Texas Water Development Board

Cross Timbers Aquifer Stakeholder Advisory Forum No.3

Upper Trinity Groundwater Conservation District

Springtown, Texas

July 9, 2021

DBS&A Daniel B. Stephens & Associates, Inc. a Geo-Logic Company

Allan R. Standen LLC Groundwater & Natural Resource Consulting

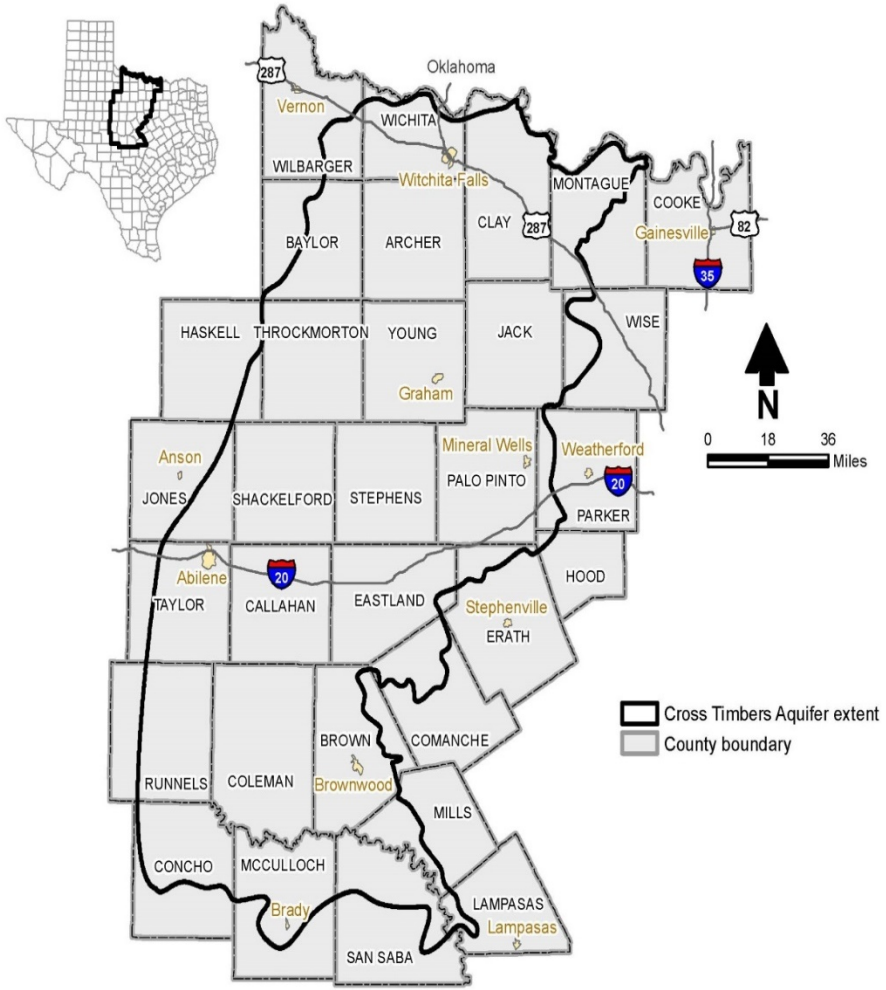
Blanton & Associates, Inc. Environmental Consulting • Planning • Project Management

Schedule

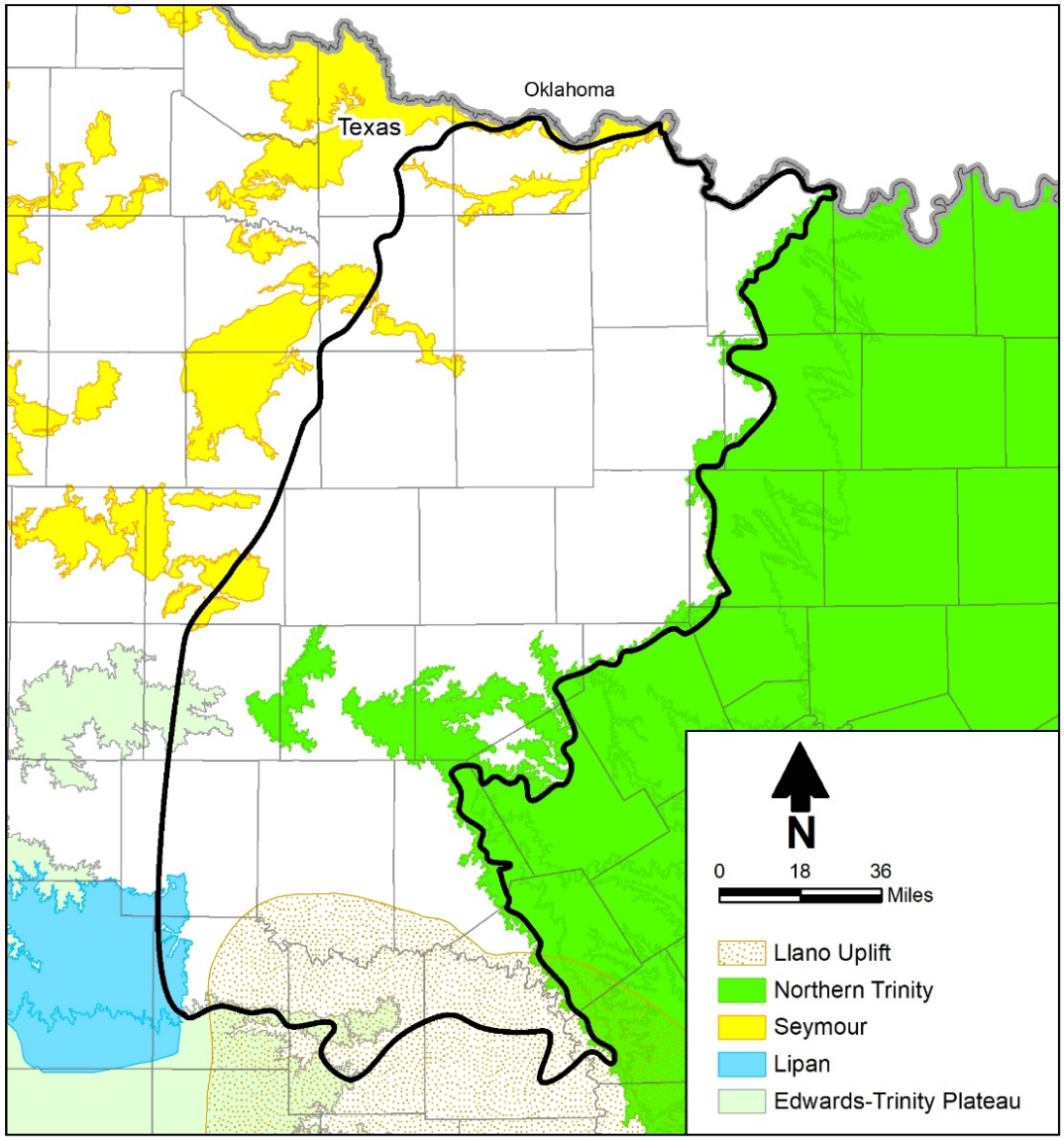
- DRAFT report submitted for review May 19, 2021
- July 9, 2021 – 3rd and final stakeholder meeting
- Comments due to TWDB (Robert Bradley) by July 23, 2021
- September 30, 2021 – Final Report to TWDB

Cross Timbers Aquifer

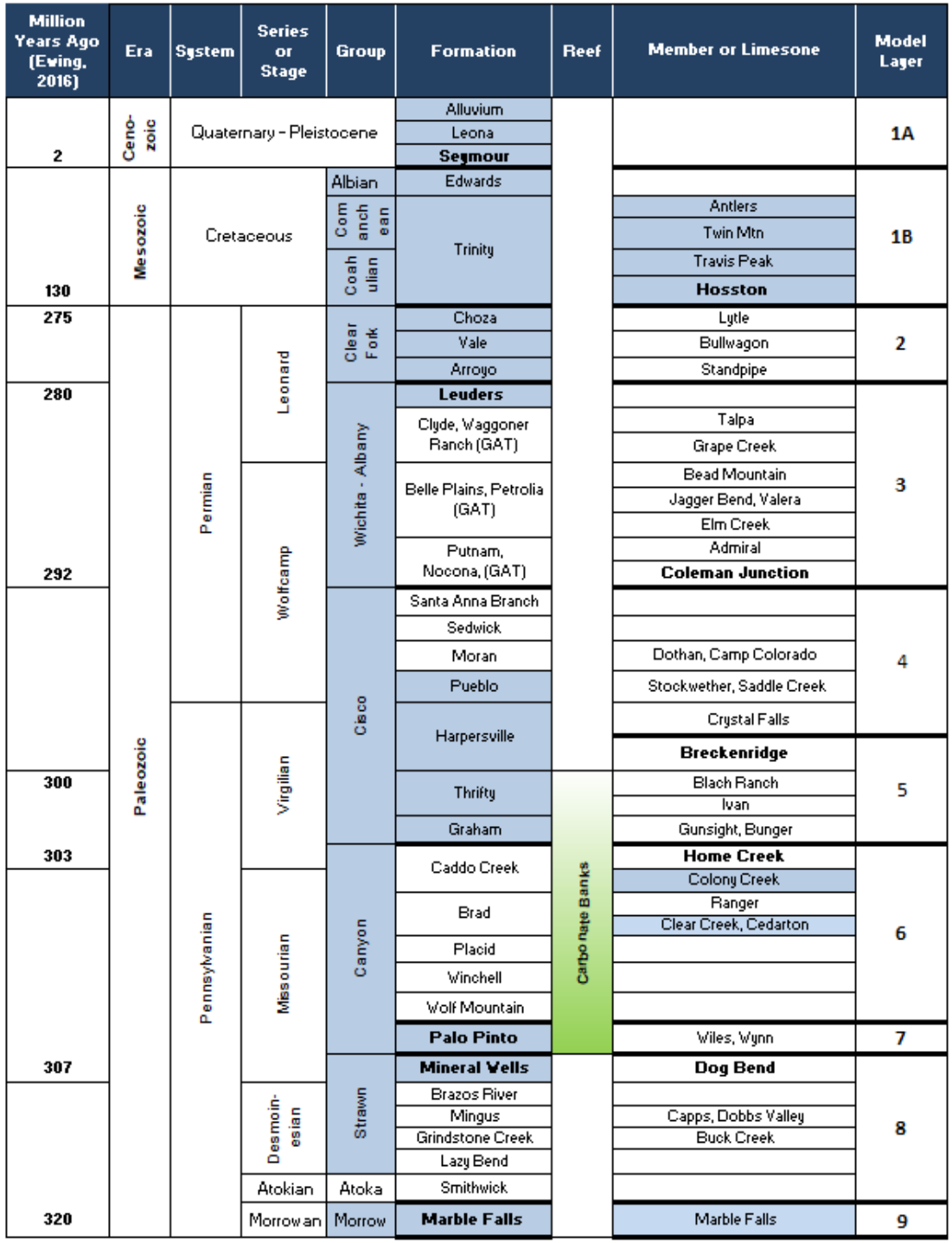
- All or portions of 31 counties; about 18,000 square miles
- Designated as Minor Aquifer in Dec 2017



