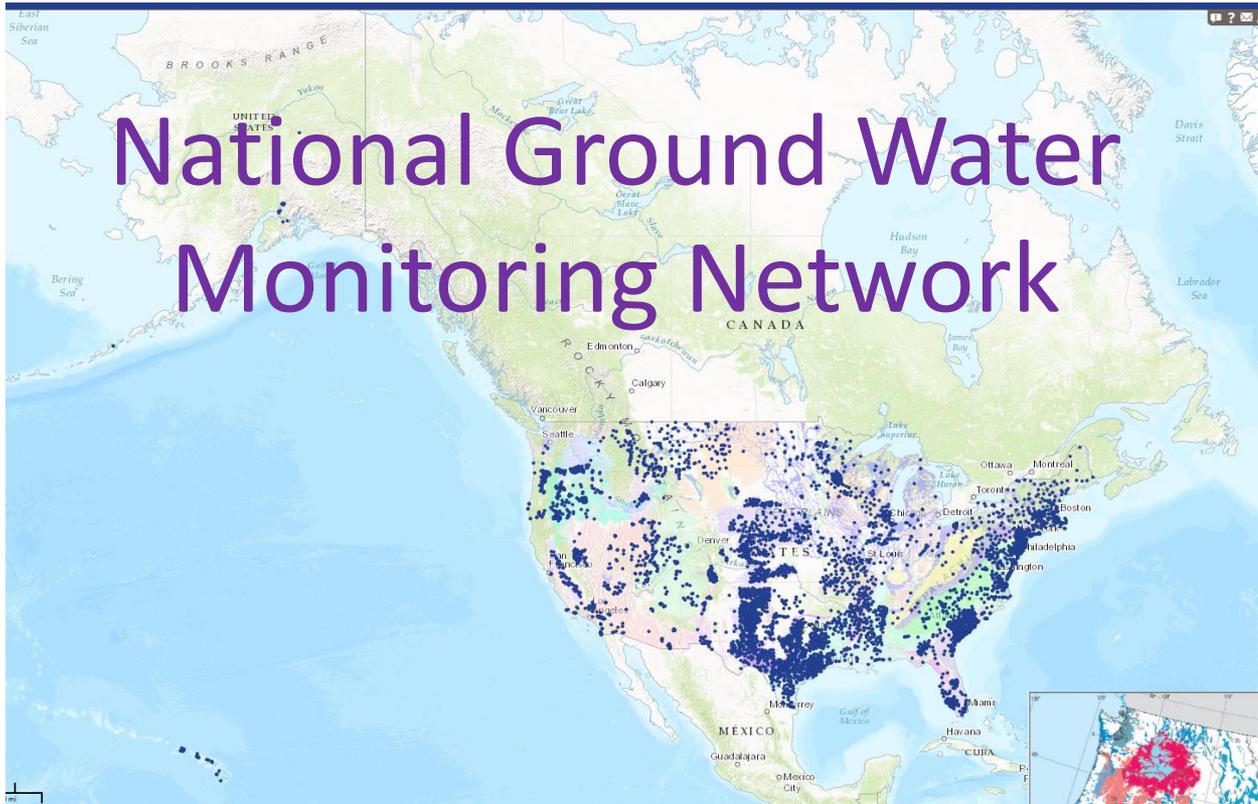


Sites sampled by TWDB and cooperators in FY2016

- ◆ Texas Water Development Board (192 samples)
 - ◆ Groundwater conservation districts and other cooperators (289 samples)
 - Major aquifers
 - Minor aquifers (only shown where there is no major aquifer)
- Total sites (481)

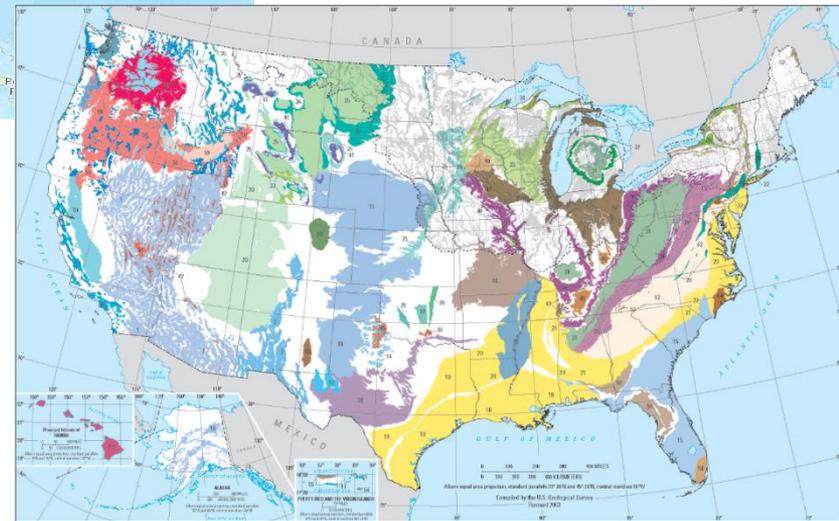
www.twdb.texas.gov/publications/reports/contracted_reports/doc/1004831125.pdf



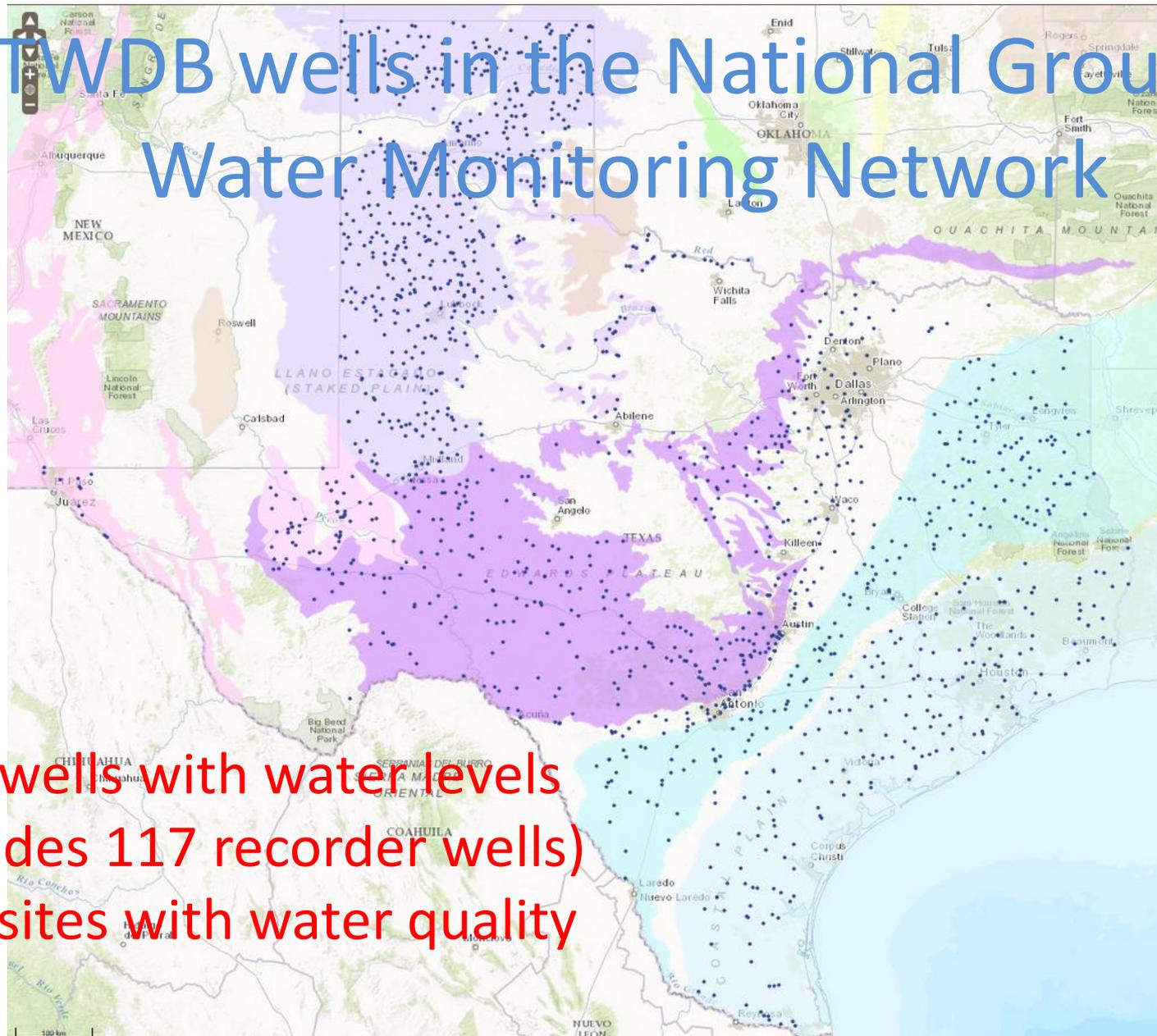


Collaborative effort between the U.S. Geological Survey and state agencies

Principal aquifers in the U.S.



TWDB wells in the National Ground Water Monitoring Network



820 wells with water levels
(includes 117 recorder wells)
572 sites with water quality



WATER DATA Interactive

Water Data Interactive



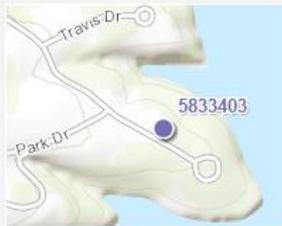
☒ **TexMesonet**

An interactive mapping application for viewing a network of selected weather stations and rain gages throughout the state of Texas. The application displays current weather conditions, radar and 24 hour time series graphs.



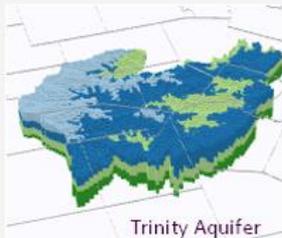
☒ **Texas FLOOD Viewer**

An interactive mapping application for viewing current conditions and up-to-date information for flooding in your area.



☒ **Groundwater Data Viewer**

This interactive mapping application provides access to water-related data for Texas. The viewer contains several GIS datasets relating to water resources, including TWDB groundwater data, brackish groundwater data, and data [click to show more](#)

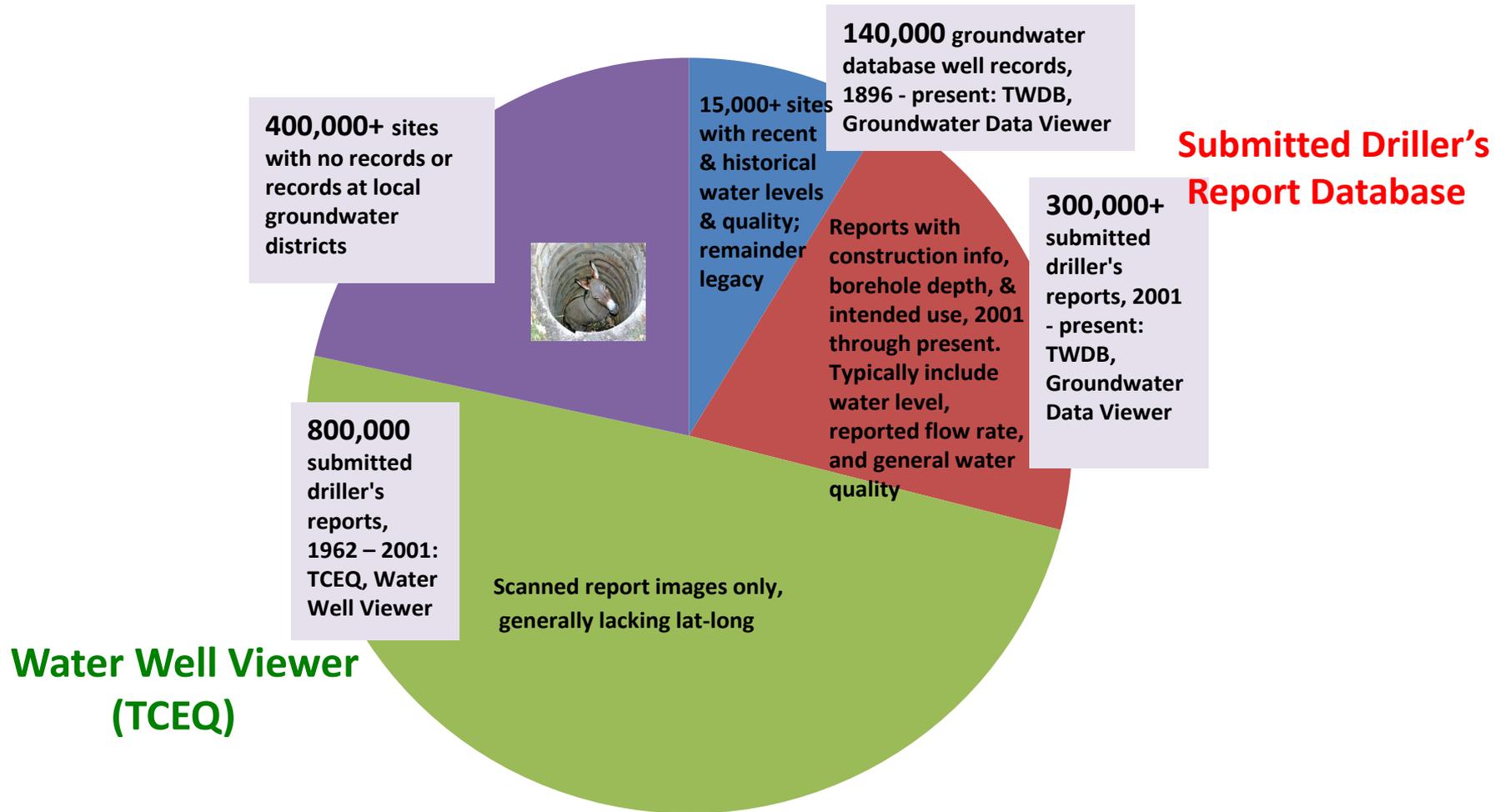


☒ **Major Aquifer 3D Viewer**

A three dimensional interactive viewer for exploring the major aquifers of Texas. After choosing an aquifer, users can choose to be re-directed to a 3D viewer that allows visual manipulation of the subsurface model. The [click to show more](#)