Nearby Aquifers

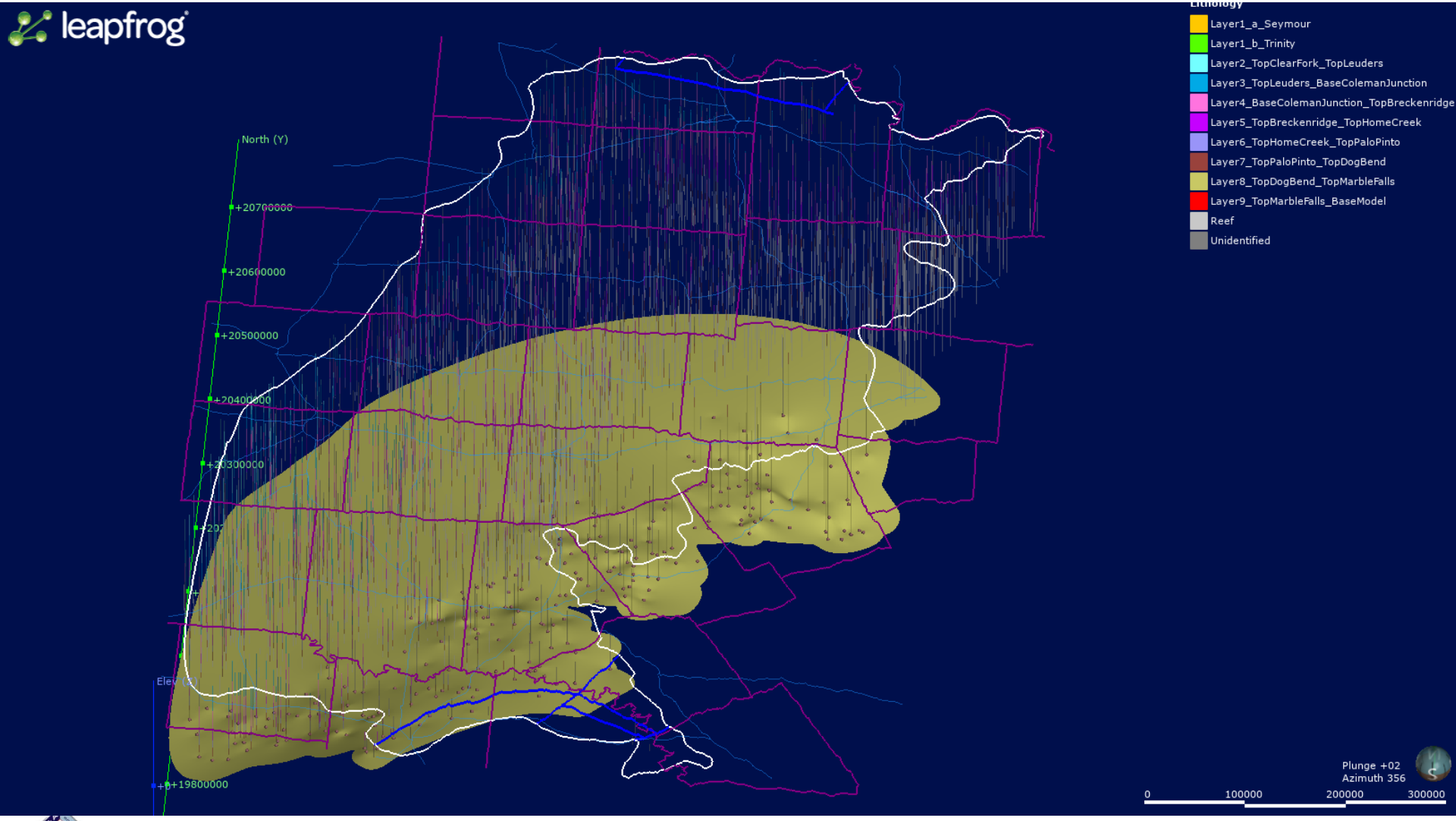


Stratigraphic Column and Geologic Model Layers

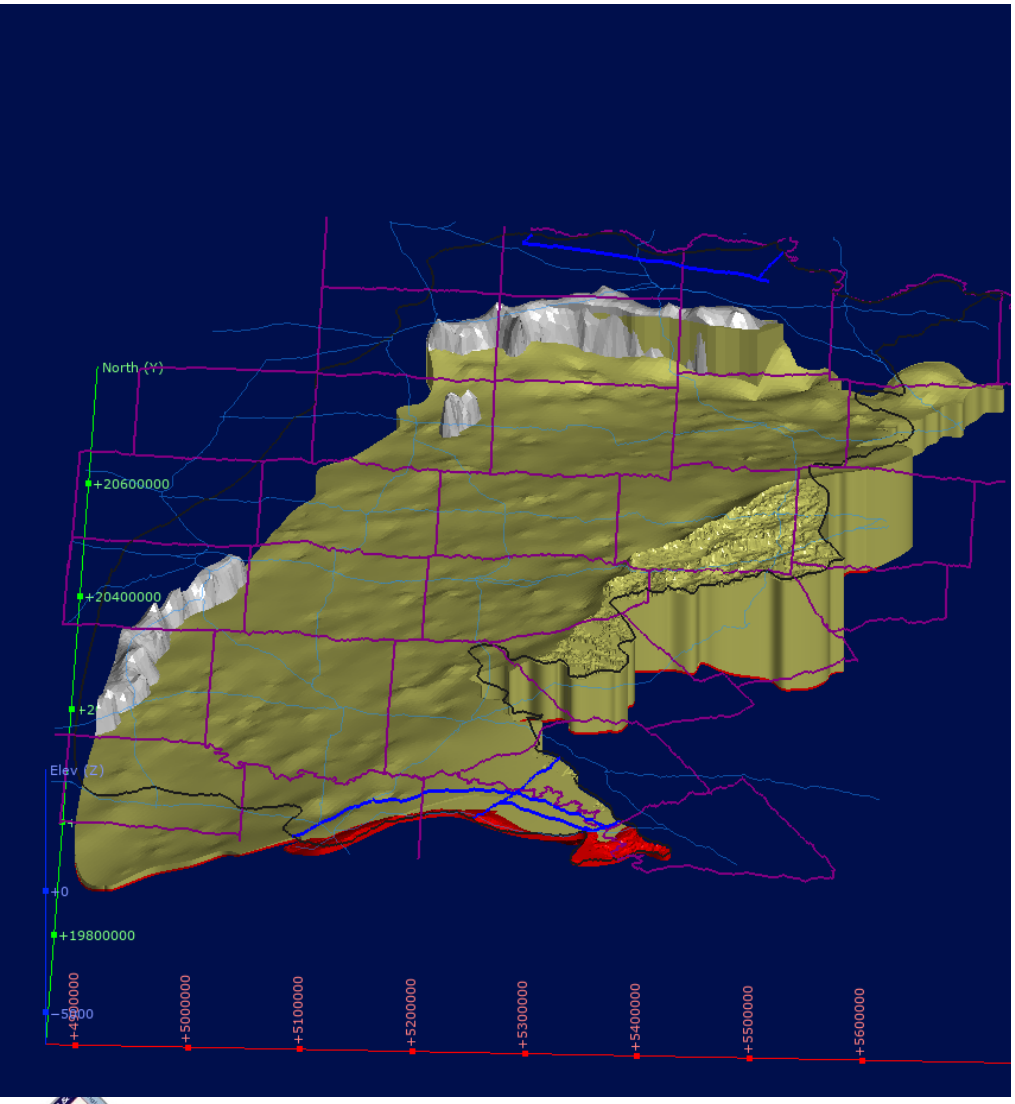


Million Years Ago (Ewing, 2016)	Era	System	Series or Stage	Group	Formation	Reef	Member or Limesone	Model Layer
	Ceno-zoic	Quaternary - Pleistocene			Alluvium			
					Leona			1A
2					**Seymour**			
	Mesozoic	Cretaceous		Albian	Edwards			
				Comanchean	Trinity		Antlers	
							Twin Mtn	1B
							Travis Peak	
130				Coahulian			**Hosston**	
275	Paleozoic	Permian	Leonard	Clear Fork	Choza		Lytle	
					Vale		Bullwagon	2
					Arroyo		Standpipe	
280				Wichita - Albany	**Leuders**			
					Clyde, Waggoner Ranch (GAT)		Talpa	
							Grape Creek	
			Wolfcamp		Belle Plains, Petrolia (GAT)		Bead Mountain	3
							Jagger Bend, Valera	
							Elm Creek	
292					Putnam, Nocona, (GAT)		Admiral	
							Coleman Junction	
				Cisco	Santa Anna Branch			
					Sedwick			
					Moran		Dothan, Camp Colorado	4
					Pueblo		Stockwether, Saddle Creek	
		Pennsylvanian	Virgilian		Harpersville		Crystal Falls	
							Breckenridge	
300					Thrifty	Carbonate Banks	Blach Ranch	5
							Ivan	
303					Graham		Gunsight, Bunger	
				Canyon	Caddo Creek		**Home Creek**	
			Missourian				Colony Creek	
					Brad		Ranger	
							Clear Creek, Cedarton	6
					Placid			
					Winchell			
					Wolf Mountain			
					Palo Pinto		Wiles, Wynn	7
307				Strawn	**Mineral Wells**		**Dog Bend**	
			Desmoin-esian		Brazos River			
					Mingus		Capps, Dobbs Valley	
					Grindstone Creek		Buck Creek	8
					Lazy Bend			
			Atokian	Atoka	Smithwick			
320			Morrowan	Morrow	**Marble Falls**		Marble Falls	9

Top of Marble Falls Surface



Layers 8 and 9



Million Years Ago (Ewing, 2016)	Era	System	Series or Stage	Group	Formation	Reef	Member or Limesone	Model Layer
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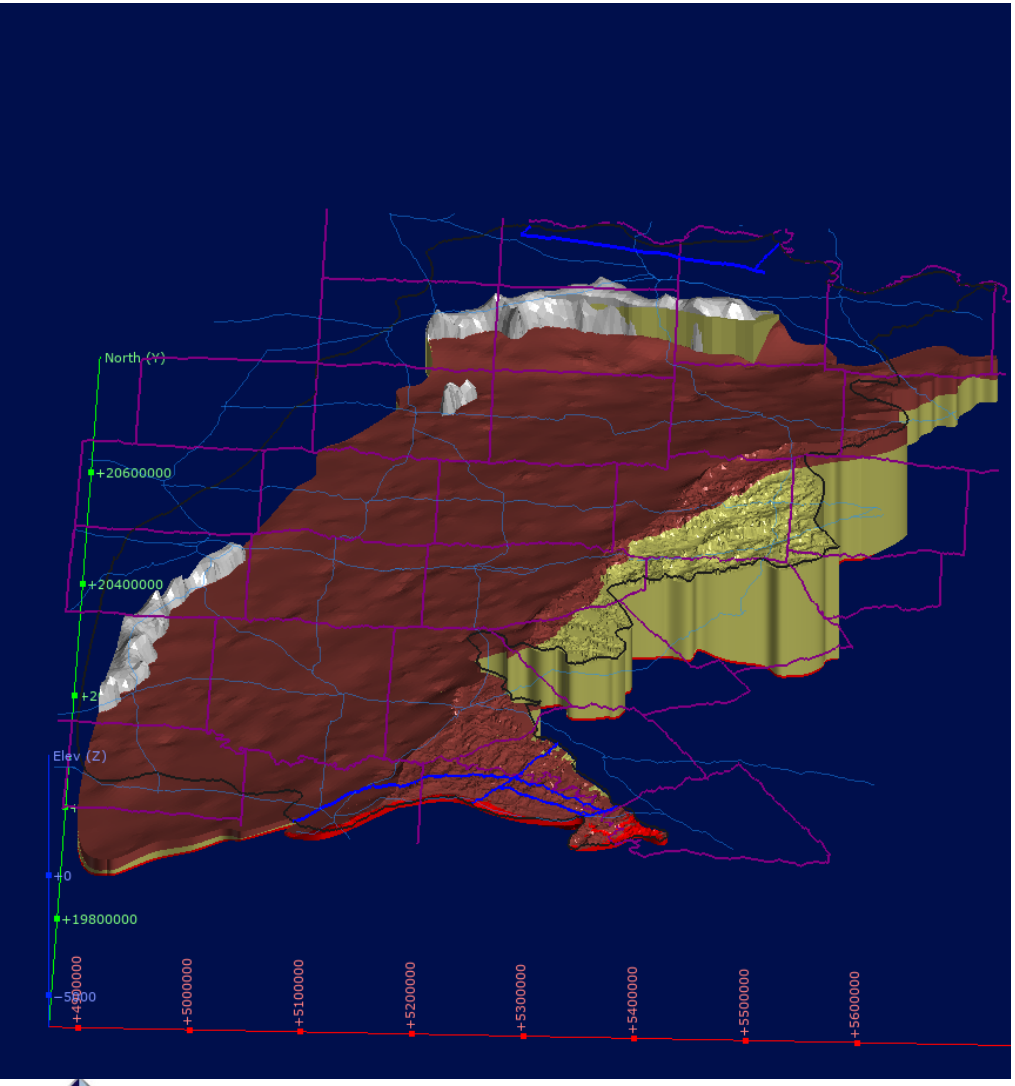
130	Mesozoic	Cretaceous		Albian	Edwards			1B
				Comanchean	Trinity		Antlers Twin Mtn Travis Peak **Hosston**	
				Coahulian				
275	Paleozoic	Permian	Leonard	Clear Fork	Choza Vale Arroyo		Lytle Bullwagon Standpipe	2
280				Wichita - Albany	**Leuders**			3
					Clyde, Waggoner Ranch (GAT)		Talpa Grape Creek	
			Wolfcamp		Belle Plains, Petrolia (GAT)		Bead Mountain Jagger Bend, Valera Elm Creek	
292					Putnam, Nocona, (GAT)		Admiral **Coleman Junction**	
				Cisco	Santa Anna Branch Sedwick			4
					Moran Pueblo		Dothan, Camp Colorado Stockwether, Saddle Creek	
					Harpersville		Crystal Falls	
300		Pennsylvanian	Virgilian		Thrifty Graham	Carbonate Banks	**Breckenridge** Blach Ranch Ivan Gunsight, Bunger	5
303				Canyon	Caddo Creek		**Home Creek**	6
			Missourian		Brad Placid Winchell Wolf Mountain		Colony Creek Ranger Clear Creek, Cedarton	
307					**Palo Pinto**		Wiles, Wynn	7
			Desmoin-esian	Strawn	**Mineral Wells** Brazos River Mingus Grindstone Creek Lazy Bend		**Dog Bend** Capps, Dobbs Valley Buck Creek	8
			Atokian	Atoka	Smithwick			
320			Morrowan	Morrow	**Marble Falls**		Marble Falls	9