Location of records for 1.5+ million water wells drilled in Texas since the late 1890s

Groundwater Database



Water Data Interactive



2017 State Water Plan

To ensure the ongoing vitality of our economy, Texas' citizens, water experts, and government agencies collaborate in a comprehensive water planning process. We plan so that Texans will have enough water in the

[click to show more](#)



Water Data for Texas



This website is a product of the Texas Water Development Board (TWDB) Water Science Conservation Division and is made possible by the support of management and staff at TWDB. This project is part of our ongoing efforts to

[click to show more](#)



GEMSS/2

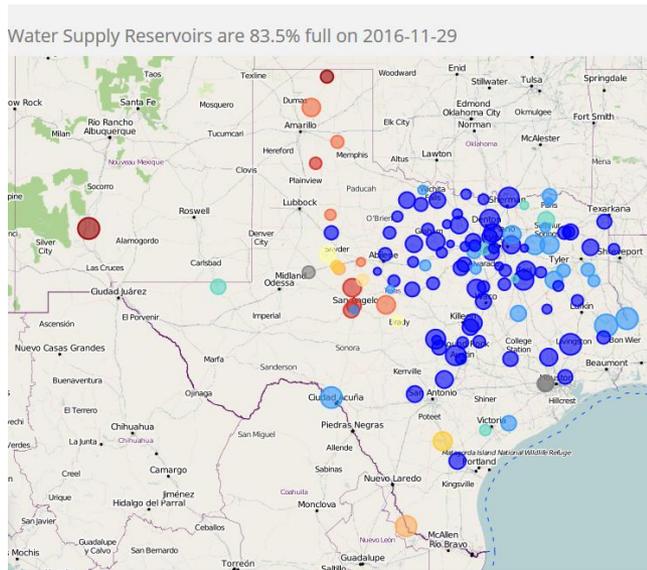
The Geospatial Emergency Management Support System (GEMSS) was developed by the Texas Natural Resources Information System (TNRIS), a part of the Texas Water Development Board, using the Hazard Mitigation Grant

[click to show more](#)

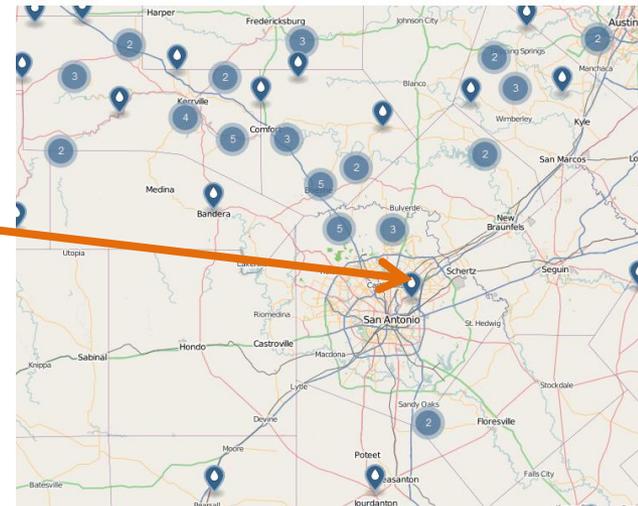
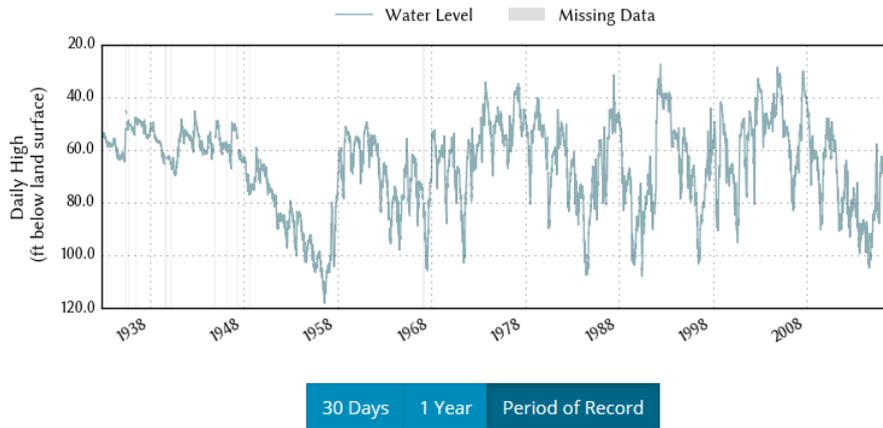


Water Data for Texas

- *reservoirs
- *recorder wells
- *drought resources
- *coastal gages



State Well Number 6837203 is 50.71 feet below land surface on 2016-11-29



TWDB Monitoring Section Contacts

Bryan Anderson - 512/475-3302

Data Team Lead

Water-Level Program Supervisor

Blake Neffendorf- 512/463-8044

Recorder Program Supervisor

Chris Muller - 512/936-0846

Groundwater Quality Program Supervisor

Janie Hopkins - 512/936-0841

Groundwater Monitoring Section Manager

Texas Water Development Board Groundwater-Related Databases

Bryan Anderson
Groundwater Data Team Lead
Groundwater Division
Texas Water Development Board

TWDB databases

- Groundwater Database (GWDB)
- Submitted Drillers Reports (SDR) Database
- Brackish Resources Aquifer Characterization System (BRACS) Database
 - Some wells exist in all three databases

Groundwater Database (GWDB)

- Main purpose to collect and store data to help identify the natural properties of the aquifers in Texas
 - Water levels, water quality, geophysical logs, etc.
- Mostly legacy data with about 10% of the wells visited by TWDB or cooperators for data collection
- Intention was not to create an inventory of all wells drilled in the state

Submitted Drillers Reports Database (SDR)

- Cooperation with Texas Department of Licensing and Regulation (TDLR) Water Well Drillers and Pump Installers Program
- Well reports & plugging reports
- Began data collection in 2001
- Well reports previous to 2002 available at the Texas Commission on Environmental Quality (TCEQ) Water Well Map Viewer

Brackish Resources Aquifer Characterization System Database (BRACS)

- Designed to store well and geology information in support of projects to characterize the brackish groundwater resources of Texas
- Compiles well information from several sources
- Currently limited to study areas in the state

GWDB reports and downloads

<http://www.twdb.texas.gov/groundwater/data/gwdbbrpt.asp>

The screenshot shows the Texas Water Development Board website. The header includes the logo, a search bar, and social media links. The navigation menu highlights "Groundwater". The main content area is titled "Groundwater Database (GWDB) Reports" and contains a detailed description of the database, a disclaimer, and a section for "Reports and Downloads". A sidebar on the right lists various categories, with "Groundwater Database (GWDB)" highlighted in yellow. Below the main text, there is a "Well Search by Map" section with a brief description.

Texas Water Development Board

Home Board SWIFT Financial Assistance Water Planning **Groundwater** Surface Water Flood Conservation Innovative Water

Groundwater Database (GWDB) Reports

The Texas Water Development Board (TWDB) Groundwater Database (GWDB) contains information on selected water wells, springs, oil/gas tests (that were originally intended to be or were converted to water wells), water levels, and water quality to gain representative information about aquifers in Texas to support water planning from a local to a more regional perspective.

Except where noted, all of the information provided in the GWDB is believed to be accurate and reliable; however, the TWDB assumes no responsibility for any errors appearing in rules or otherwise. Further, TWDB assumes no responsibility for the use of the information provided. PLEASE NOTE that users of these data are responsible for checking the accuracy, completeness, currency and/or suitability of all information themselves. TWDB makes no guarantees or warranties as to the accuracy, completeness, currency, or suitability of the information provided via the GWDB. TWDB specifically disclaims any and all liability for any claims or damages that may result from providing GWDB data or the information it contains. Check out the [Explanation of TWDB Groundwater Database](#) for more information.

Reports and Downloads

Reports are designed to view a select set of information in the GWDB, not for viewing all records in the database. Reports allow the user to select or enter certain information to obtain records for that specific criteria. There is an option to export the reports to several different formats; although the reports are optimized for viewing as PDF and CSV formats. To get the entire GWDB, go to the Downloads section below.

Reports

[Well Search by Map](#)
Use the TWDB Water Data Interactive (WDI) Groundwater Data Viewer to search for well records. Click "Groundwater" at the top of the page to view other groundwater data, including well and plugging reports. Several base maps and layers, along with

- Aquifers
- Groundwater Management Areas
- Groundwater Conservation Districts
- Groundwater Data
 - Numbered Reports
 - Bulletins
 - Historical Groundwater Reports
 - Automated Groundwater Level Wells
 - Groundwater Database (GWDB)**
 - Submitted Drillers Reports (SDR) Database
 - Water Data Interactive (WDI) Groundwater Data Viewer
- Groundwater Models
- Groundwater Educational Videos
- Regional Water Planning Areas
- Special Projects
- Rules and Statutes
- Frequently Asked Questions
- External Resources
- Groundwater Staff

Owner: Driller: View Report
 Grid Number (up to 5 digits, no dashes): County:
 River Basin: Aquifer:
 Groundwater Conservation District (GCD): Pump:
 Groundwater Management Area (GMA): Well Type:
 Regional Water Planning Area (RWPA): Well Use:
 Well Report Tracking Number: Owner Well Number:
 TCEQ Source ID: GCD Well Number:
 USGS Site Number: Coordinate Format:


Texas Water Development Board (TWDB) Groundwater Database (GWDB)
Record of Wells Report
Advanced Search
Number of Wells: 697

State Well Number	Coordinates	County	River Basin	GMA	RWPA	GCD	Grid Number	Aquifer	Aquifer Code	Owner	Driller	Well Type	Drilling End Date	Well Depth (ft. below land surface)	Casing Intervals				Land Surface Elevation (ft. above sea level)	Water Number - Period - Min & Max
															Cas Type	Dia (In.)	Top (ft.)	Bot (ft.)		
6850207	29° 14' 13" N 098° 47' 51" W	Atascosa	Nueces	13	L - South Central Texas	Evergreen UWCD	68502	Carrizo-Wilcox	124WLXC - Wilcox Group	City of Lytle	Oliver Well Service	Withdrawal of Water	9/16/1991	106	Blank Screen	5	0	76	721	1 Mea: 1991 20
6850208	29° 14' 06" N 098° 47' 46" W	Atascosa	Nueces	13	L - South Central Texas	Evergreen UWCD	68502	Carrizo-Wilcox	124WLXC - Wilcox Group	City of Lytle	Oliver Well Service	Withdrawal of Water	9/18/1991	106	Blank Screen	5	0	76	721	1 Mea: 1991 20
6850501	29° 12' 12" N 098° 48' 10" W	Atascosa	Nueces	13	L - South Central Texas	Evergreen UWCD	68505	Carrizo-Wilcox	124WLXC - Wilcox Group	O.M. Naegelin		Withdrawal of Water	0/0/1965	530				720	1 Mea: 1969 174.18	

SDR reports and downloads

<http://www.twdb.texas.gov/groundwater/data/drillersdb.asp>

The screenshot shows the Texas Water Development Board website. The page title is "Submitted Drillers Reports (SDR) Database". The navigation menu includes "Home", "Board", "SWIFT", "Financial Assistance", "Water Planning", "Groundwater", "Surface Water", "Flood", "Conservation", and "Innovative Water". The "Groundwater" menu item is highlighted in yellow. The main content area contains a description of the SDR Database, a warning about unverified well locations, and a link to the Texas Commission on Environmental Quality (TCEQ) Water Well Report Viewer. A pink banner highlights "★ Licensed Water Well Drillers - see bottom of page". Below this is the "Reports and Downloads" section, which explains that reports are designed to view a select set of information. The "Reports" section includes a link to "Well Reports Search by Map" and instructions on how to use the TWDB Water Data Interactive (WDI) Groundwater Data Viewer. A right-hand sidebar contains a list of links, with "Submitted Drillers Reports (SDR) Database" highlighted in yellow. The sidebar also includes links for "Aquifers", "Groundwater Management Areas", "Groundwater Conservation Districts", "Groundwater Data", "Groundwater Models", "Groundwater Educational Videos", "Regional Water Planning Areas", "Special Projects", "Rules and Statutes", and "Frequently Asked Questions".

Submitted Drillers Reports (SDR) Database

The Submitted Drillers Report (SDR) Database is populated from the online Texas Well Report Submission and Retrieval System (TWRSSRS) which is a cooperative Texas Department of Licensing and Regulation (TDLR) and Texas Water Development Board (TWDB) application that registered water-well drillers use to submit their required reports. This system was started 2/5/2001 and began collecting all reports in 2003. **Be aware that the locations of the wells in this database are not verified by State staff and may be inaccurate. Added Proposed Use: Fracking Supply in February 2011.**

Reports that drillers submitted by mail before the inception date are not included in this database, but are available for access at the [Texas Commission on Environmental Quality \(TCEQ\) Water Well Report Viewer](#).

★ **Licensed Water Well Drillers - see bottom of page**

Reports and Downloads

Reports are designed to view a select set of information in the SDR database, not for viewing all records in the database. Reports allow the user to select or enter certain information to obtain well records for that specific criteria. There is an option to export the reports to several different formats. To get the entire SDR database, go to the Downloads section below.