Layers 7 through 9



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							Twin Mtn	
							Travis Peak	
				Coahulian			**Hosston**	
275	Paleozoic	Permian	Leonard	Clear Fork	Choza		Lytle	2
					Vale		Bullwagon	
					Arroyo		Standpipe	
280				Wichita - Albany	**Leuders**			3
					Clyde, Waggoner Ranch (GAT)		Talpa	
							Grape Creek	
			Wolfcamp		Belle Plains, Petrolia (GAT)		Bead Mountain	
							Jagger Bend, Valera	
							Elm Creek	
292					Putnam, Nocona, (GAT)		Admiral	
							Coleman Junction	
				Cisco	Santa Anna Branch			4
					Sedwick			
					Moran		Dothan, Camp Colorado	
					Pueblo		Stockwether, Saddle Creek	
		Pennsylvanian	Virgilian		Harpersville		Crystal Falls	
							Breckenridge	5
300					Thrifty	Carbonate Banks	Blach Ranch	
							Ivan	
303					Graham		Gunsight, Bunger	
				Canyon	Caddo Creek		**Home Creek**	6
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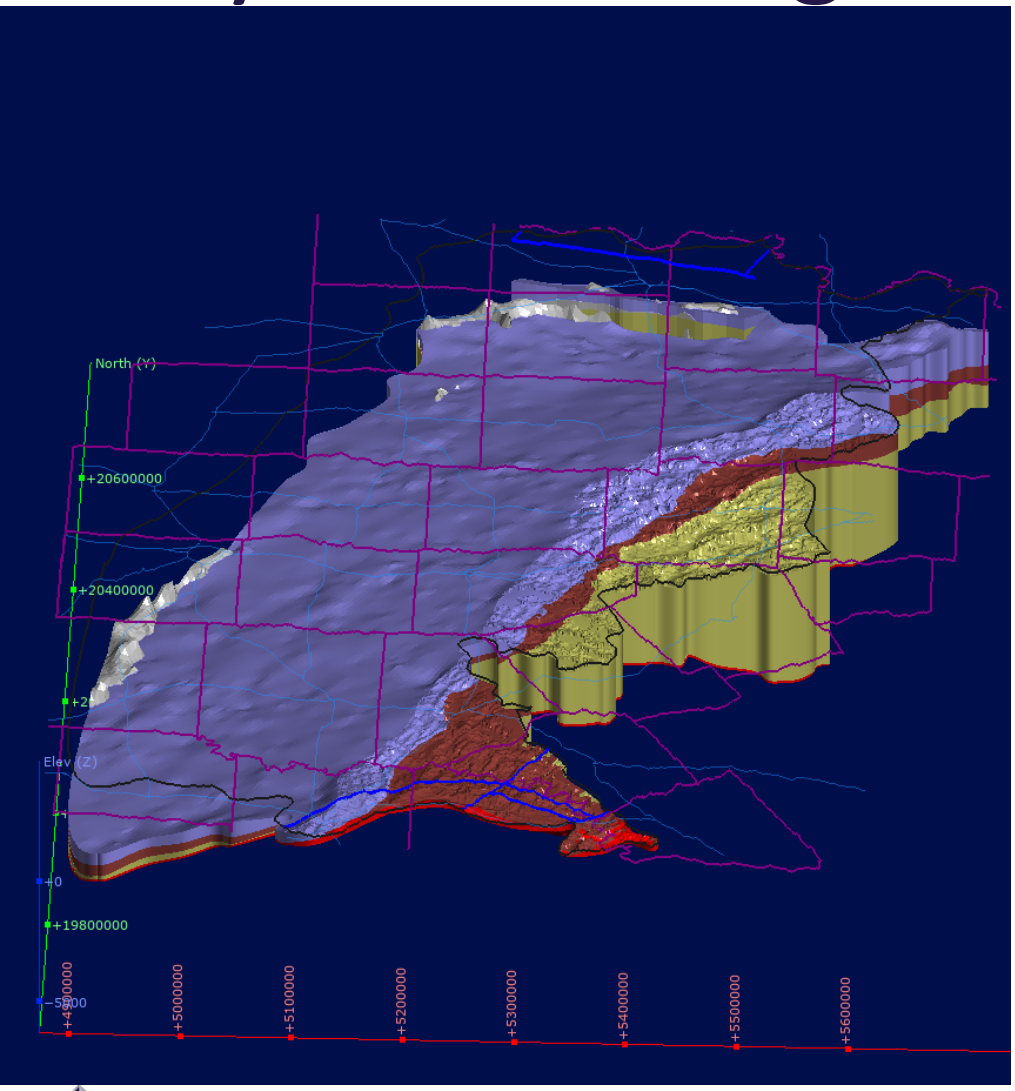
							Ranger	
					Placid		Clear Creek, Cedarton	
					Winchell			
					Wolf Mountain			
307					**Palo Pinto**		Wiles, Wynn	7
				Strawn	**Mineral Wells**		**Dog Bend**	8
			Desmoin-esian		Brazos River			
					Mingus		Capps, Dobbs Valley	
					Grindstone Creek		Buck Creek	
					Lazy Bend			
			Atokian	Atoka	Smithwick			
320			Morrowan	Morrow	**Marble Falls**		Marble Falls	9

Layers 6 through 9



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				Coahulian				
275	Paleozoic	Permian	Leonard	Clear Fork	Choza Vale Arroyo		Lytle Bullwagon Standpipe	2
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					Harpersville		Crystal Falls	
300			Virgilian		Thrifty	Carbonate Banks	**Breckenridge** Blach Ranch Ivan	5
303		Pennsylvanian			Graham		Gunsight, Bunger	
				Canyon	Caddo Creek		**Home Creek** Colony Creek	6
			Missourian		Brad		Ranger Clear Creek, Cedarton	
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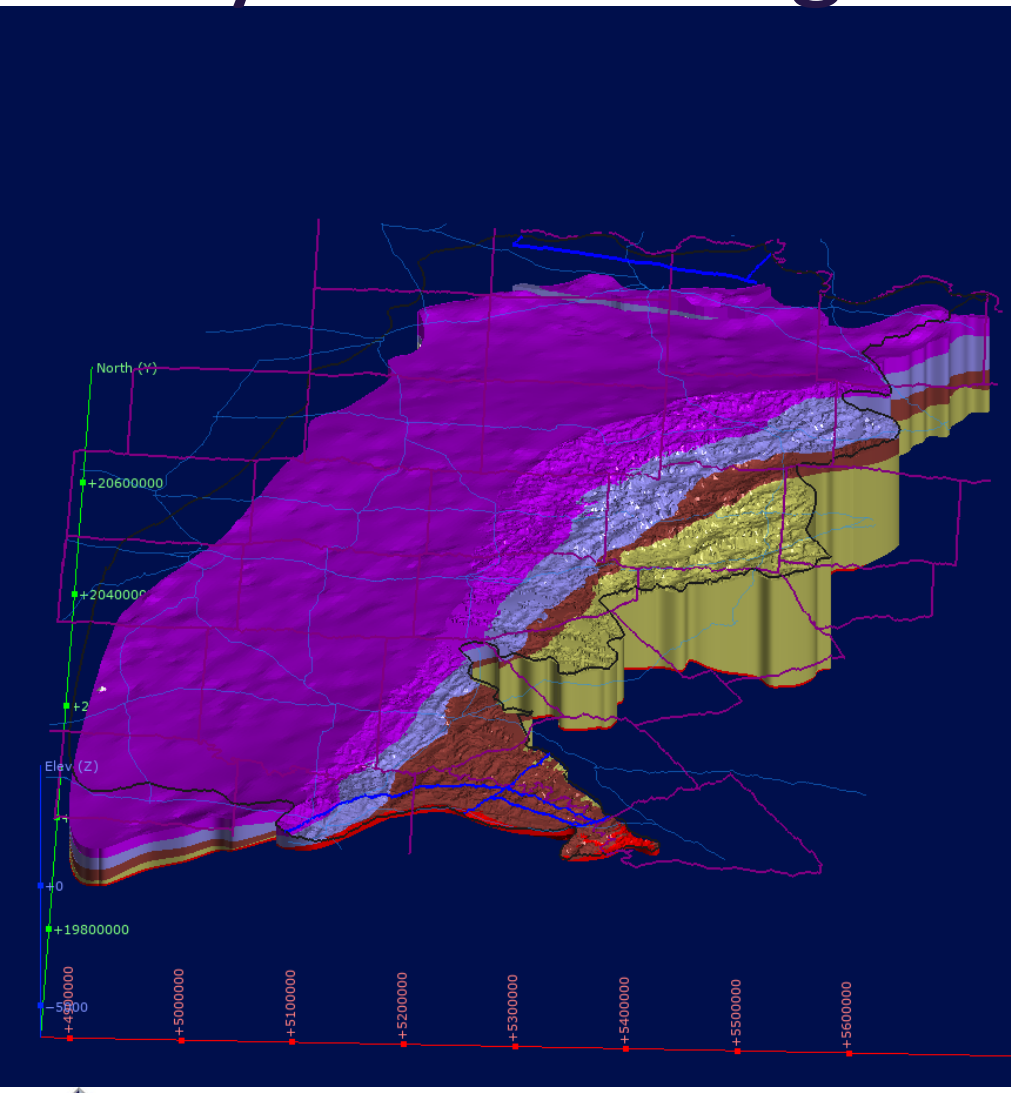
307					**Palo Pinto**		Wiles, Wynn	7
				Strawn	**Mineral Wells**		**Dog Bend**	8
			Desmoin-esian		Brazos River			
					Mingus		Capps, Dobbs Valley	
					Grindstone Creek		Buck Creek	
					Lazy Bend			
			Atokian	Atoka	Smithwick			
320			Morrowan	Morrow	**Marble Falls**		Marble Falls	9

Layers 5 through 9



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		Pennsylvanian	Virgilian				**Breckenridge**	5
300					Thrifty	Carbonate Banks	Blach Ranch Ivan	
303					Graham		Gunsight, Bunger	
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307					**Palo Pinto**		Wiles, Wynn	7
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					Brazos River			
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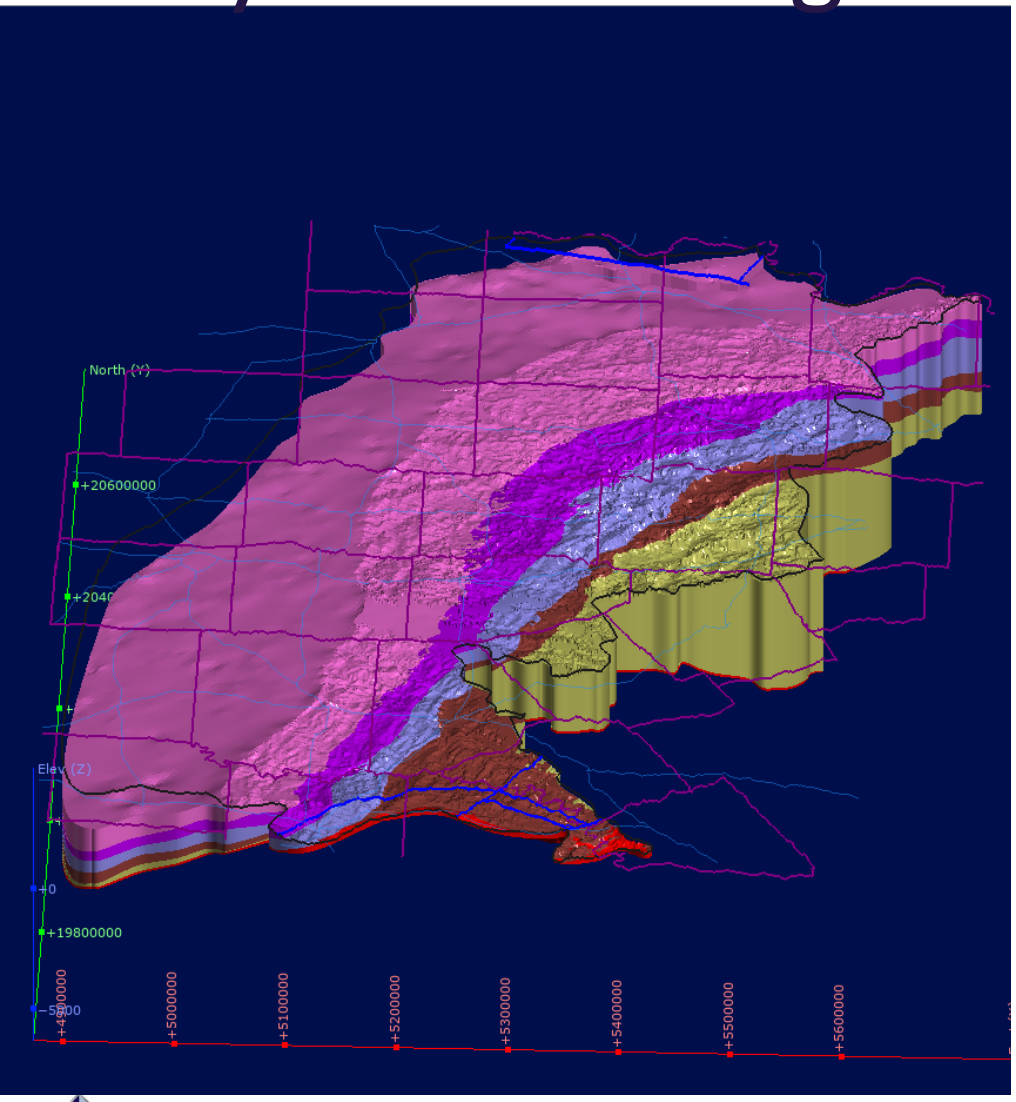
					Grindstone Creek		Buck Creek	
					Lazy Bend			
			Atokian	Atoka	Smithwick			
320			Morrowan	Morrow	**Marble Falls**		Marble Falls	9