Reports

[Well Reports Search by Map](#)

Use the TWDB Water Data Interactive (WDI) Groundwater Data Viewer to search for well reports. Click "Groundwater" at the top of the page to view other groundwater

- Aquifers
- Groundwater Management Areas
- Groundwater Conservation Districts
- Groundwater Data
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- Groundwater Educational Videos
- Regional Water Planning Areas
- Special Projects
- Rules and Statutes
- Frequently Asked Questions

Drilling Date Range: From NULL Drilling Date Range: To NULL View Report

Owner Name Well Address

County Well City

Well Zip License Number

Driller Name Drilling Company

Grid Number Proposed Use

Well Report Tracking Number

Submitted Drillers Reports - Well Reports



Well Report Tracking Number	Type Of Work	Proposed Use	Owner Name	County	Well Address	Latitude DD	Longitude DD	Grid Number	Drilling Start Date	Drilling End Date	Borehole Depth (ft.)	Driller Name	Drilling Company	Lic Nu
438549	New Well	Domestic	Tammy Hickman	Aransas	623 Rabbit Run Road, Aransas Pass, 78336	27.9450000	-97.1369440	83-07-6	12/6/2016	12/7/2016	182	Michael Roy Deyo	Mikes Drilling and Pump Service	
438275	New Well	Domestic	Arthur Barragan	Aransas	1002 W Corpus Christi St, Rockport, 78382	28.0155560	-97.0744440	79-64-8	12/1/2016	12/2/2016	158	Michael Roy Deyo	Mikes Drilling and Pump Service	
437601	New Well	Domestic	Dana Wilson	Aransas	489 Bee Rd, Rockport, 78382	27.9888890	-97.1211110	83-08-1	11/17/2016	11/21/2016	176	Michael Roy Deyo	Mikes Drilling and Pump Service	
436153	New Well	Domestic	Bill McCall	Aransas	2191 Mundine Rd, Aransas Pass	27.9673330	-97.1325560	83-07-3	9/29/2016	9/29/2016	150	Scott D Carter	CARTER WATER WELL DRILLING	
436119	New Well	Domestic	Chris Anderson Boat Lodge	Aransas	1941 A1 Hil Rd, Aransas Pass, 78336	27.9619440	-97.1302780	83-07-3	10/26/2016	10/28/2016	187	Michael Roy Deyo	Mikes Drilling and Pump Service	
436098	New Well	Domestic	James Elder	Aransas	1602 W 4th St., Rockport	28.0123610	-97.0821670	79-64-8	9/28/2016	9/28/2016	180	Scott D Carter	CARTER WATER WELL DRILLING	
436095	New Well	Domestic	Dias Construction Company	Aransas	23 Osprey Dr, Rockport	28.1093330	-97.0431390	79-64-2	9/23/2016	9/23/2016	200	Scott D Carter	CARTER WATER WELL DRILLING	
436063	New Well	Domestic	Daniel Phillips	Aransas	1218 W Moore Ave, Aransas Pass, 78336	27.9325000	-97.1425000	83-07-6	10/25/2016	10/27/2016	168	Michael Roy Deyo	Mikes Drilling and Pump Service	
435955	New Well	Domestic	Sim Henry	Aransas	234 Coastal Wildwood Dr., Rockport	27.9851670	-97.1038330	83-08-1	9/12/2016	9/12/2016	180	Scott D Carter	CARTER WATER WELL	



BRACS Database

<http://www.twdb.texas.gov/innovativewater/bracs/database.asp>

The **Brackish Resources Aquifer Characterization System (BRACS) Database** was designed to store well and geology information in support of projects to characterize the brackish groundwater resources of Texas. The BRACS database is fully relational, with self-documenting object naming. The database design relies on extensive use of lookup tables. The BRACS database is a Microsoft Access 2007 format that has been compressed with the WinZip utility. This database will be updated periodically; the date of the last update is embedded in the filename.

This database was developed for use by TWDB staff in support of the BRACS program. The information changes on a daily basis and users should note the following disclaimer regarding the information:

Except where noted, all of the information provided is believed to be accurate and reliable; however, TWDB assumes no responsibility for any errors. Further, TWDB assumes no responsibility for the use of the information provided. PLEASE NOTE that users of these data are responsible for checking the accuracy, completeness, currency and/or suitability of all information themselves. TWDB makes no guarantees or warranties as to the accuracy, completeness, currency, or suitability of the information provided via the BRACS Database. TWDB specifically disclaims any and all liability for any claims or damages that may result from providing BRACS data or the information it contains. Well data and interpretations will be posted during the course of a BRACS study, however data is subject to change prior to publication of the study.

A data dictionary to accompany the BRACS Database is now available for download. The dictionary describes each primary table in the database and custom tables developed for a study.

- Aquifer Storage and Recovery
- Brackish Resources Aquifer Characterization System
 - BRACS FAQs
 - BRACS Studies
 - BRACS Projects
 - BRACS House Bill 30
 - BRACS Database**
 - BRACS GIS Data
 - BRACS Well Logs
 - BRACS TWDB Documents
 - BRACS Useful Links
- Desalination
- Rainwater Harvesting
- Water Reuse
- Innovative Water Technologies Staff
- State Water Implementation Fund for Texas (SWIFT)

Water Data Interactive

<http://www.twdb.texas.gov/mapping/index.asp>

Texas Water Development Board

Home Board SWIFT Financial Assistance Water Planning Groundwater Surface Water Flood Conservation Innovative Water

WATER DATA Interactive

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Interactive Apps and Maps

- TWDB Maps
- GIS Data
- Map Resources
- Data Services

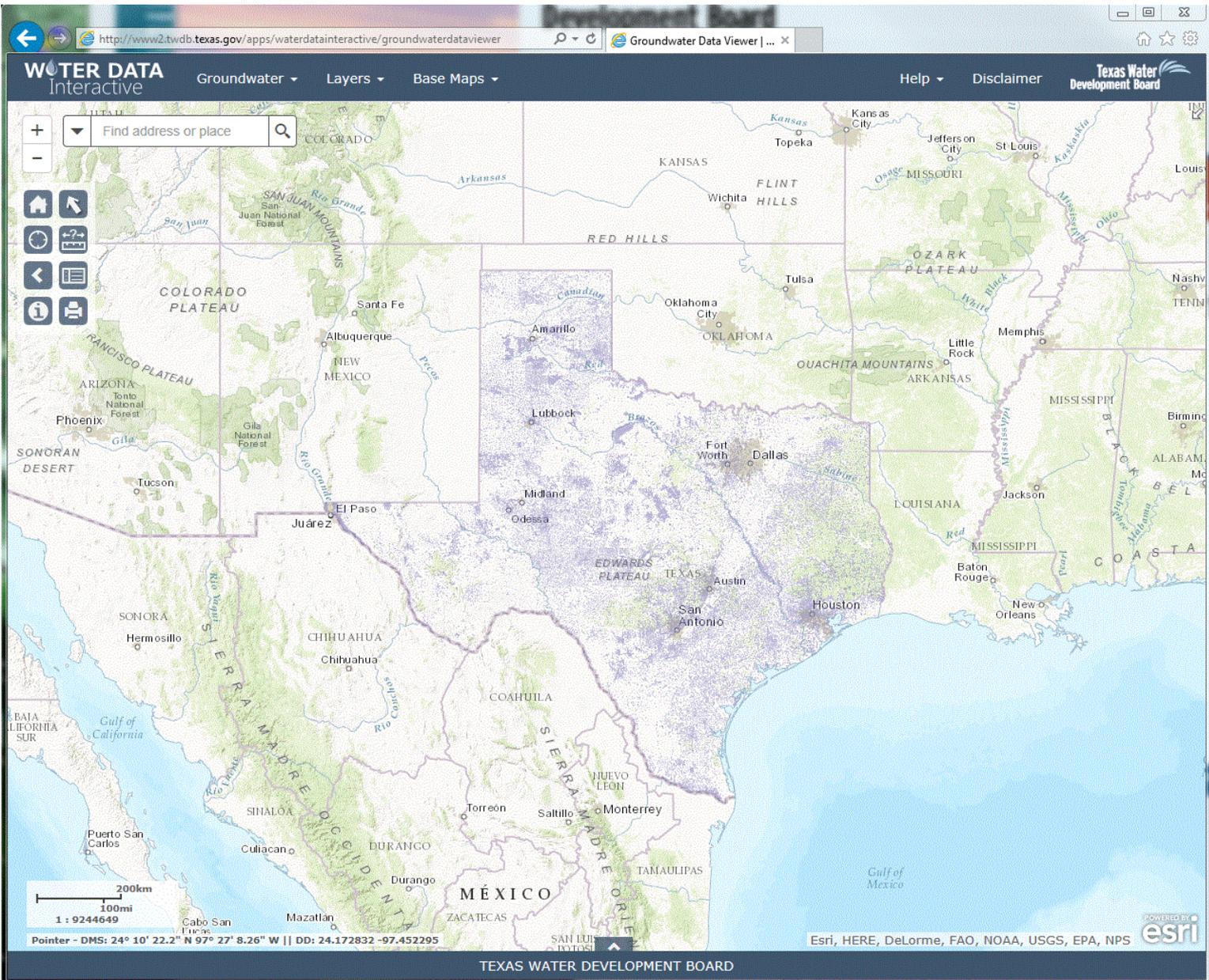
State Water Implementation Fund for Texas (SWIFT)

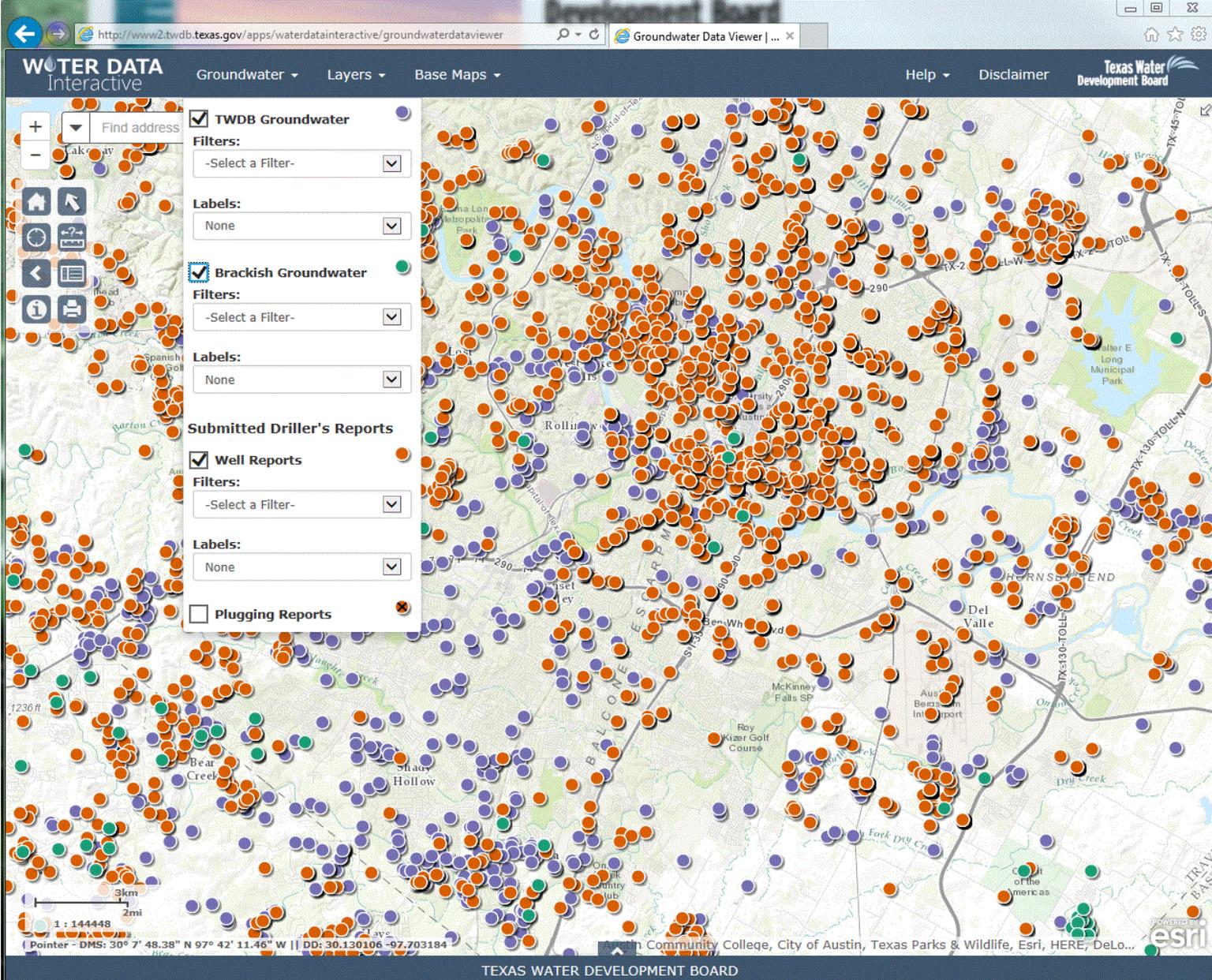
TexMesonet
Weather data-viewer for Texas
An interactive mapping application for viewing a network of selected weather stations and rain gages throughout the state of Texas. The application displays current weather conditions, radar and 24 hour time series graphs.

Texas FLOOD Viewer
An interactive mapping application for viewing current conditions and up-to-date information for flooding in your area.

Groundwater Data Viewer
This interactive mapping application provides access to water-related data for Texas. The viewer contains several GIS datasets relating to water resources, including TWDB groundwater data, brackish groundwater [click to show more](#)

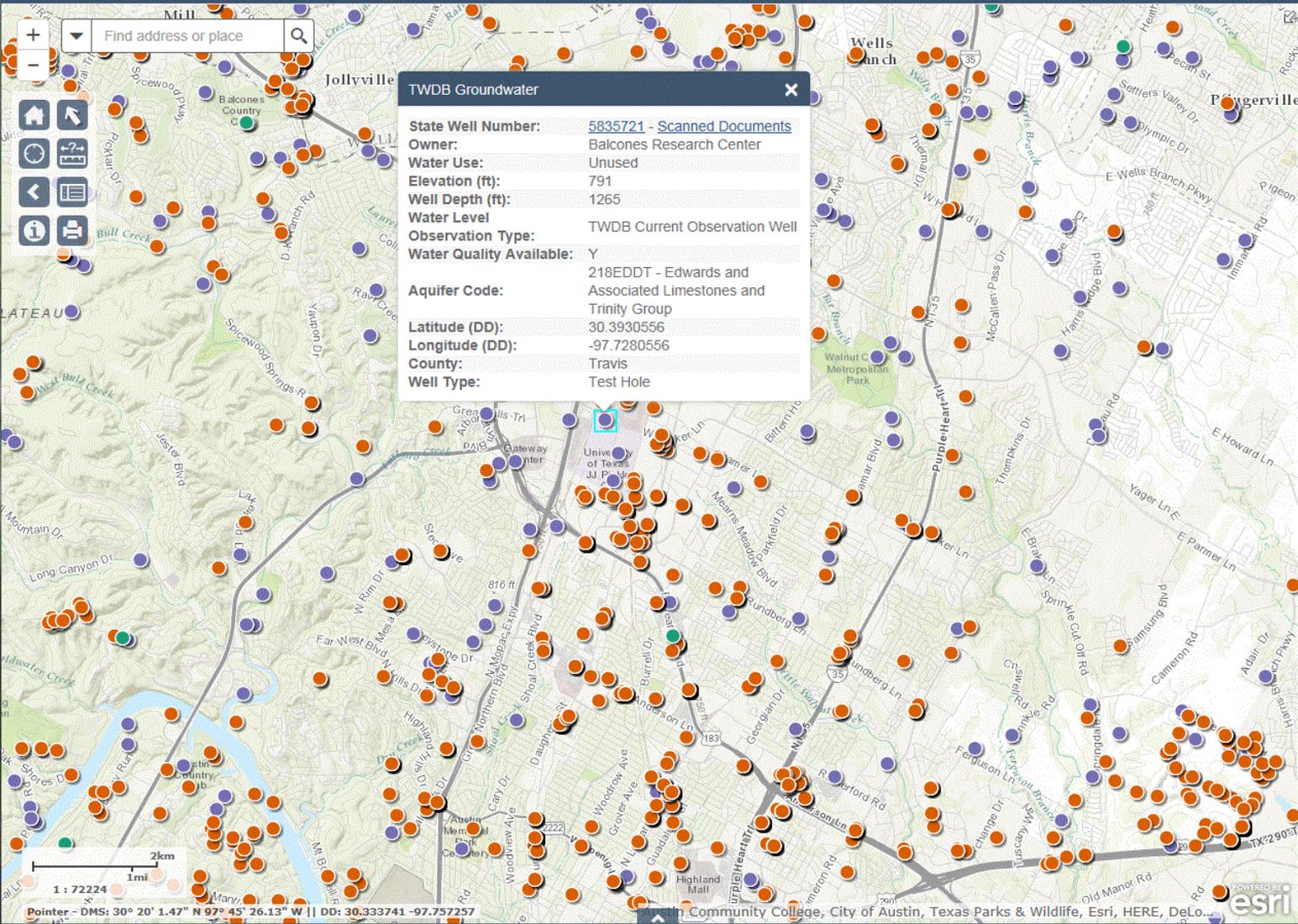
Major Aquifer 3D Viewer
A three dimensional interactive viewer for exploring the major aquifers of Texas. After choosing an aquifer, users





TEXAS WATER DEVELOPMENT BOARD





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Water Data for Texas

<https://waterdatafortexas.org/groundwater>

Water Data for Texas | Reservoirs | Drought | Groundwater | Coastal | About | Texas Water Development Board

Statewide | Download Data | Frequently Asked Questions | About

Automated Groundwater Level Wells

Map showing Automated Groundwater Level Wells across Texas. The map displays numerous wells marked with blue circular icons, each containing a number. The wells are distributed across the state, with a higher concentration in the eastern and central regions. The map includes state boundaries, major cities, and geographical features like rivers and the Gulf of Mexico.

Leaflet | © OpenStreetmap France | © OpenStreetMap

All data are provisional and subject to revision. The Texas Water Development Board (TWDB) specifically disclaims any and all liability for any claims or damages that may result from providing these data.

Download Recent Conditions (only active wells): [csv](#), [json](#)
Download Well Metadata: [kmz \(Google Earth\)](#), [geojson](#)

State Well Number 0712401 is 251.21 feet below land surface on 2016-12-13

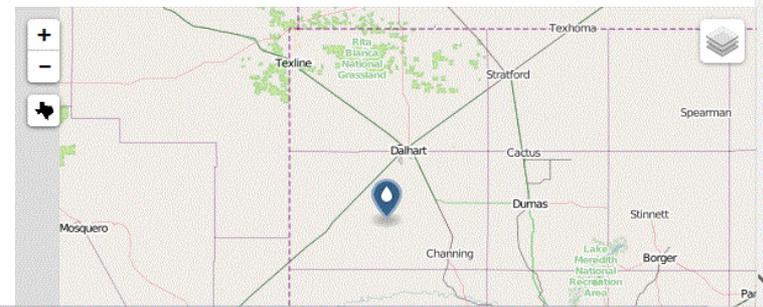


30 Days 1 Year Period of Record

Well Information

All data are provisional and subject to revision. The Texas Water Development Board (TWDB) specifically disclaims any and all liability for any claims or damages that may result from providing these data.

County	Hartley
State Well Number	0712401
Status	Active
Period of Record	1995-09-22 to present
Entity/Cooperator	Texas Water Development Board
Aquifer	Ogallala
Formation	Ogallala Formation
Aquifer Type	Unconfined



Questions & Feedback

Groundwater Data Team

GroundwaterData@twdb.texas.gov

Bryan Anderson

Texas Water Development Board

bryan.anderson@twdb.texas.gov

(512) 475-3302

Groundwater Management

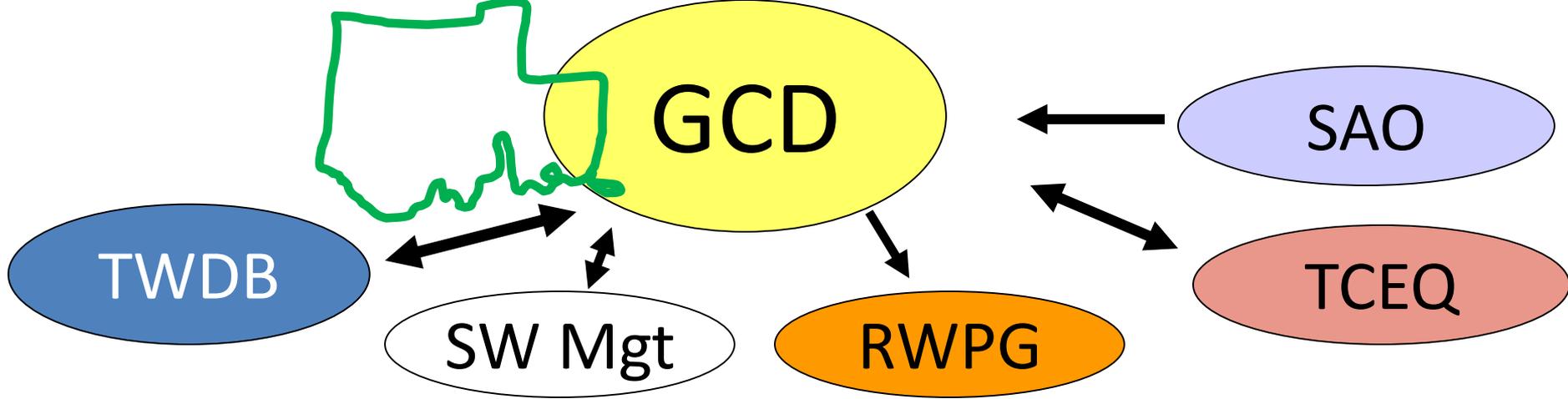
Rima Petrossian, Ph.D., P.G., C.P.G.
Manager
Groundwater Technical Assistance

Background

- Water rights in Texas dependent on source
 - Surface Water
 - Owned by the State
 - Requires permission of State
 - Groundwater
 - Generally belongs to landowner
 - Pump and capture whatever water is available, regardless of the effects on neighboring wells (Rule of Capture)
 - Groundwater conservation districts modify the Rule of Capture through spacing and tract size, correlative rights, historical use, subsidence mitigation...

1949 policy underpinnings: “...underground water isn’t worth a dime if it is left undeveloped.”

- U.S. Geological Survey geologist, W. L. Broadhurst, later to be employed by High Plains Underground Water Conservation District No.1
- Judge I.B. Holt from Lamb County
 - Proposed H.B. 162 establishing groundwater conservation districts in 1949 after a short drought
- Local control established, first districts in the High Plains in 1951



- GCD develops management plan (coordinates w/ surface water management entity)
- TWDB staff assists management plan development; the Executive Administrator approves management plans; serves as a non-voting member of each groundwater management area
- GMA is a map unit comprised of groundwater conservation districts
- RWPG uses groundwater availability for quantifying groundwater
- TCEQ provides regulatory oversight as needed
- SAO may audit District finances

Joint planning (Texas Water Code 36.108)

- Groundwater conservation districts meet at least annually to decide on relevant **aquifers'** future desired conditions
- ✓ these are aquifer conditions used to quantify the amount of groundwater to be extracted from the aquifer
- ✓ this is a locally established policy goal

GCD duties

- Texas Water Code Chapter 36 authorizes
 - Setting rules to limit groundwater production
 - tract size
 - spacing
 - Permit and register wells
 - Controlling land subsidence
 - Preventing degradation of water quality
 - Preventing waste of groundwater
 - Coordinate planning with regions, surface water entities, and stakeholders, in groundwater management areas
 - Keeping records of groundwater production and use

Goals

- as *applicable*:
 - Providing the most efficient use of groundwater (1949)
 - Controlling and preventing waste of groundwater (1949)
 - – “Waste” defined in TWC §36.001(8)(A)-(G)
 - Controlling and preventing subsidence (1997)
 - – generally coastal districts
 - Addressing *conjunctive* surface water management issues (1997)
 - Addressing natural resource issues (1997)

Goals

- Drought conditions (2001)
- Addressing where **appropriate** and **cost-effective**
 - Conservation (2001)
 - Recharge enhancement (arguably 1949)
 - Rainwater harvesting (2005)
 - Precipitation enhancement (2005)
 - Brush control (2005)

Goals

- Address the desired future conditions of the groundwater resources (2005)
 - Monitor progress
 - Spring flow
 - Drawdown
 - Groundwater elevation minimum
 - Groundwater volume in storage
 - Compare to the desired future condition

TWDB: where we fit into the plan

- **Following Chapter 16 and 36 statutes we**
 - help with technical information
 - provide management plan reviews
 - approve or deny management plans for administrative completeness
 - measure wells and collect water samples for maintaining a state well database
 - collect and analyze data, develop groundwater models, and write reports

Contact:

Rima Petrossian

Manager, Groundwater Technical Assistance

512-936-2420

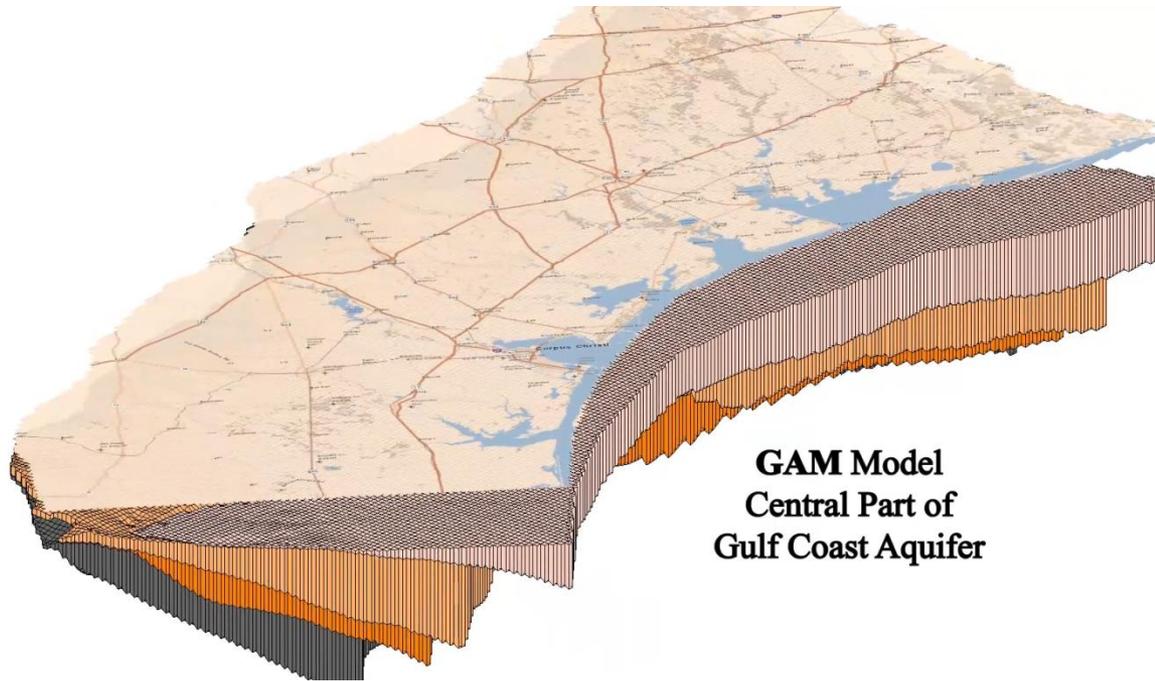
Groundwater Availability Modeling: What's a GAM?

Cindy Ridgeway, P.G.
Manager
Groundwater Availability Modeling

Overview

- What's a GAM?
- Why do we model?
- Where are we modeling?
- Questions?

What's a GAM?