Layers 4 through 9



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			Desmoin-esian					
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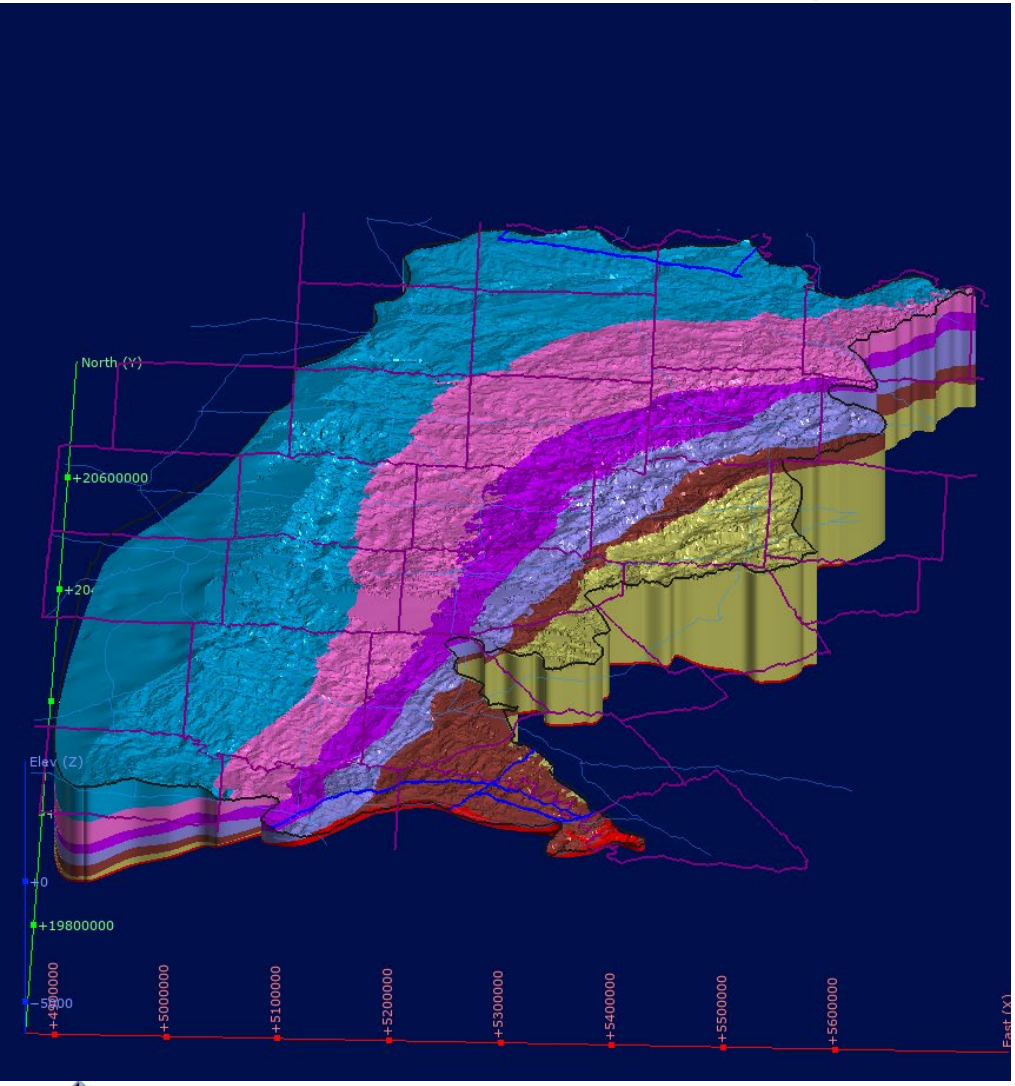
320			Morrowan	Morrow	**Marble Falls**		Marble Falls	9

Layers 3 through 9



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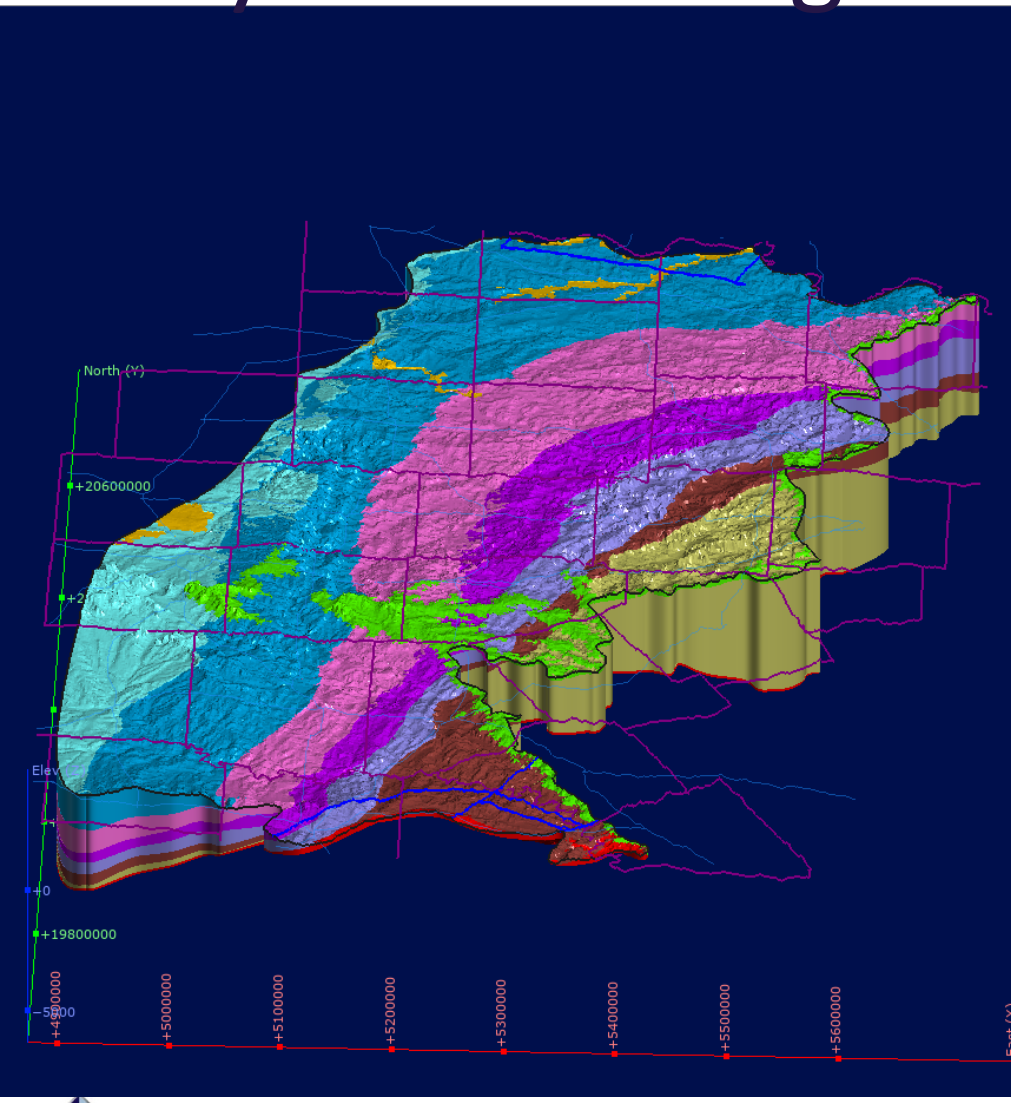
			Atokian	Atoka	Smithwick			
320			Morrowan	Morrow	**Marble Falls**		Marble Falls	9

Layers 1 through 9



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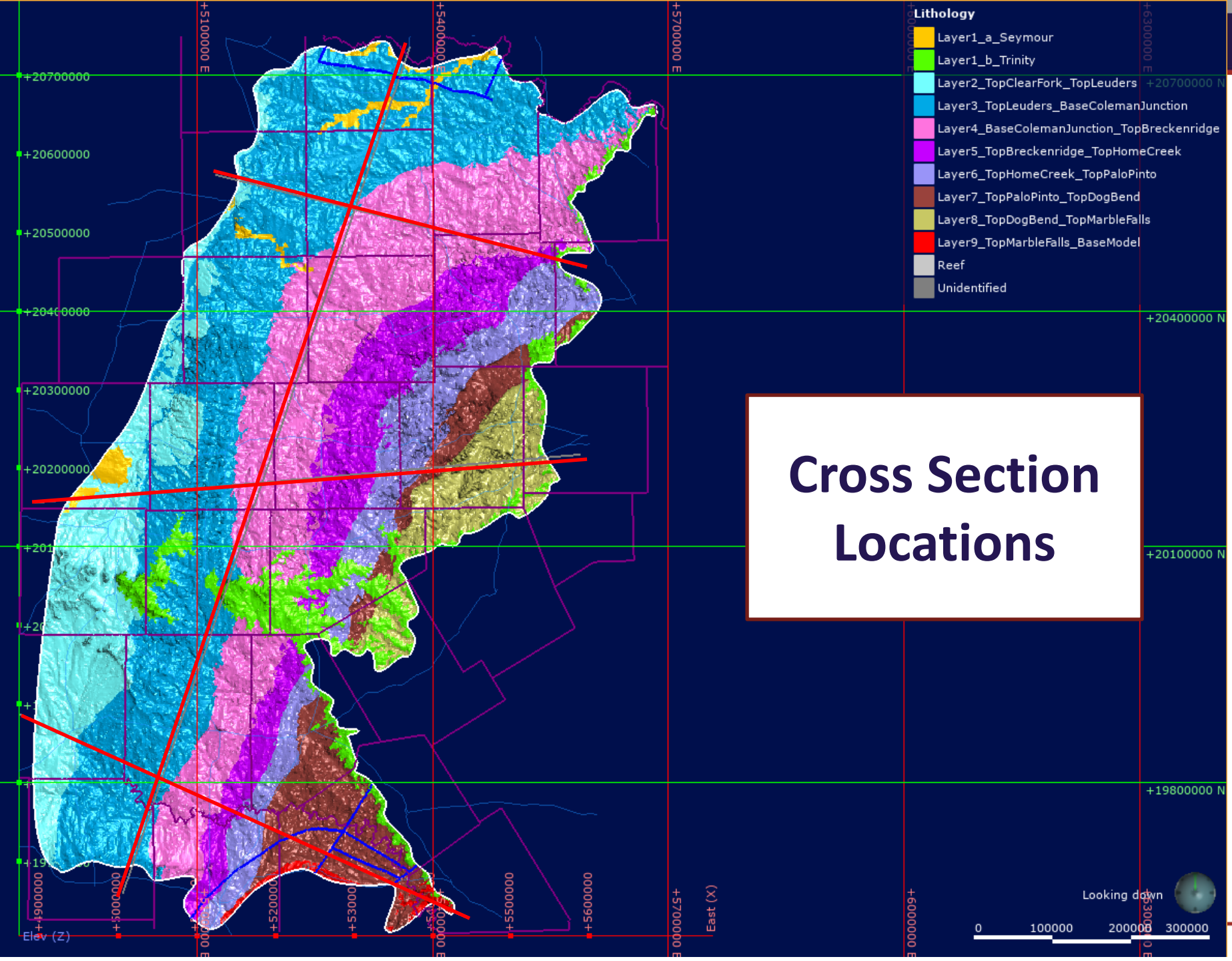
Lithology
Layer1_a_Seymour
Layer1_b_Trinity
Layer2_TopClearFork_TopLeuders
Layer3_TopLeuders_BaseColemanJunction
Layer4_BaseColemanJunction_TopBreckenridge
Layer5_TopBreckenridge_TopHomeCreek
Layer6_TopHomeCreek_TopPaloPinto
Layer7_TopPaloPinto_TopDogBend
Layer8_TopDogBend_TopMarbleFalls
Layer9_TopMarbleFalls_BaseModel
Reef
Unidentified
Cross Section Locations
+20700000 N
+20600000 N
+20500000 N
+20400000 N
+20300000 N
+20200000 N
+20100000 N
+19800000 N
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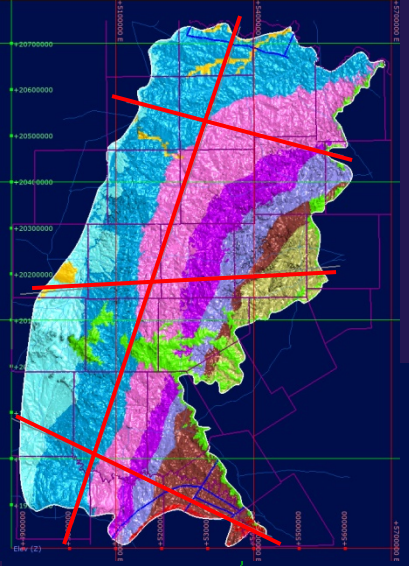
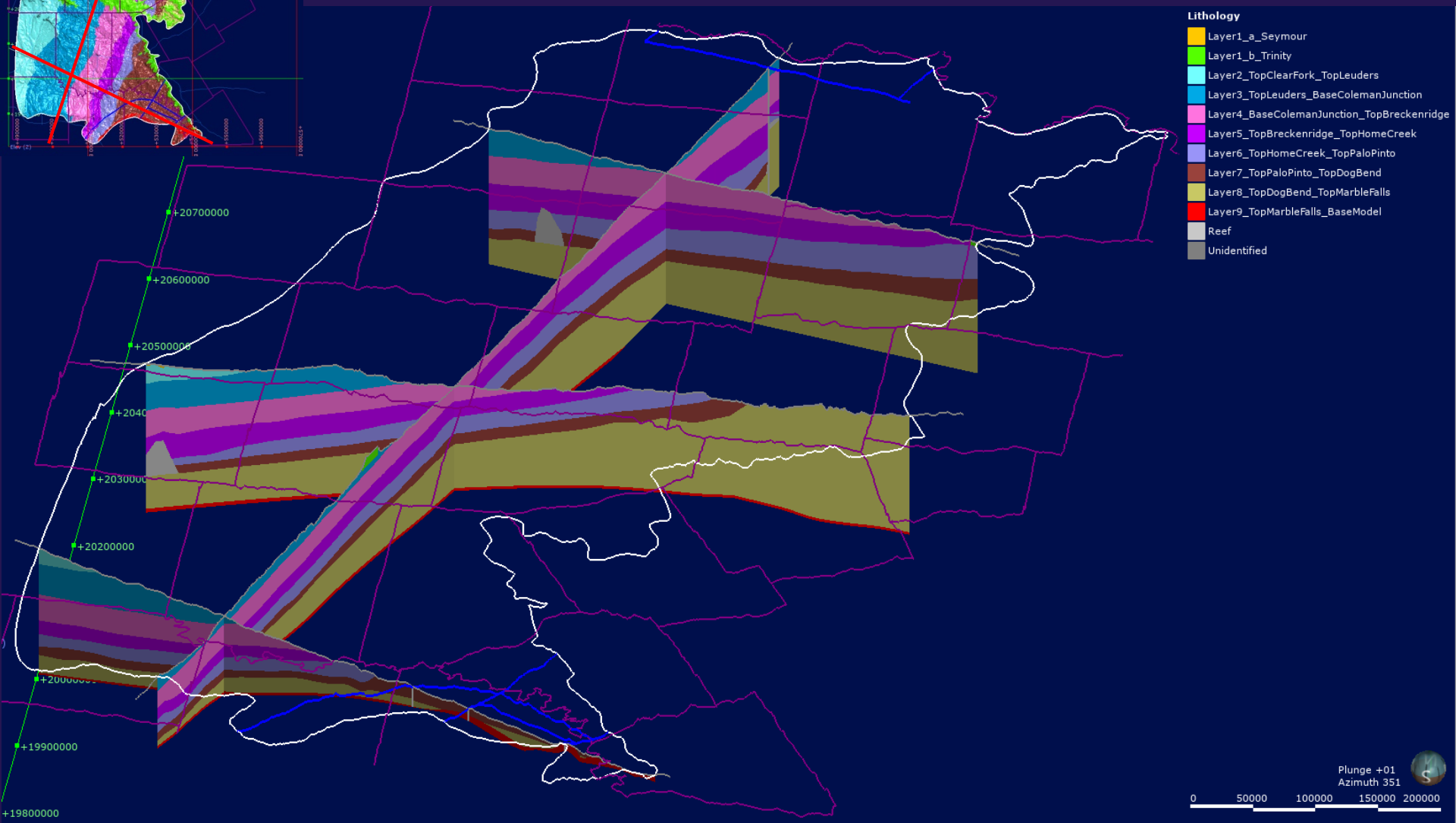
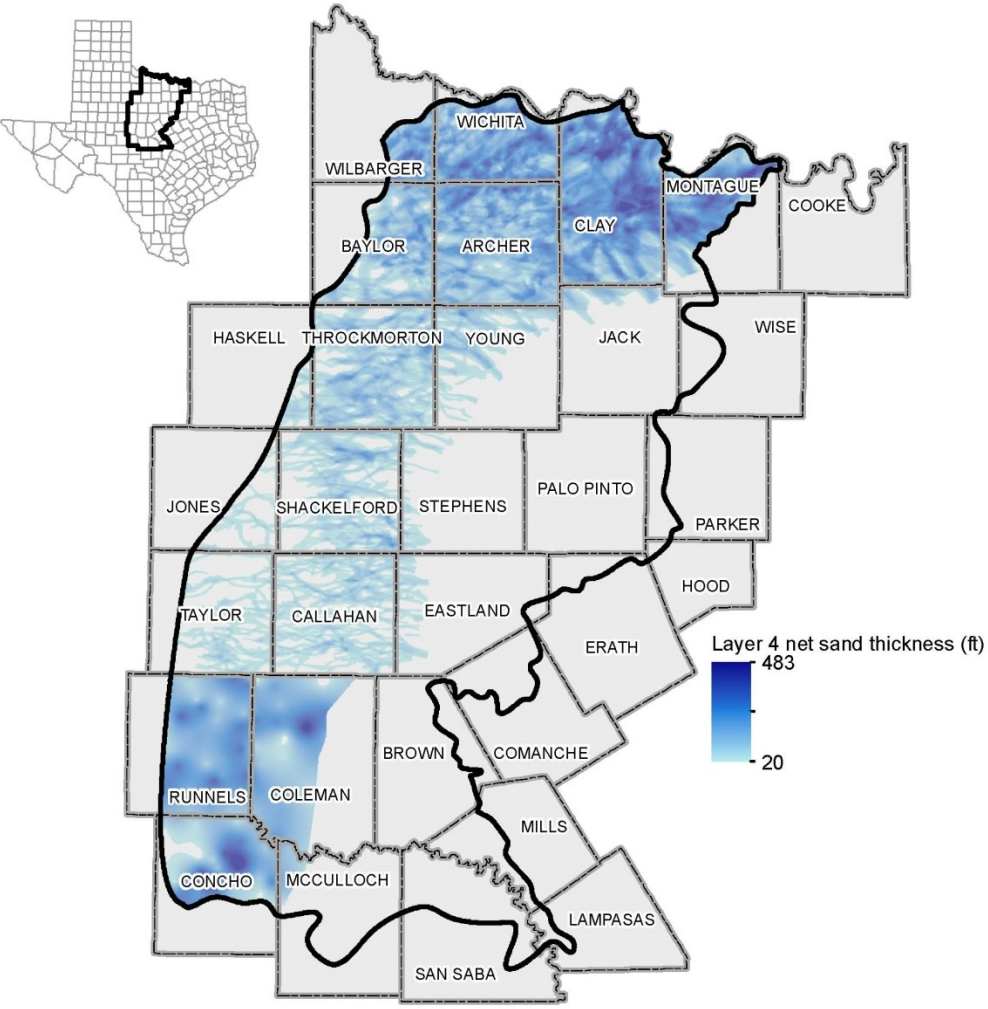
+5400000 E
+5700000 E
+6300000 E
East (X)
Elev (Z)
Looking down
0
100000
200000
300000

Cross Sections

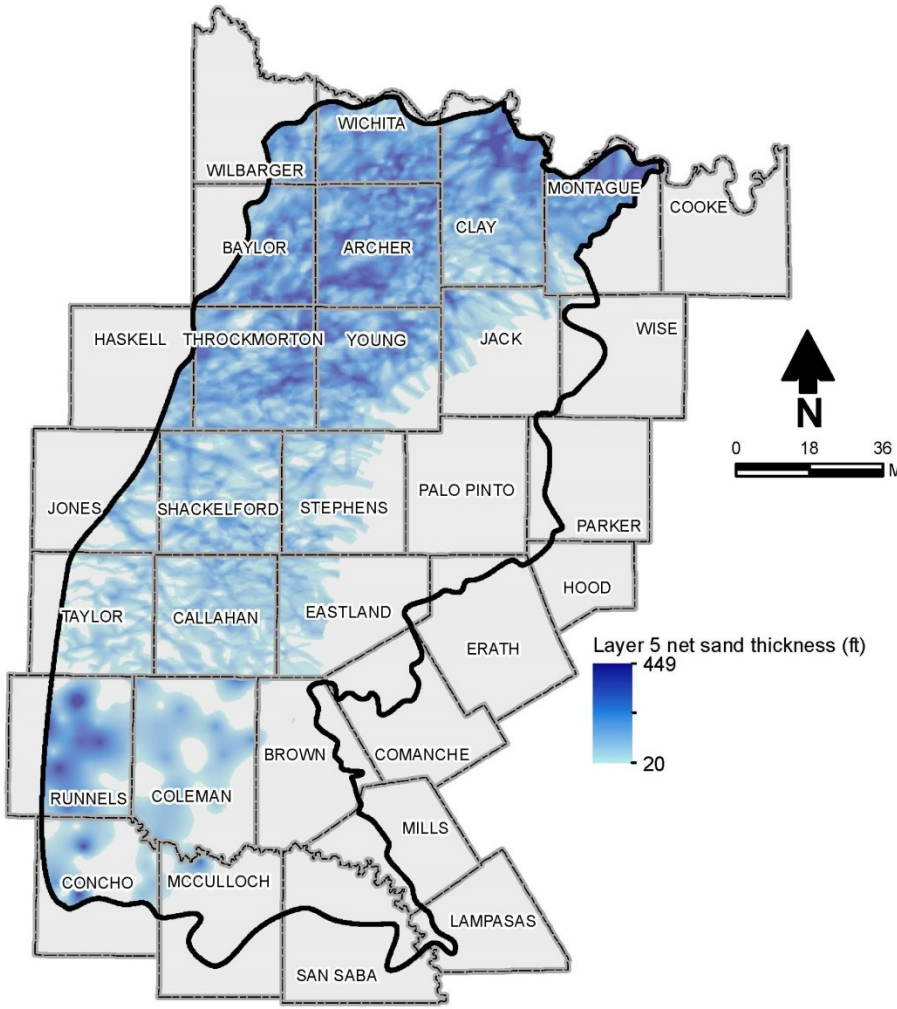




Net Sand Isopachs

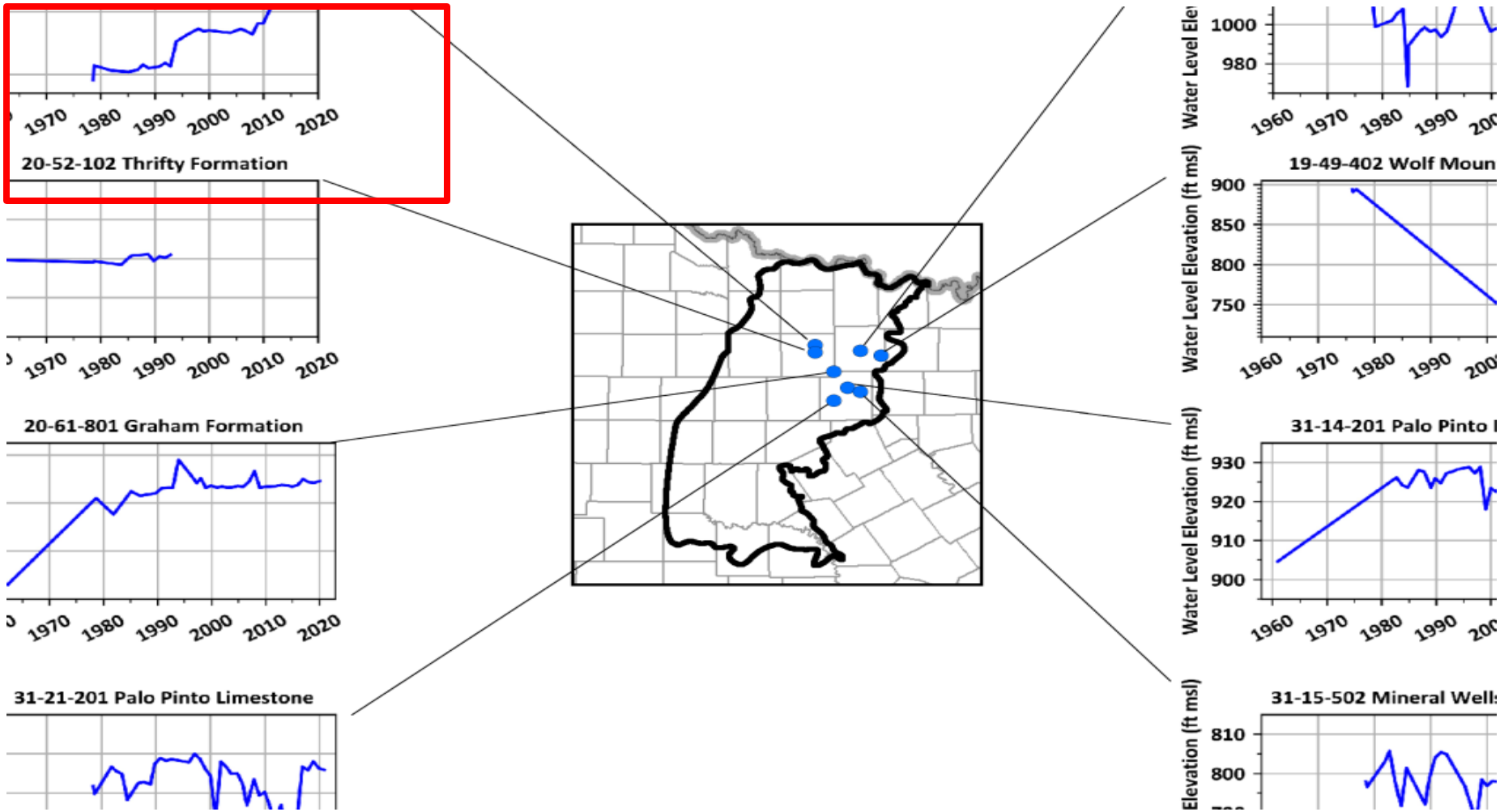


Layer 4 – Upper/Middle Cisco

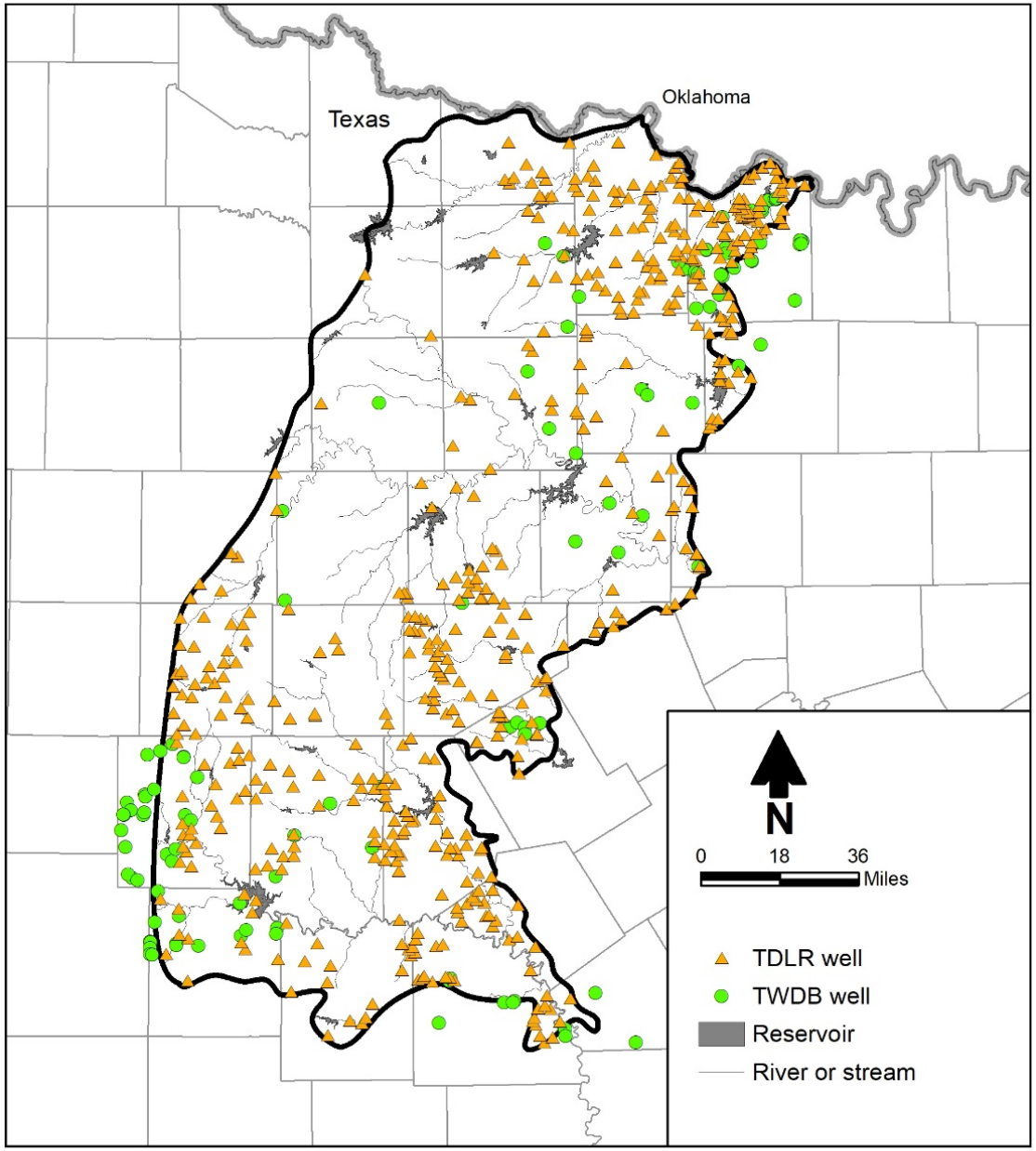


Layer 5 – Lower Cisco

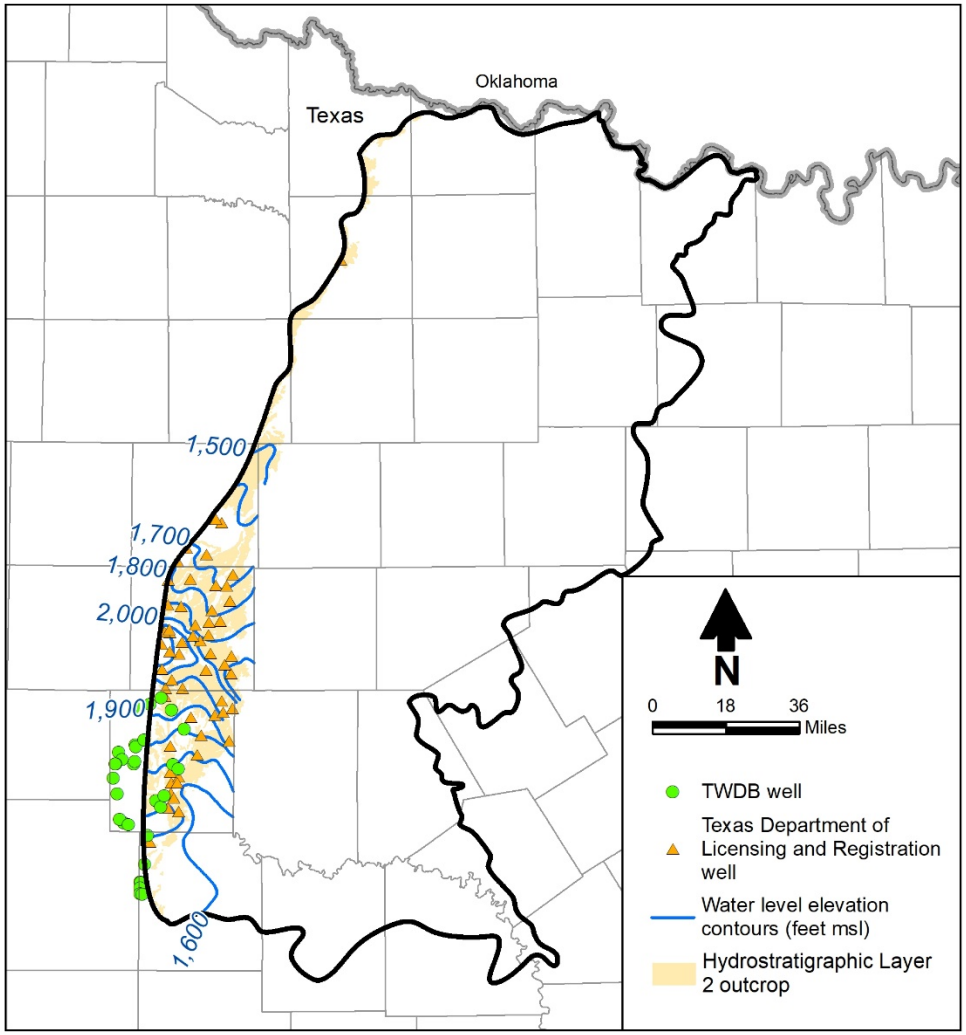