GAM = groundwater availability model

- GAMs are regional-scale groundwater assessment tools
- GAMs use publicly available code—**MODFLOW** (model code by U.S. Geological Survey)
- GAMs are developed through a structured process with public involvement.
- GAMs are publicly available models

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Why do we model?



It's in statute...

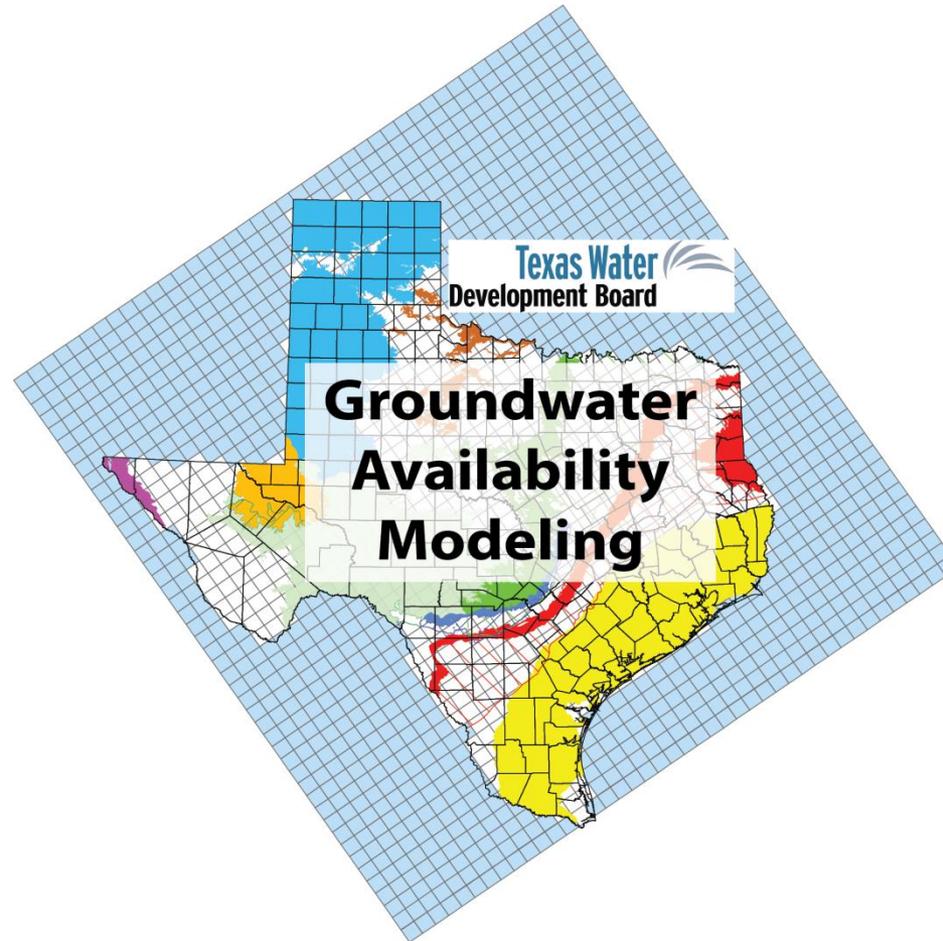
- Section 16.012 STUDIES, INVESTIGATIONS, SURVEYS, Water Code, Subsection (I) The executive administrator shall obtain or develop **groundwater availability models** for major and minor aquifers in coordination with groundwater conservation districts and regional water planning groups ... Modeling of major aquifers shall be completed not later than October 1, 2004.

How do we use groundwater models?

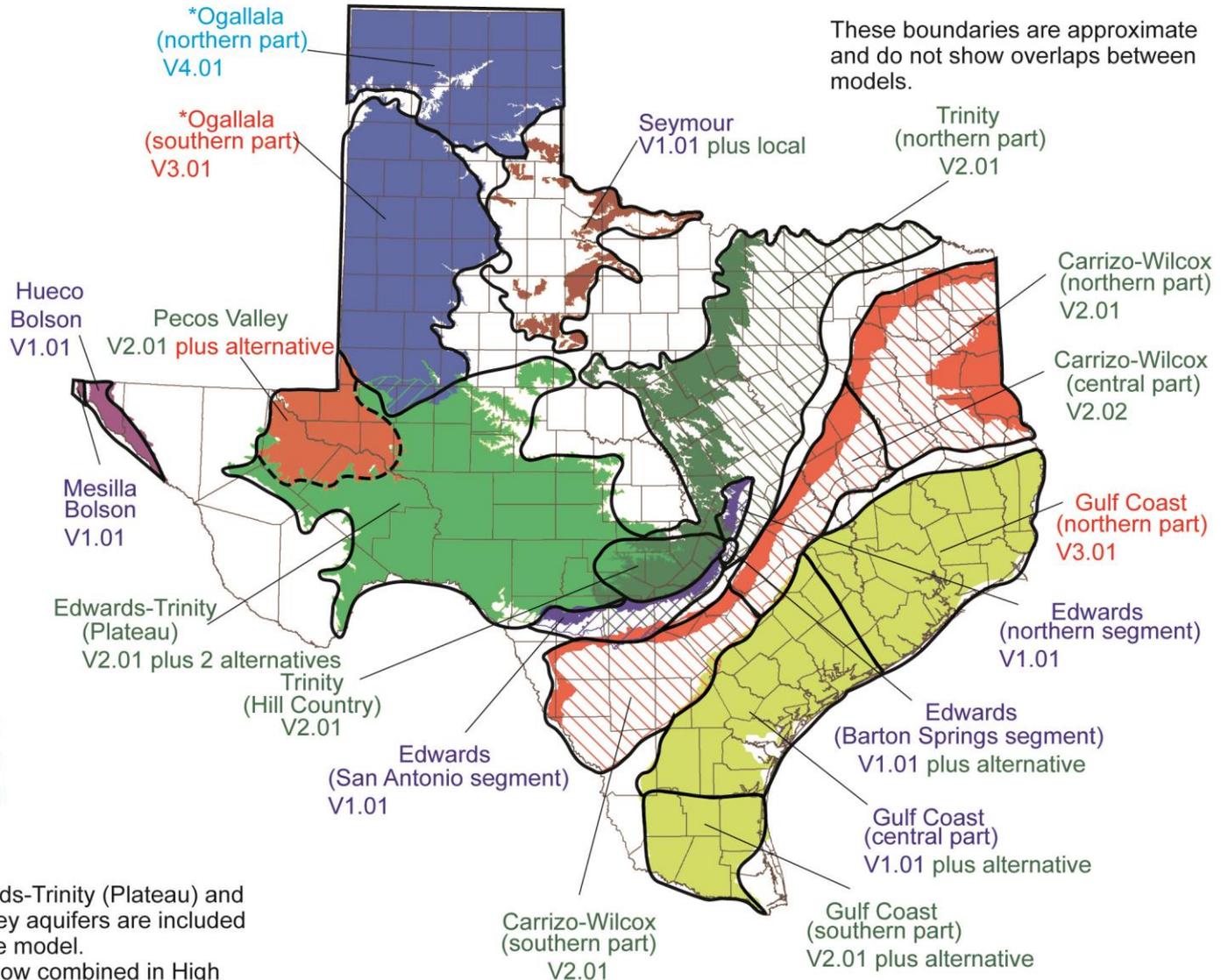
Per Statute:

- Groundwater management areas can use to assist in determining desired future conditions.
- TWDB uses when calculating estimated Modeled Available Groundwater.
- TWDB uses when calculating Total Estimated Recoverable Storage.
- TWDB provides groundwater conservation districts with water budget data for their management plans.
- Assist with information for House Bill 30/House Bill 1232
- Use for analysis of reasonableness for desired future condition petitions

Where do we model?

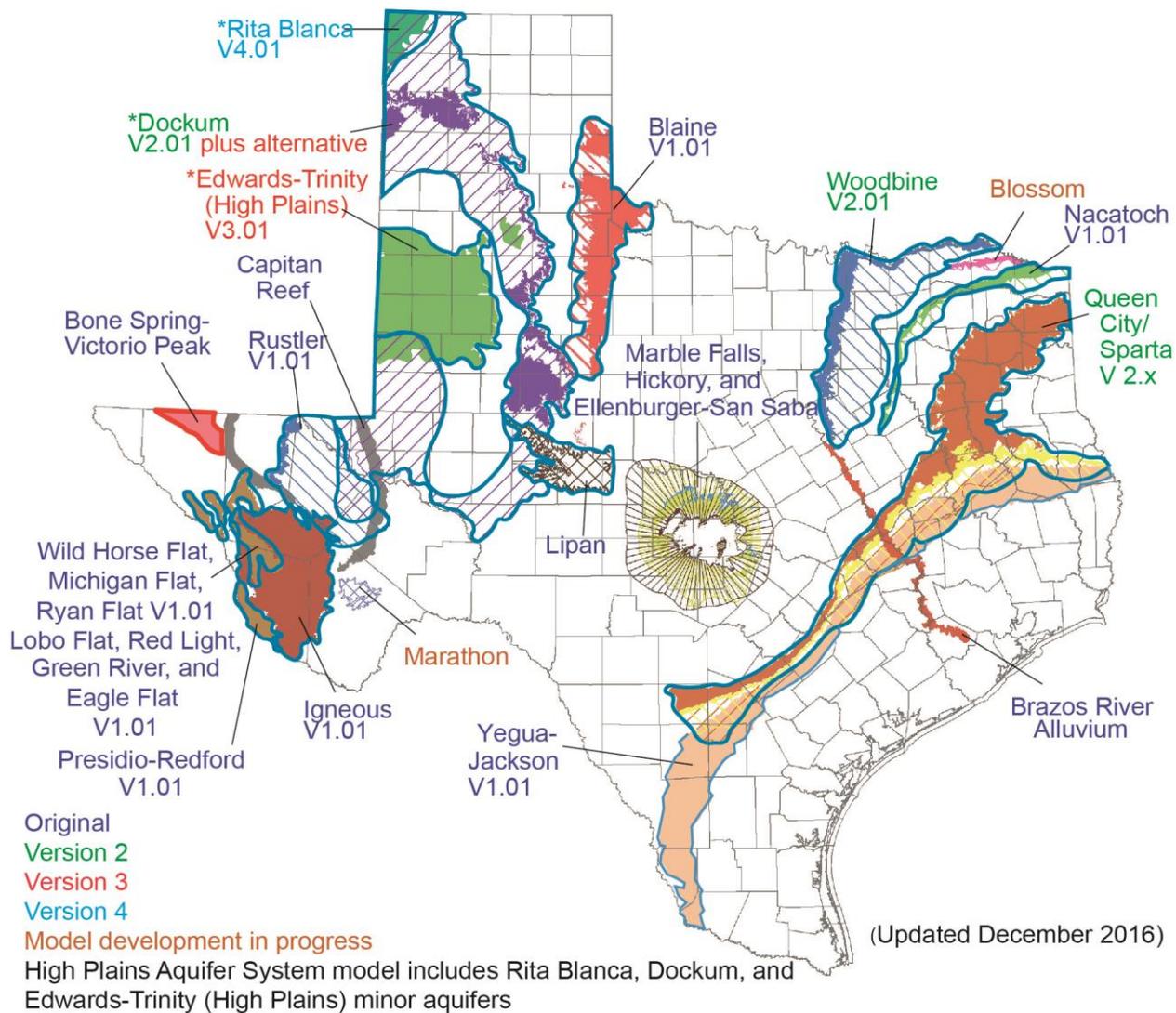


Major aquifers



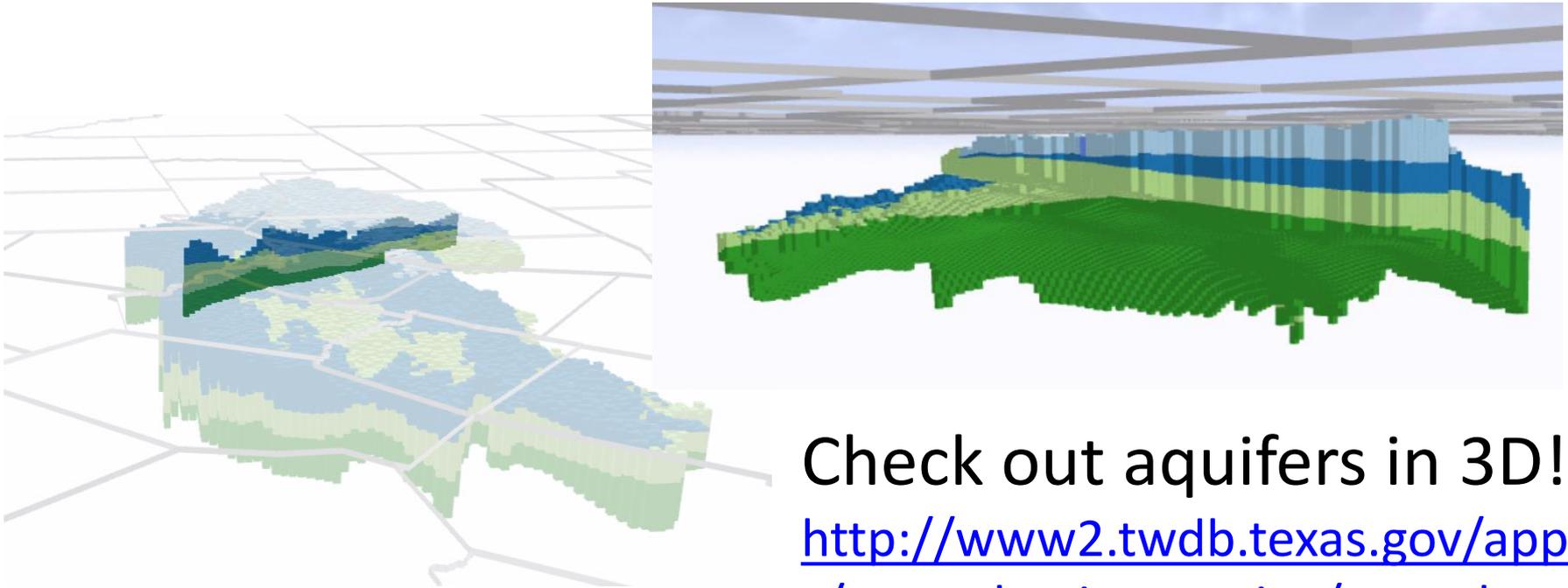
Note:
 The Edwards-Trinity (Plateau) and Pecos Valley aquifers are included in the same model.
 *Ogallala now combined in High Plains Aquifer System model

Minor aquifers



GAMs are good!