Example Hydrographs



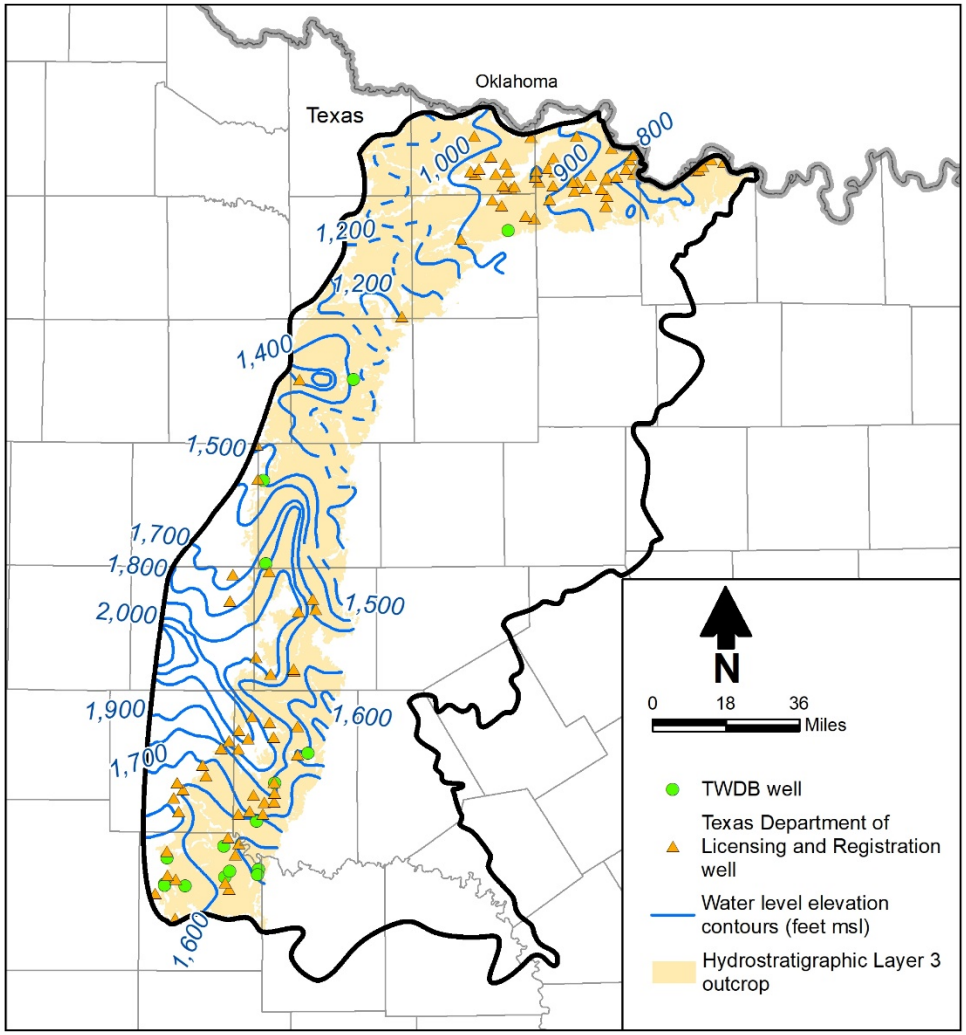
2010-2019 Water Level Data Points



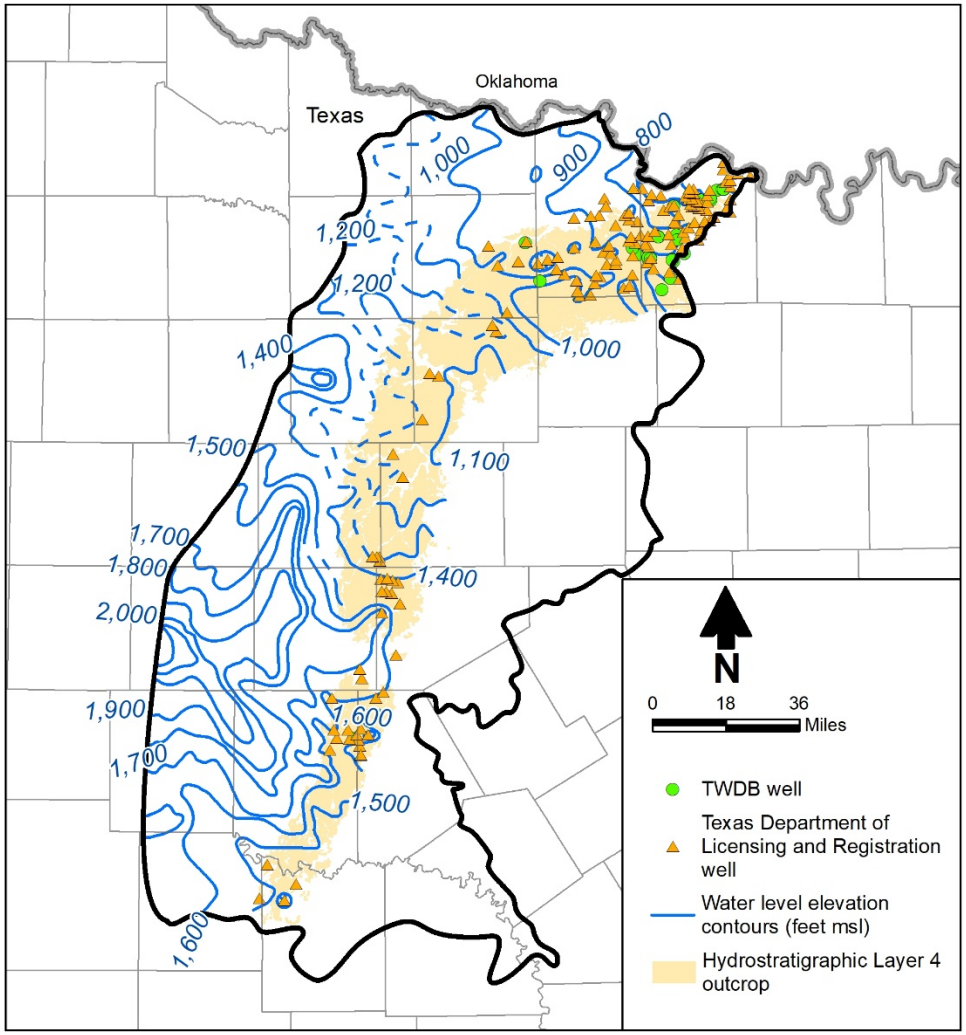
Layer 2 – Clear Fork Group



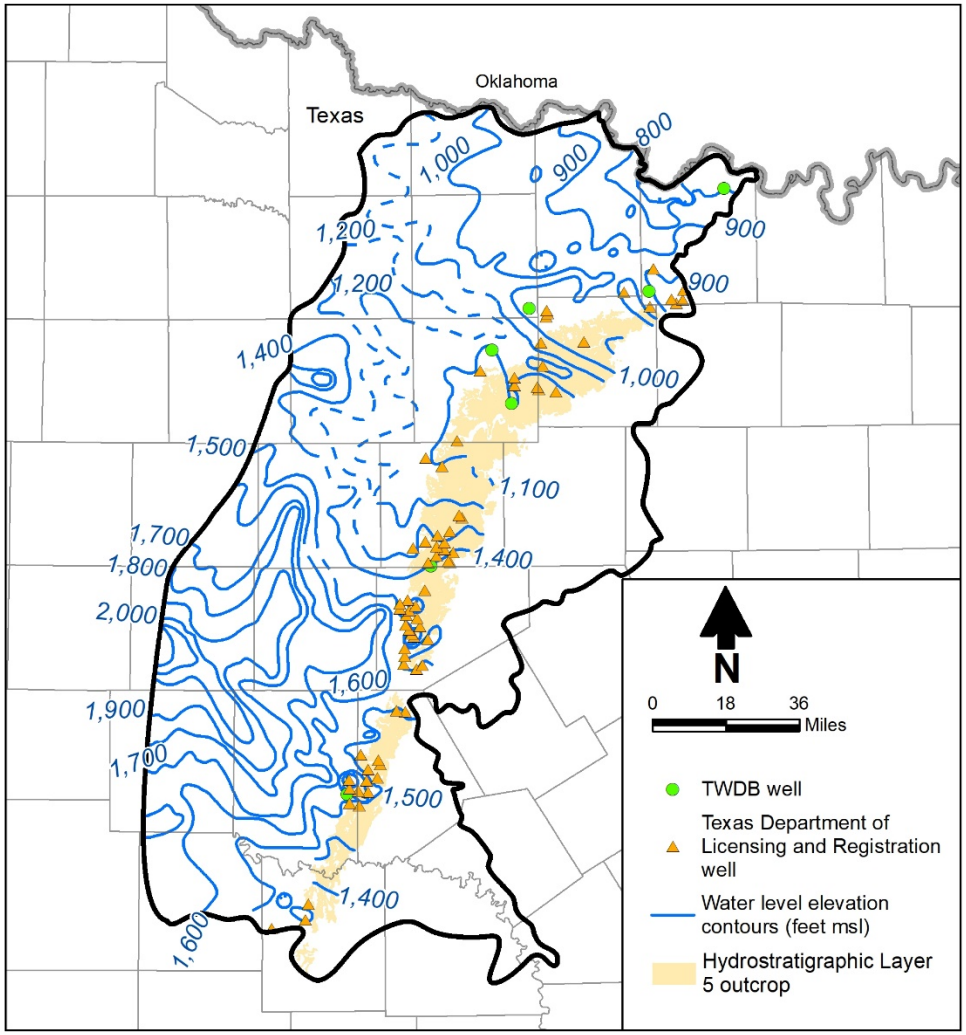
Layer 3 – Wichita-Albany Group



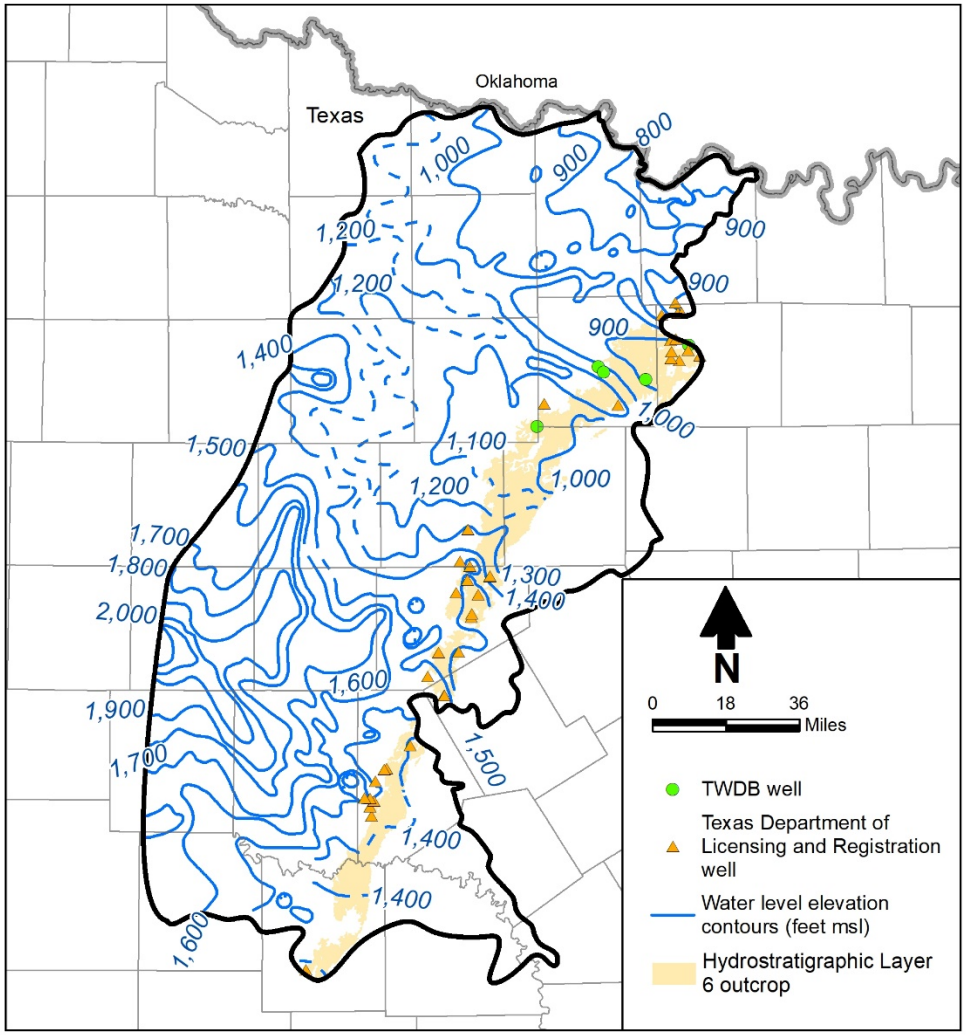
Layer 4 – Upper Cisco Group



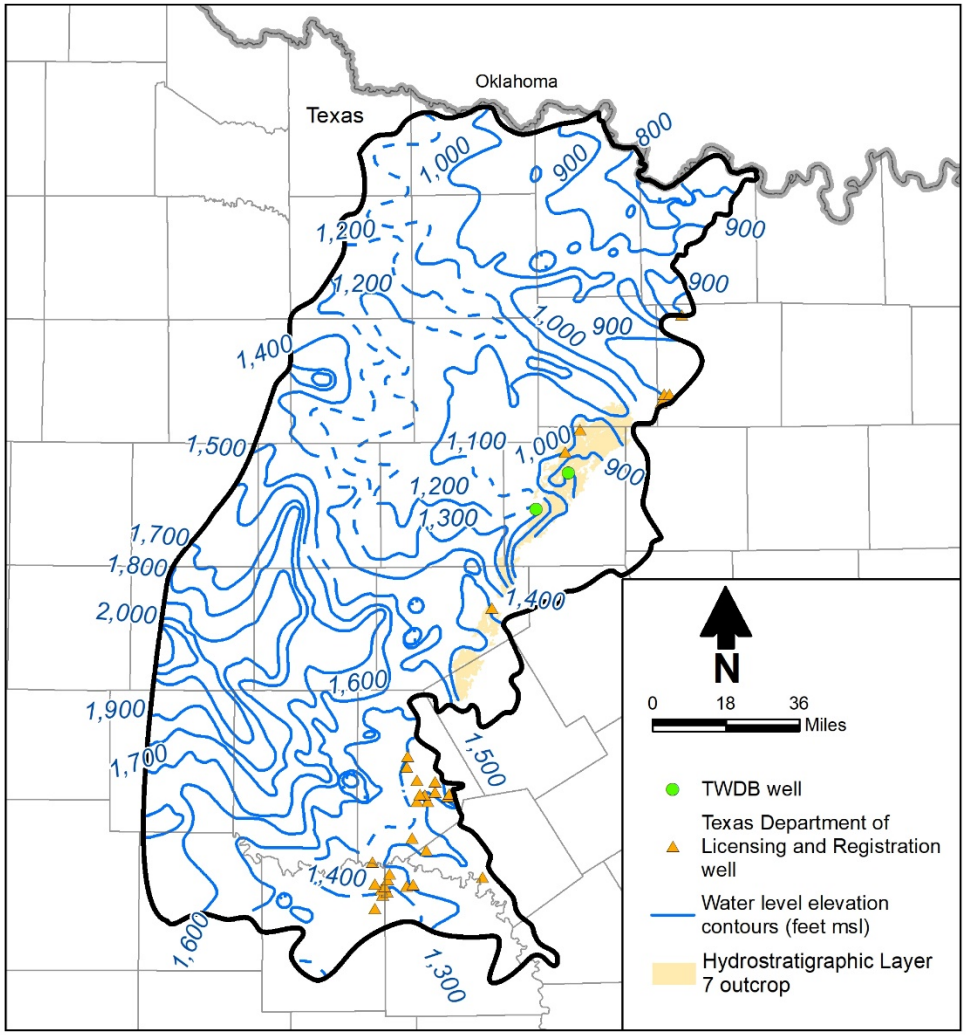
Layer 5 – Lower Cisco Group



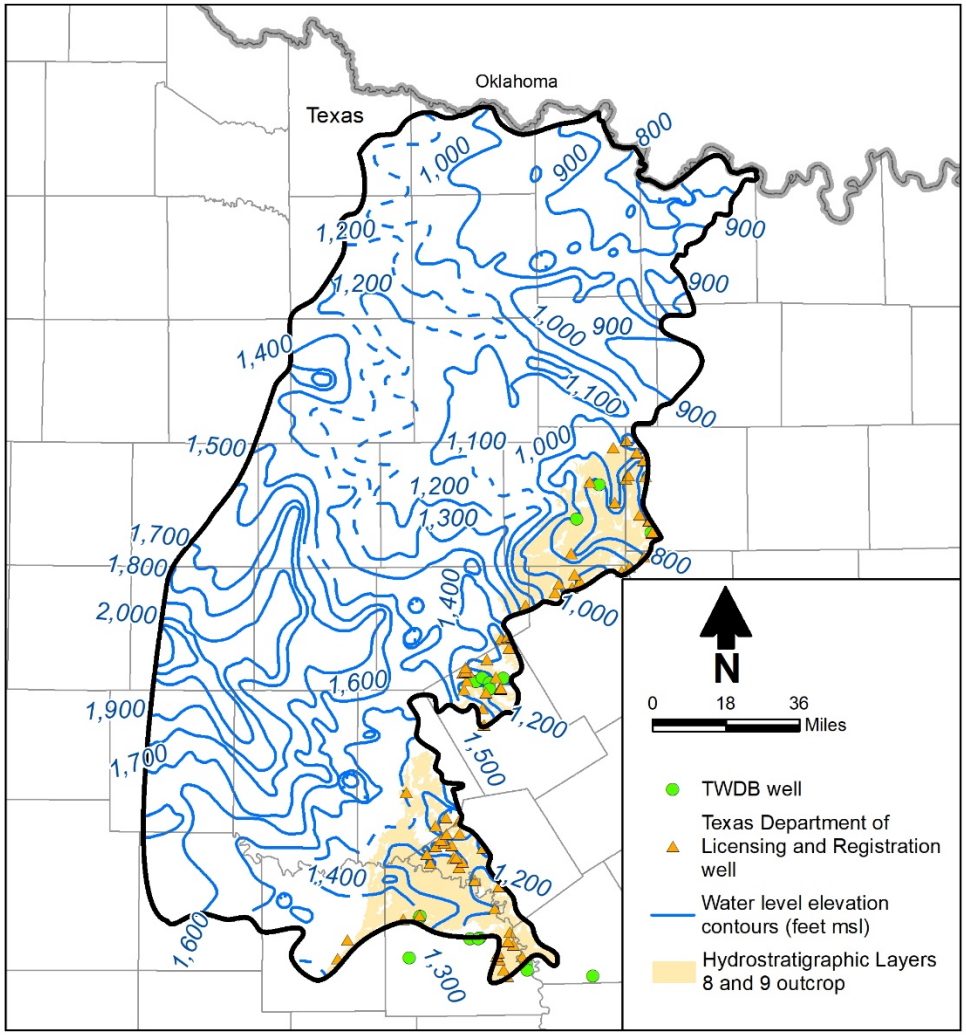
Layer 6 – Upper Canyon Group



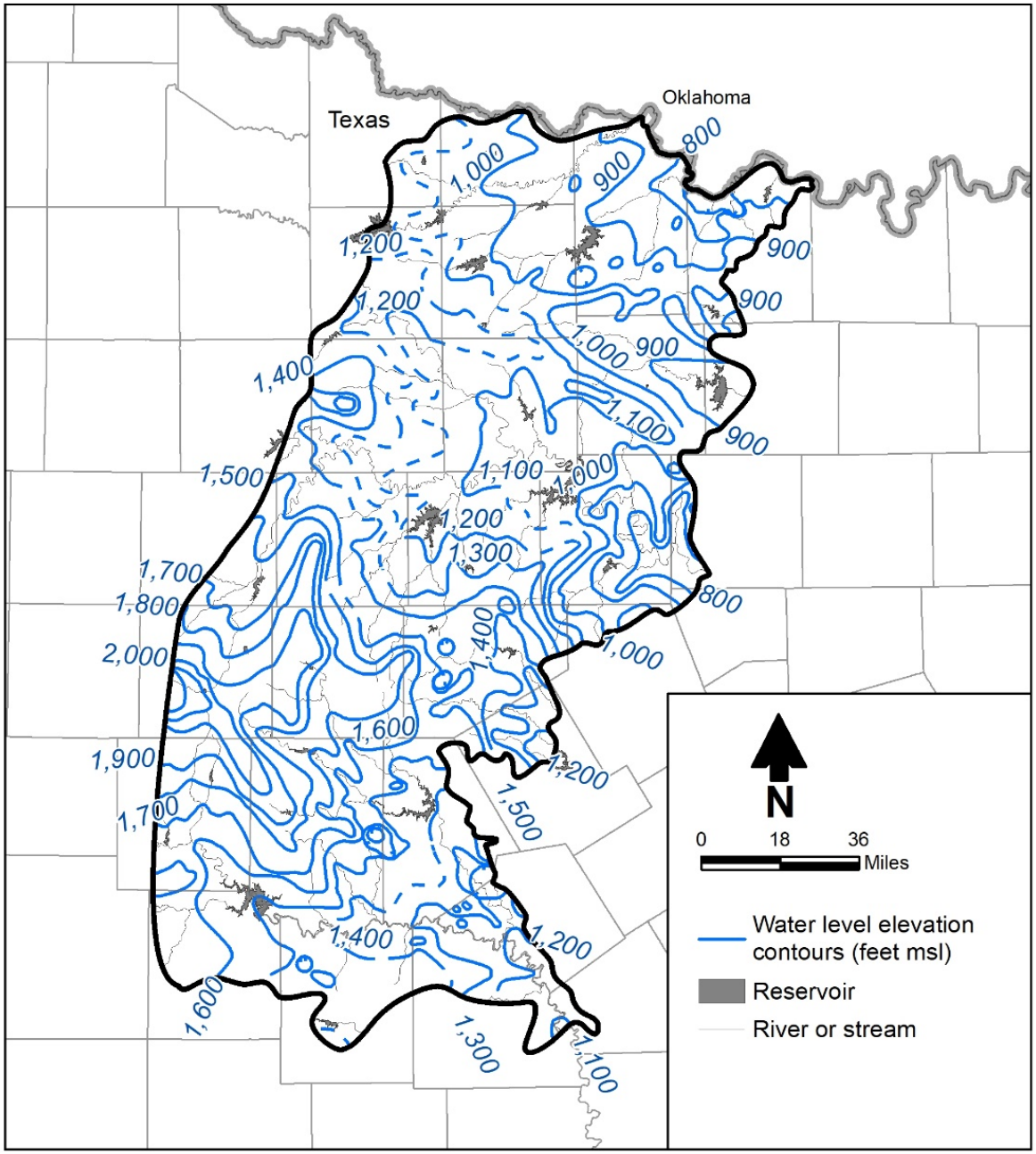