<http://www.twdb.texas.gov/groundwater/models/index.asp>



Check out aquifers in 3D!

<http://www2.twdb.texas.gov/apps/waterdatainteractive/gamsdataviewer>

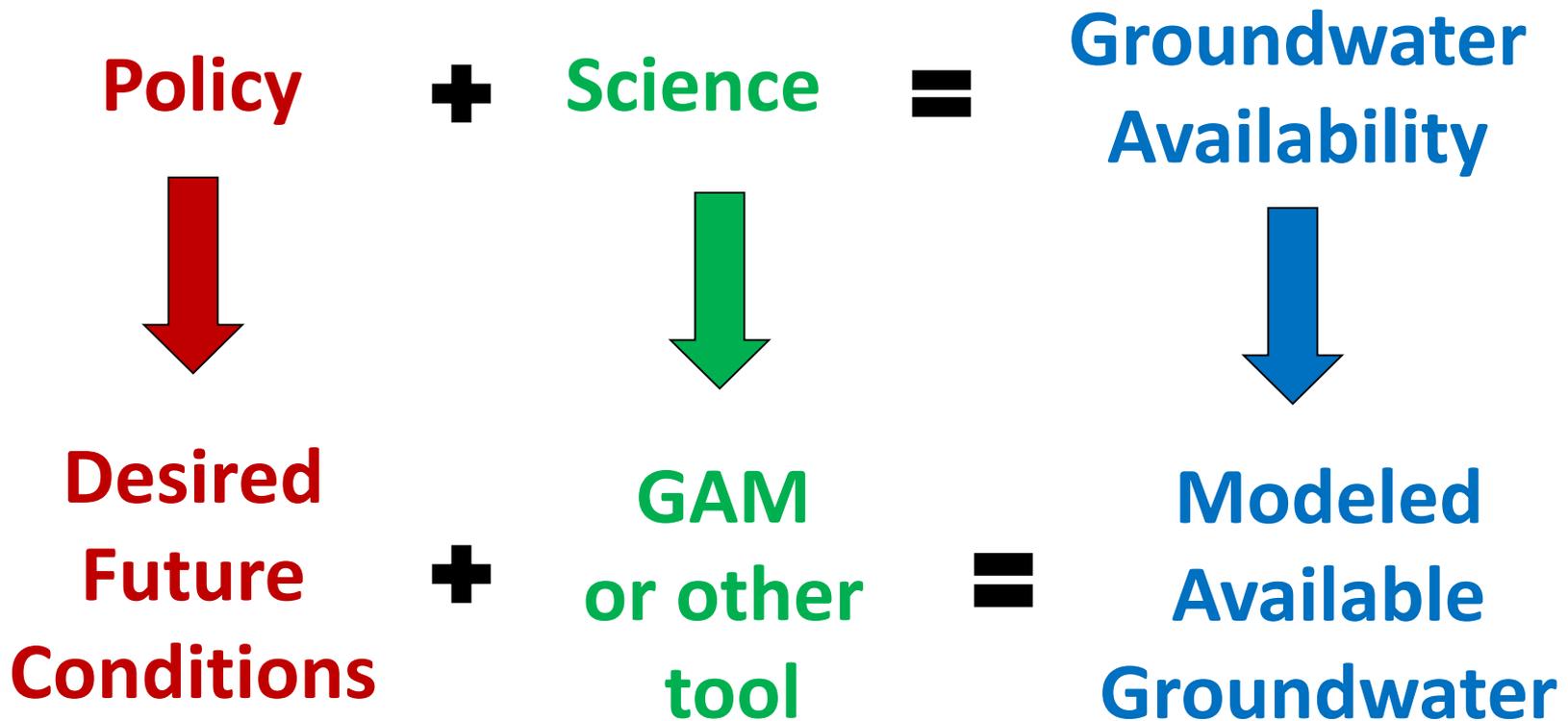
Groundwater Availability and New Topics

Larry French, P.G.

Director

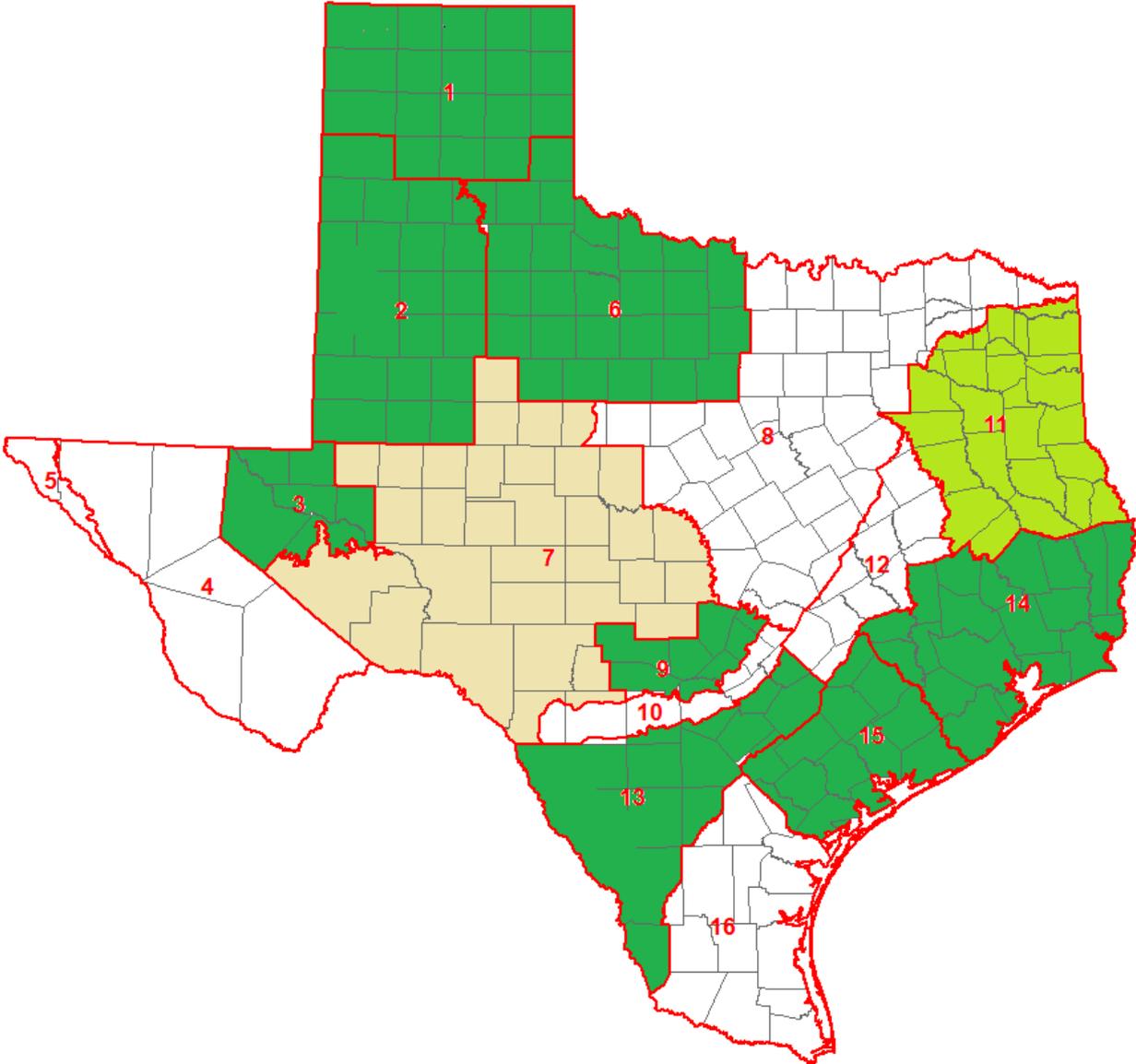
Groundwater Division

What is groundwater availability?

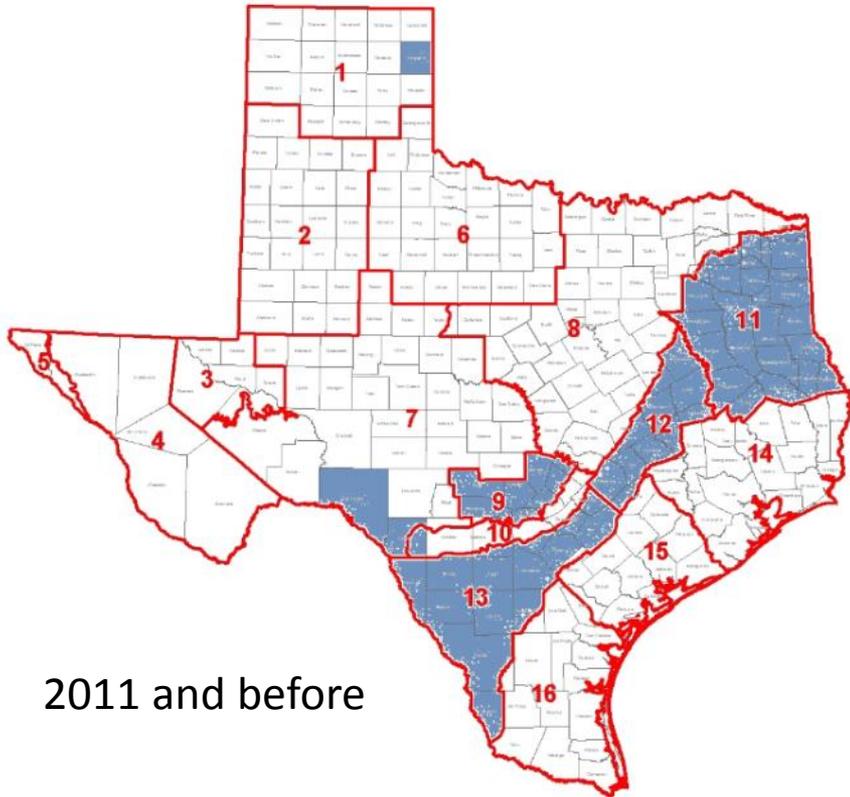


Goal: informed decision-making

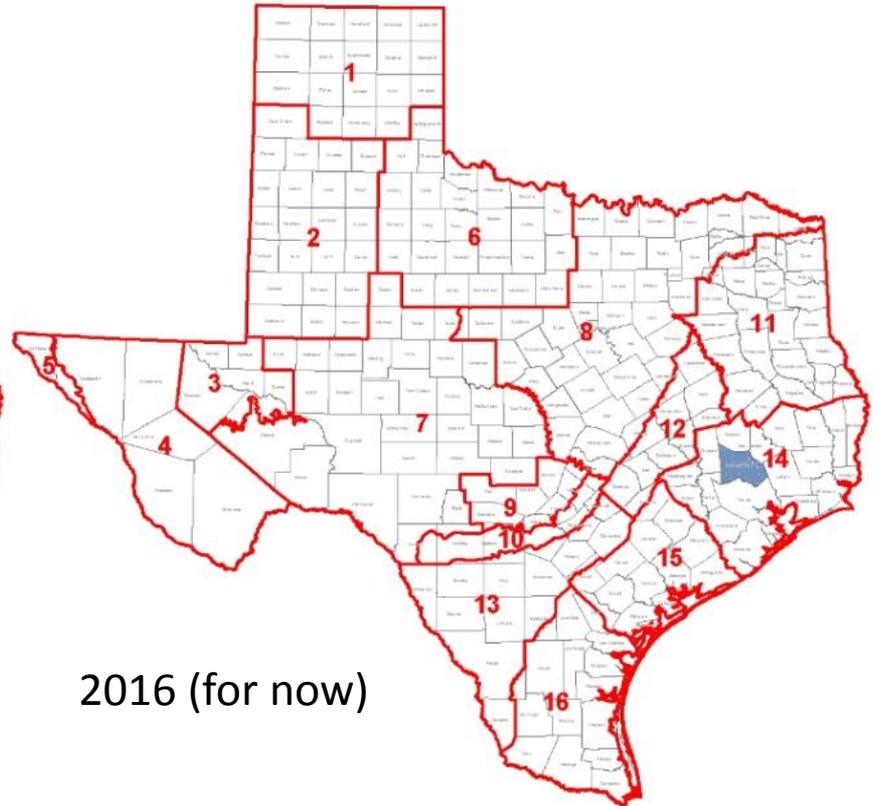
GMAAs with adopted desired future conditions



DFC appeals – then and now (as of 12/16)



2011 and before



2016 (for now)

Note: Law governing DFC appeals was substantially changed in 2015. Previously GMA-based and now GCD-based.

What is a MAG?

"Modeled available groundwater" means the amount of water that may be produced on an average annual basis to achieve a desired future condition.

Districts in groundwater management areas
Establish
Desired Future Conditions
and deliver to TWDB

TWDB provides
estimates of
**Modeled
Available
Groundwater**
to districts and regional
planning groups

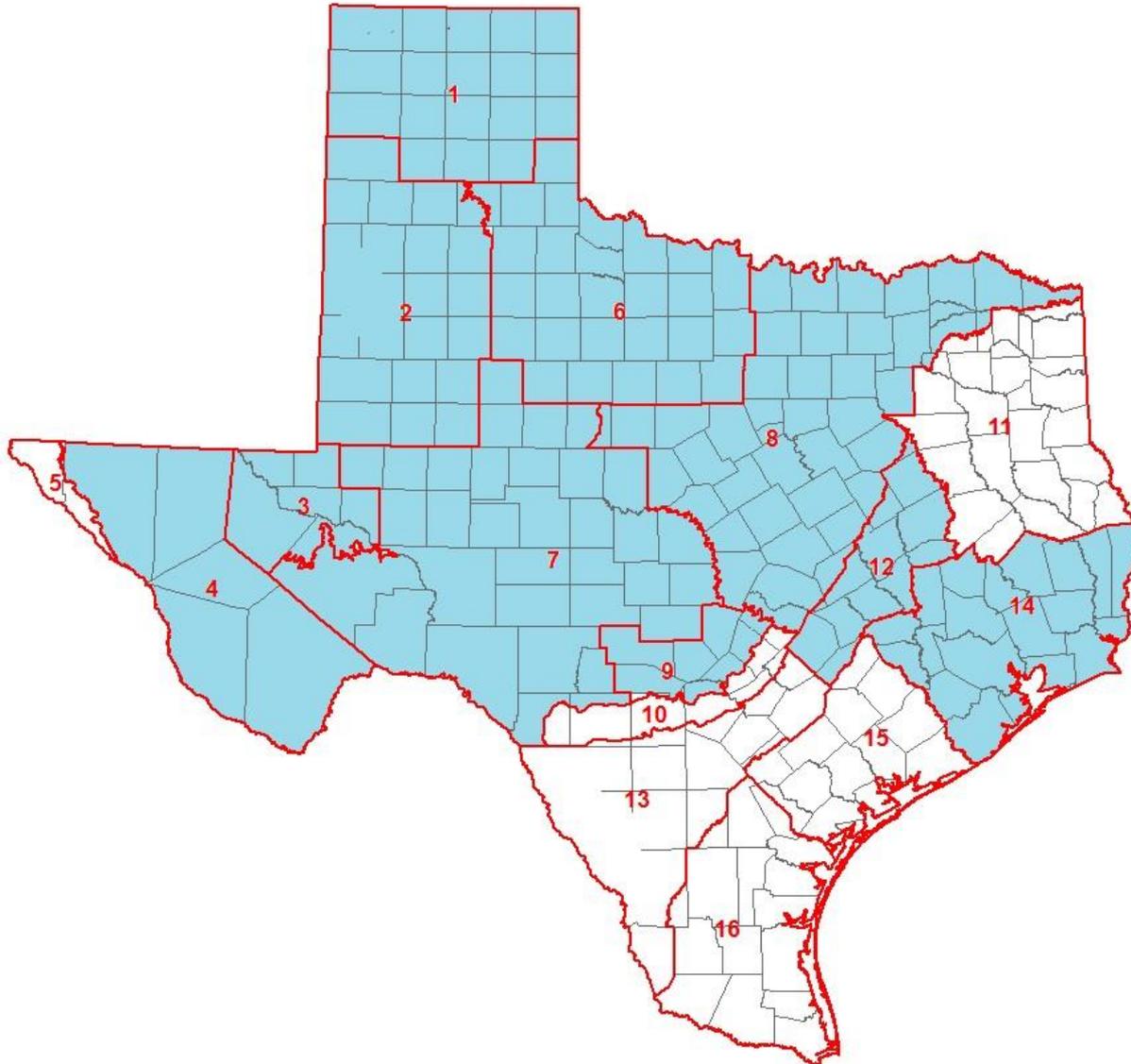
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TWDB provides
estimates of
total pumping
to regional water
planning groups

Districts consider
**Modeled
Available
Groundwater**
in plans and permitting

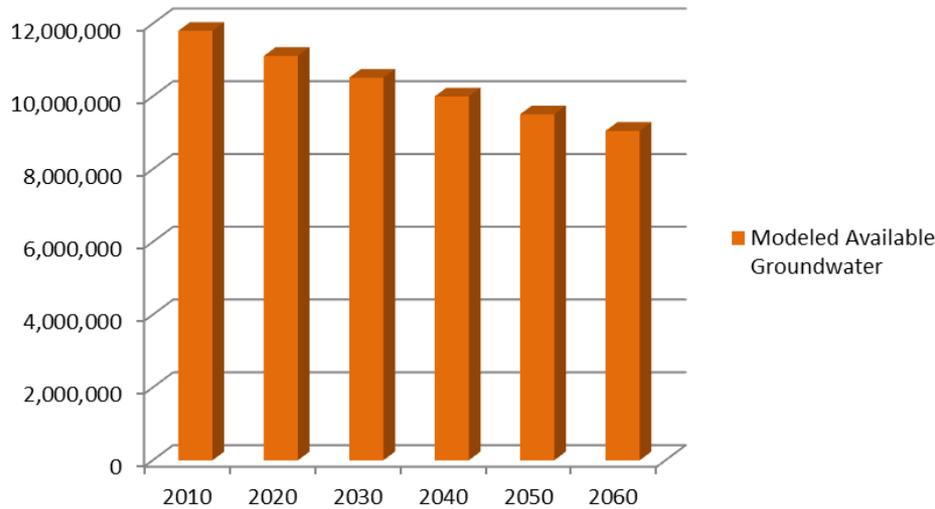
Regional planning groups
include estimates of
**total pumping and
Modeled Available
Groundwater**
in regional water plans

GMAAs with new or upgraded groundwater availability models

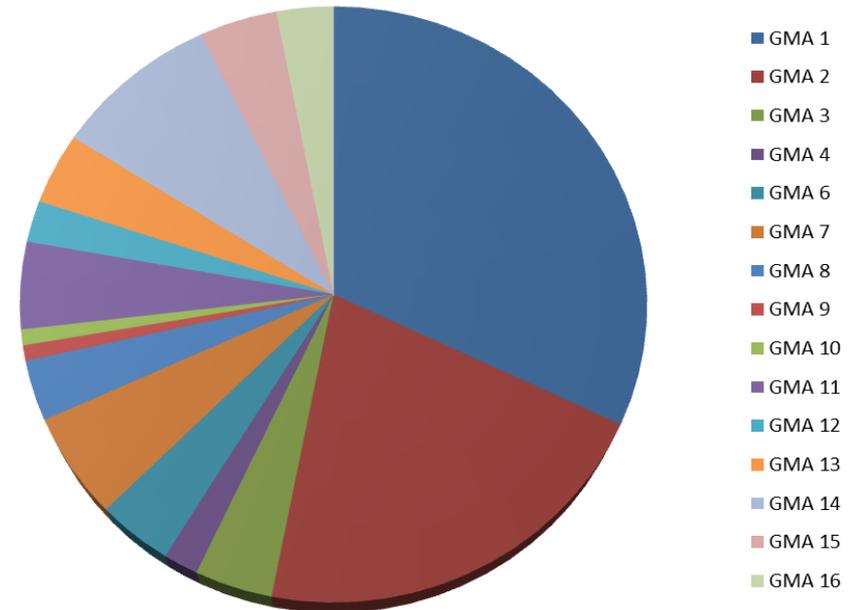


Some facts about modeled available groundwater...

All GMAs



Proportion of Modeled Available Groundwater



**Groundwater
management areas
(GMAs) = Texas**

Development of DFCs

GMAAs = Texas

**Major and minor
aquifers**

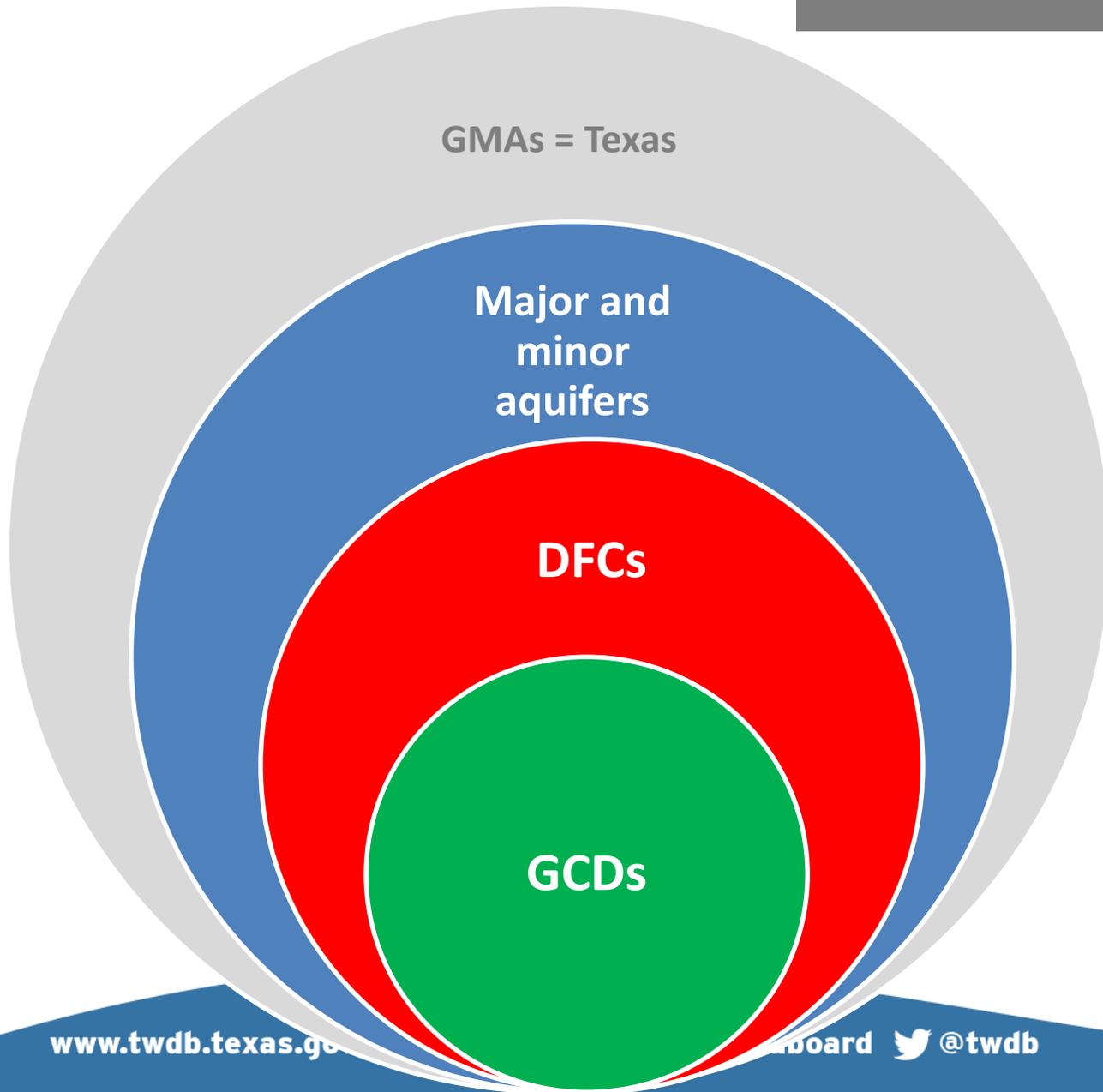
Development of DFCs

GMA = Texas

Major and
minor aquifers

GCDs

Development of DFCs



Development of DFCs

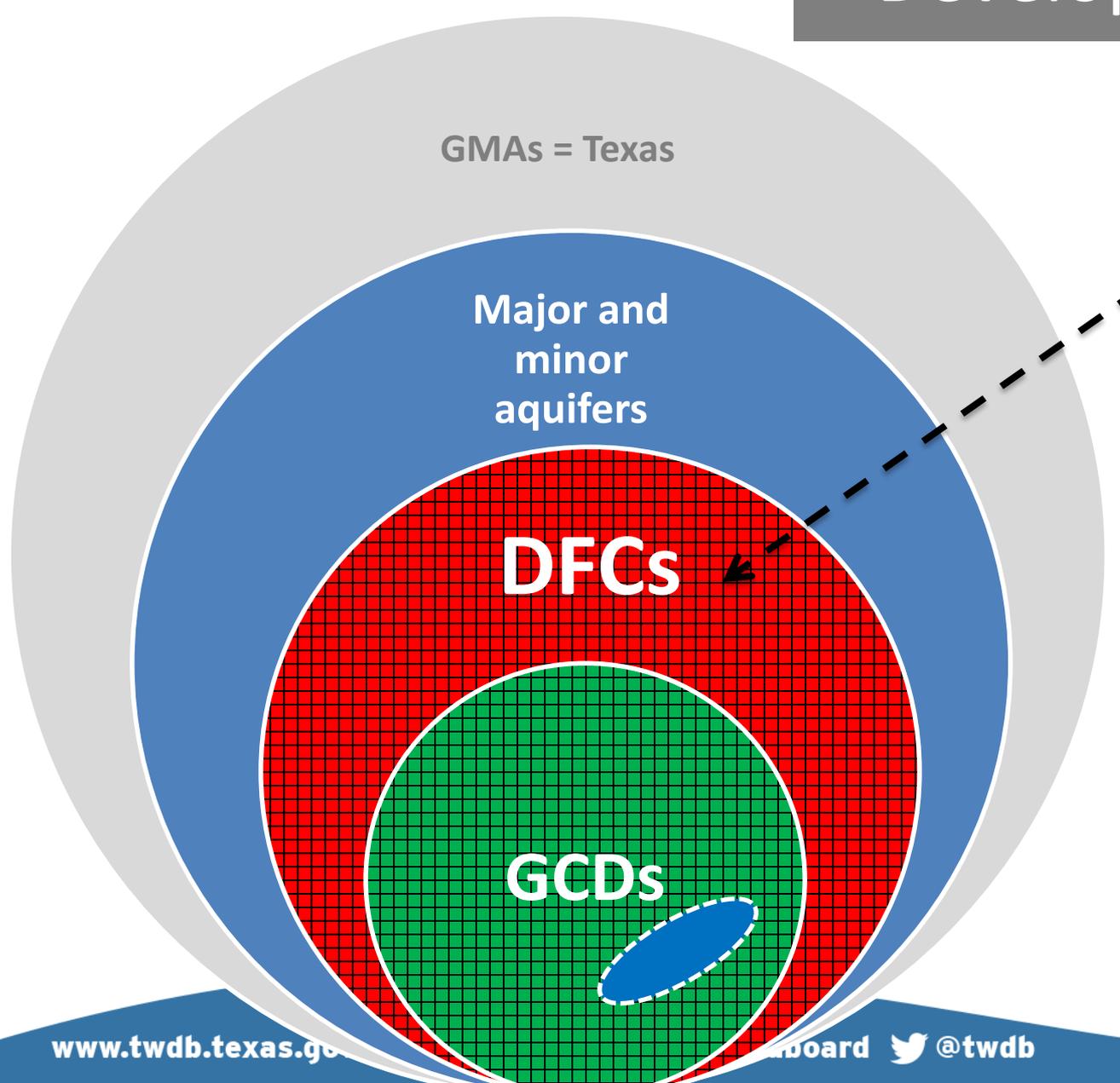
GMA = Texas

Major and minor aquifers

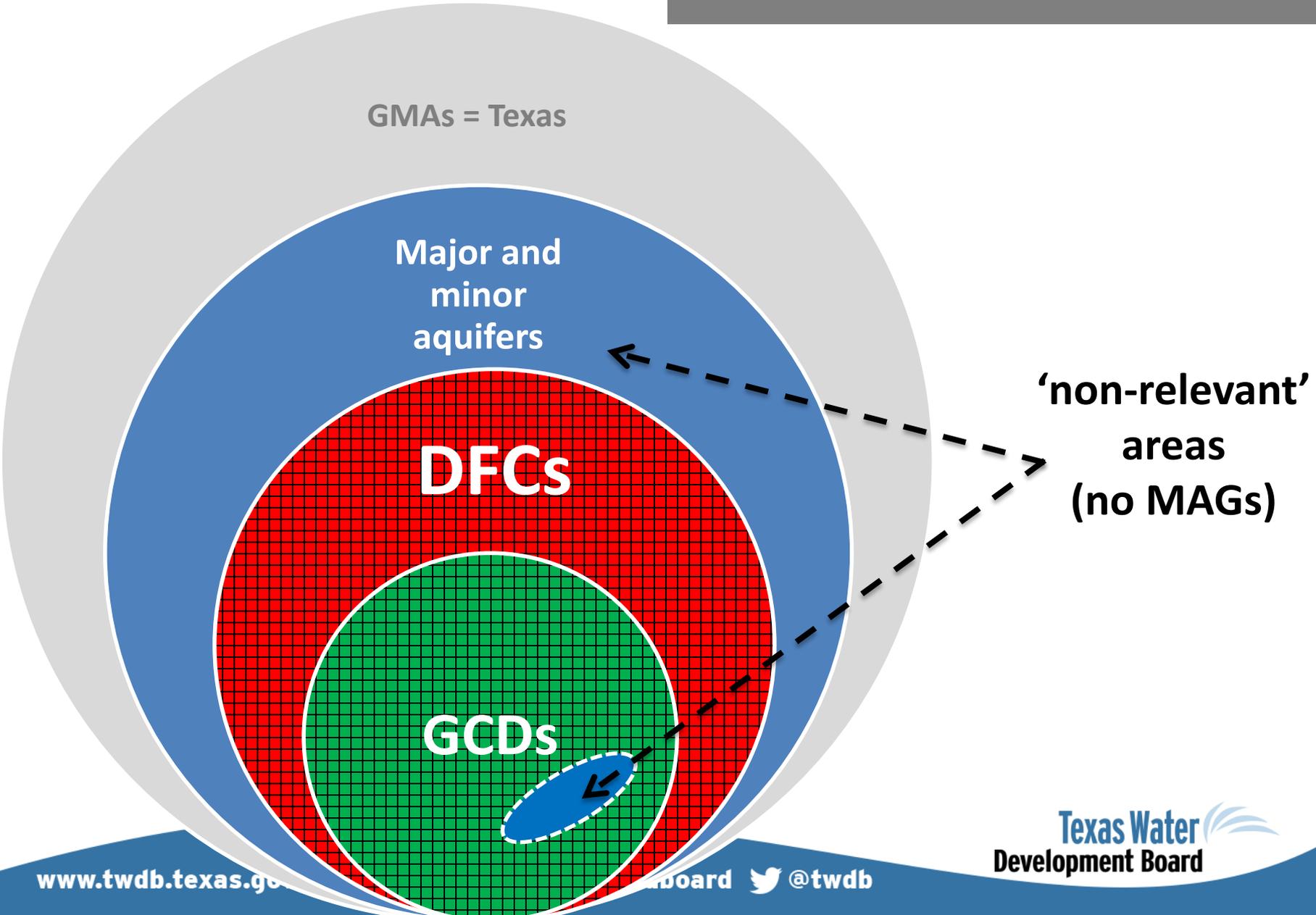
DFCs

GCDs

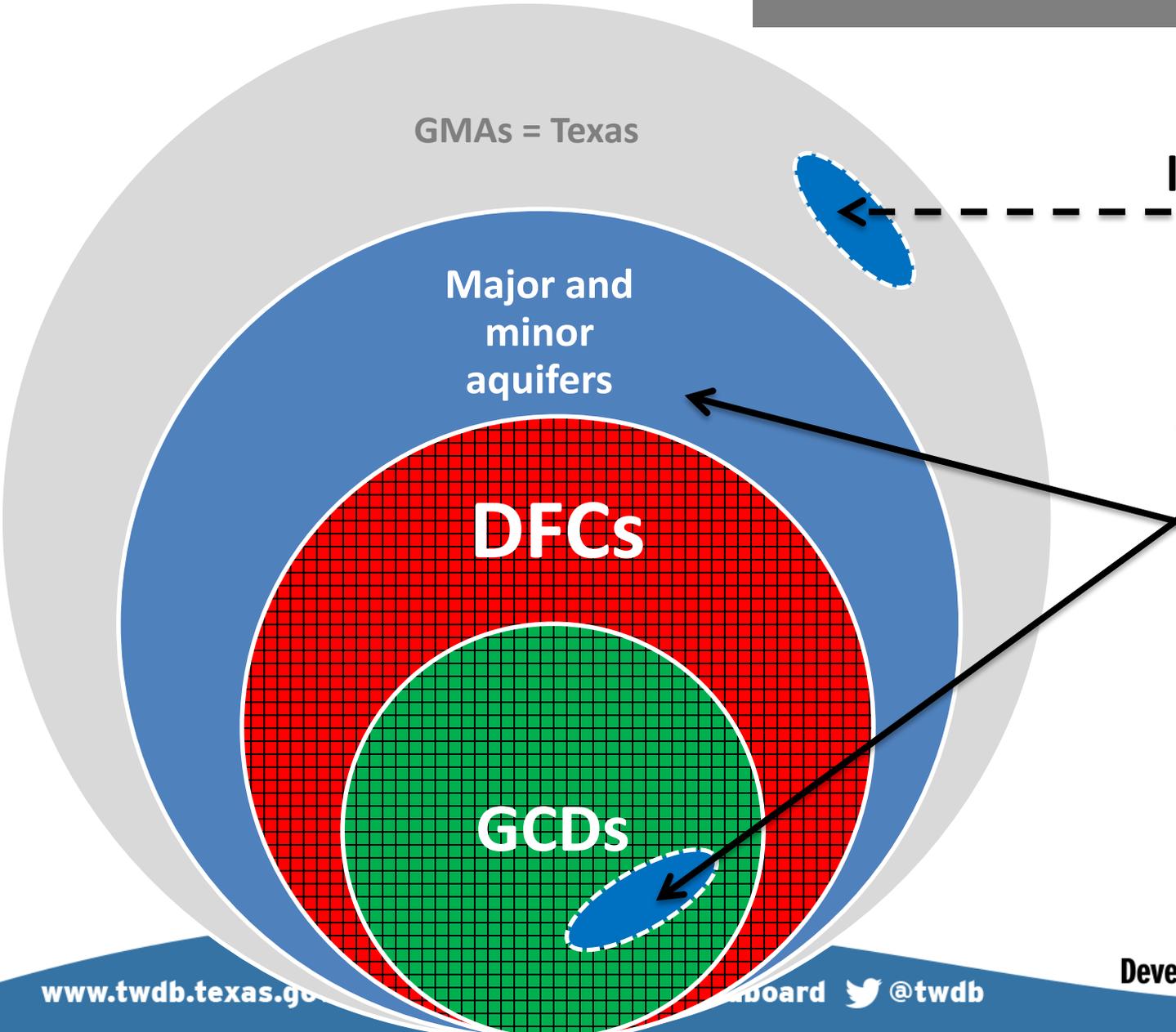
Areas with MAGs



Areas without DFCs



Areas without DFCs



GMAs = Texas

Major and minor aquifers

DFCs

GCDs

'other' local aquifer areas (no MAGs) & 'non-relevant' areas (no MAGs)

Areas without DFCs

GMA = Texas

Major and
minor
aquifers

DFCs

GCDs

'other'
local aquifer
areas
(no MAGs)
&
'non-relevant'
areas
(no MAGs)

RWPGs
responsible for
availability
estimates

Texas Water
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MAG Peak Factor

- A percentage (e.g., greater than 100%) that is applied to a MAG value reflecting the annual groundwater availability that, for planning purposes, shall be considered temporarily available for pumping consistent with DFCs.
- Provides temporary accommodation of increased groundwater demands by accommodating anticipated fluctuations in pumping
- Does **not** limit permitting or guarantee approval of any future permit applications.
- Requires review and approval by relevant groundwater conservation districts, groundwater management areas, and the TWDB Executive Administrator

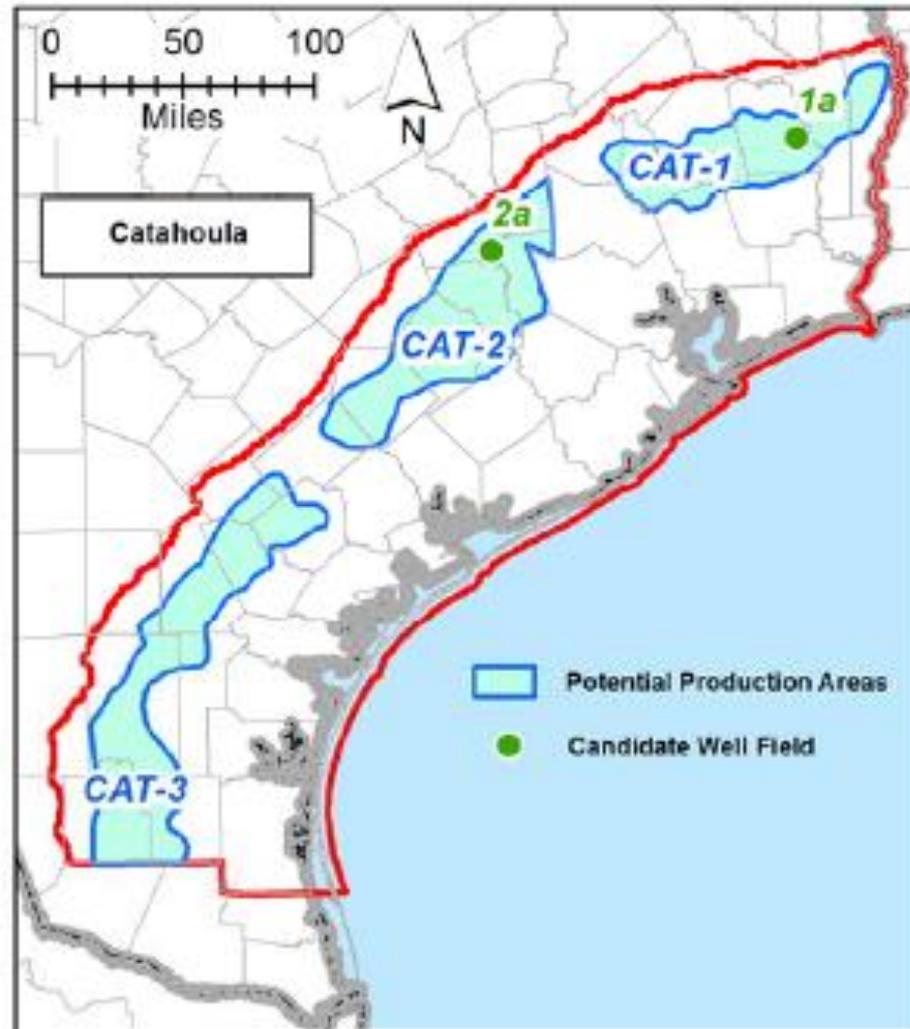
Groundwater-surface water

- Nearly all aquifers contribute some groundwater to baseflow of streams/rivers
- Statewide, an estimated 9.3 million acre-feet per year, on average, discharges from aquifers to surface water.
- Gulf Coast Aquifer discharges about 3.8 million acre-feet per year
- About half of the aquifers contribute less than 50,000 acre-feet per year to streams/rivers
- Largest contributors of groundwater are in East Texas, Hill Country, and major springs in West Texas.

Tributary and non-tributary aquifers

- Percentage of streamflow attributable to inflows of groundwater ranges from 14 percent (several aquifers) to 72 percent (Edwards [Balcones Fault Zone] Aquifer)
- All aquifers with surface outcrops are tributary
- Only the Rita Blanca Aquifer is considered non-tributary
- Deep, buried portions of aquifers may be non-tributary in character

Brackish groundwater production zones



Thank you for attending!

- Larry French, *Director, Groundwater Division*
- Janie Hopkins, *Manager, Groundwater Monitoring Section*
- Bryan Anderson, *Team Lead, Groundwater Data Team*
- Rima Petrossian, *Manager, Groundwater Technical Assistance Section*
- Cindy Ridgeway, *Manager, Groundwater Availability Modeling Section*