Layer 7 – Lower Canyon Group



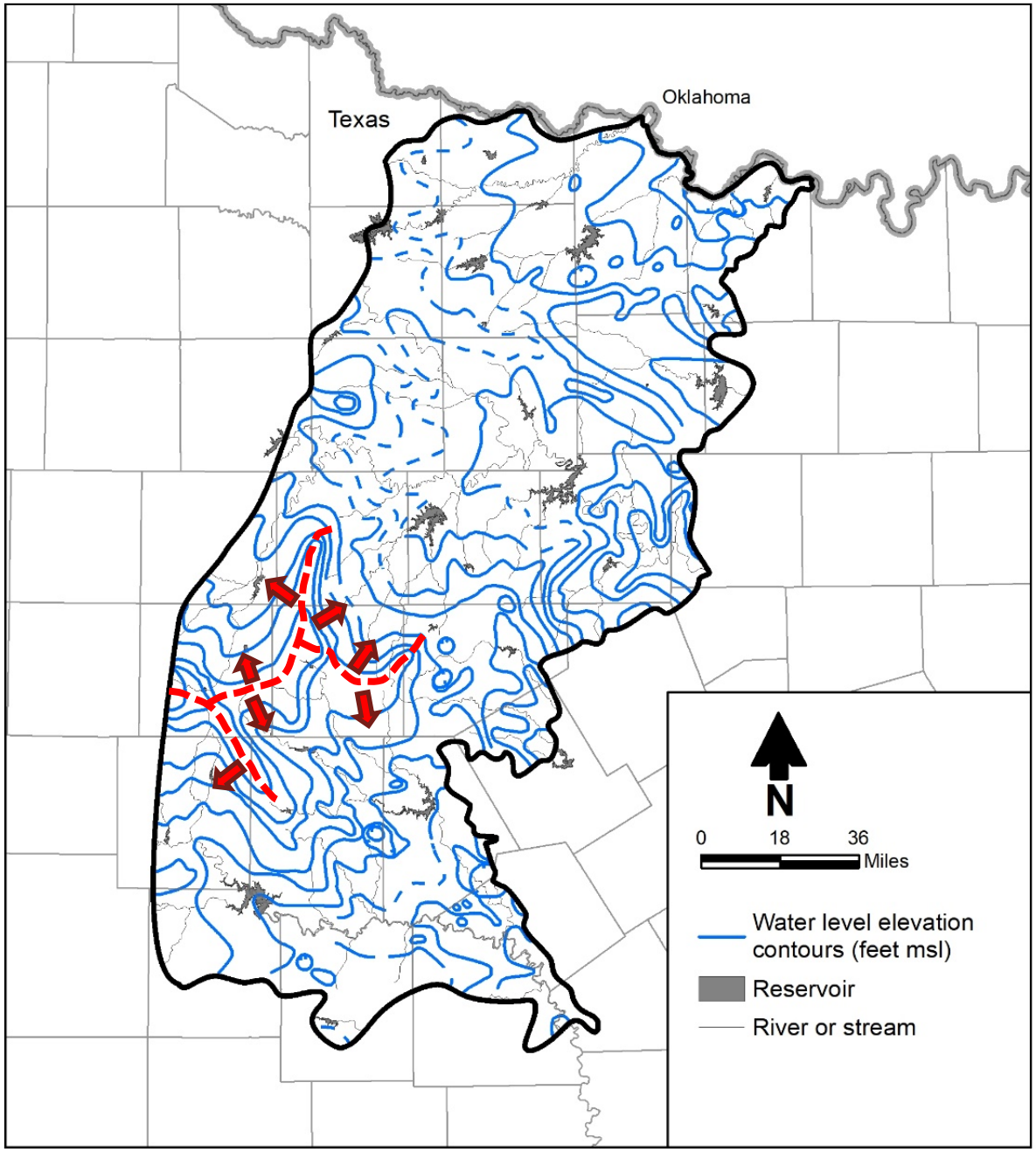
Layers 8 and 9 – Strawn Group and older



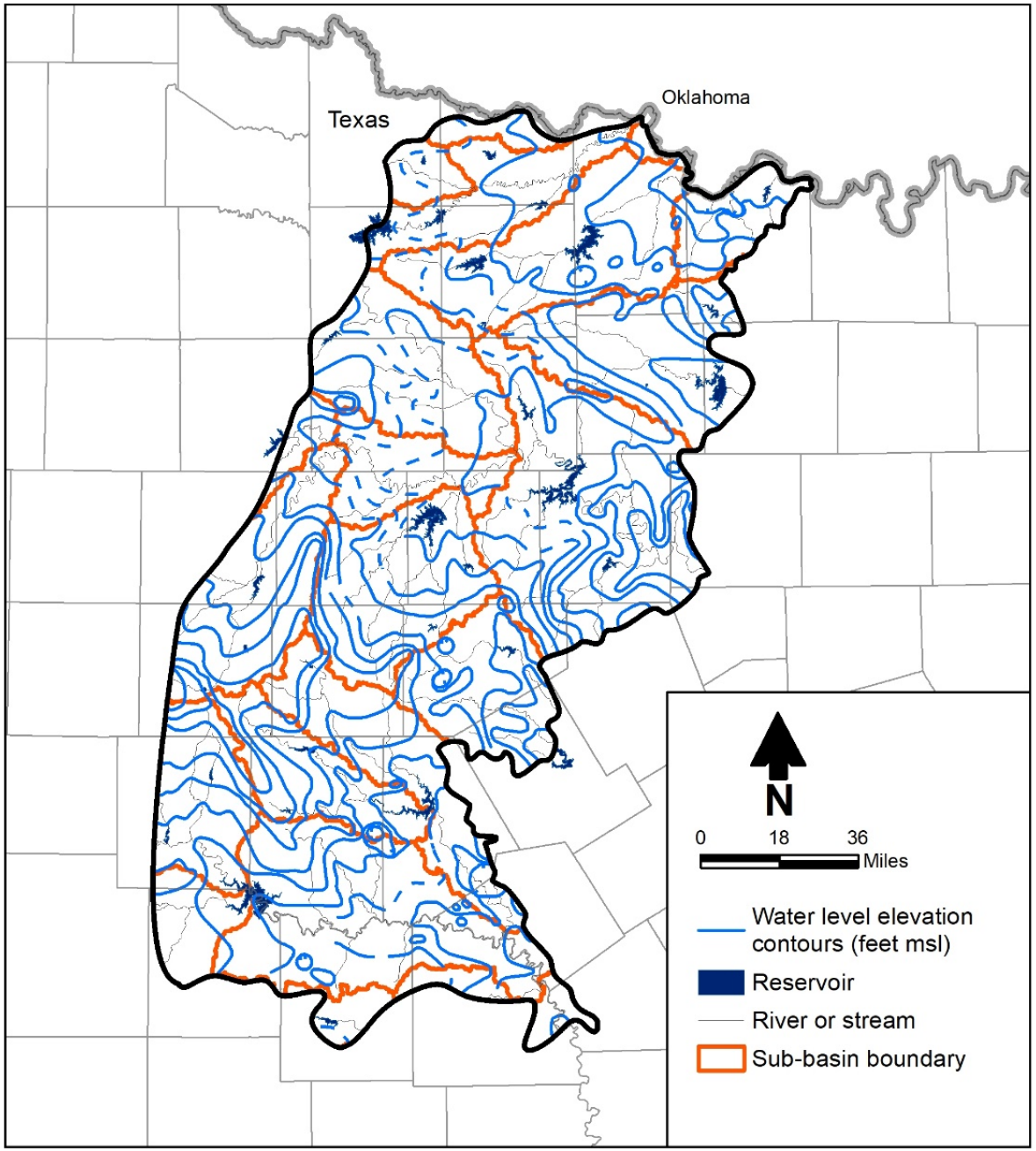
“Recent” water level map



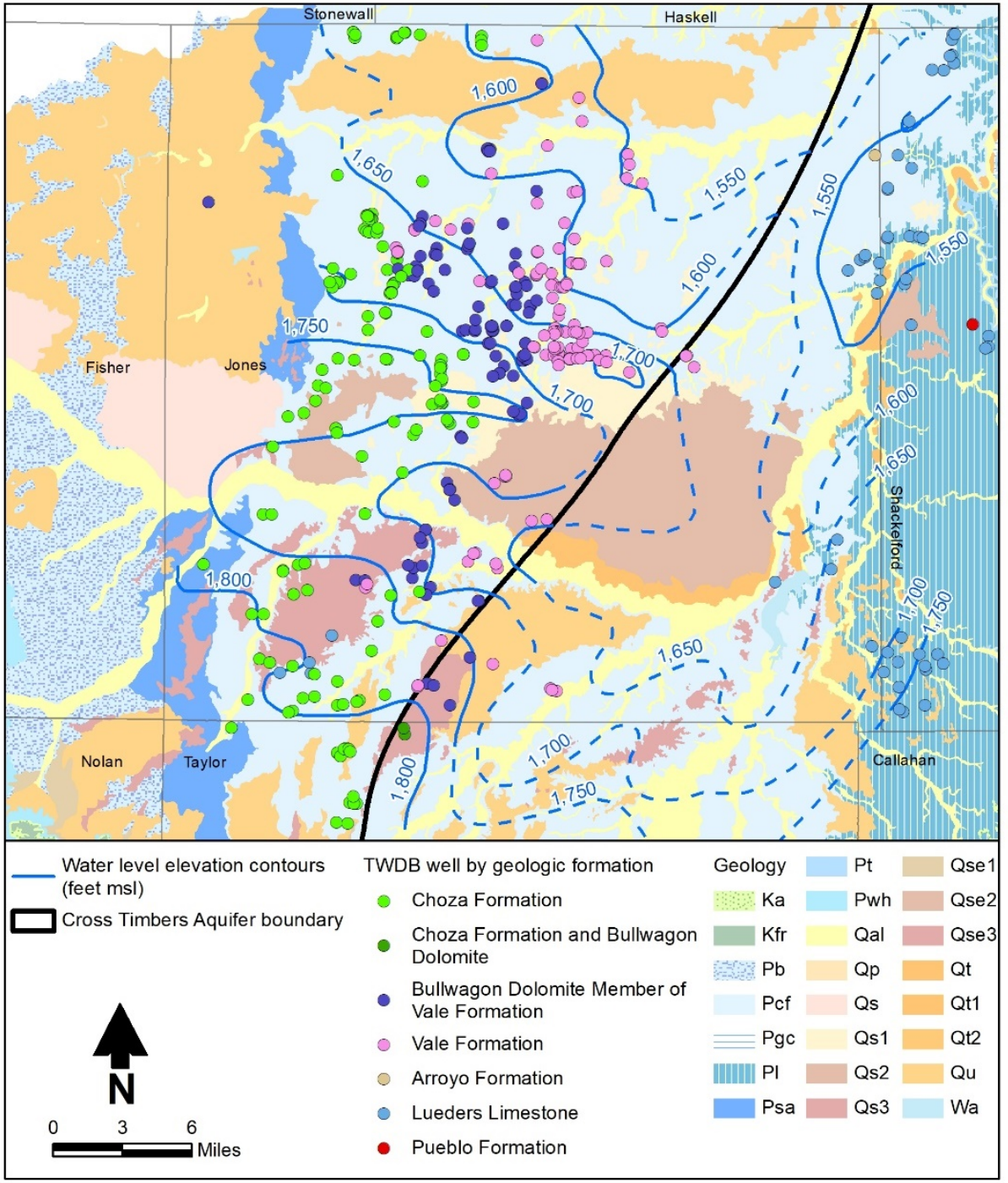
“Recent” water level map



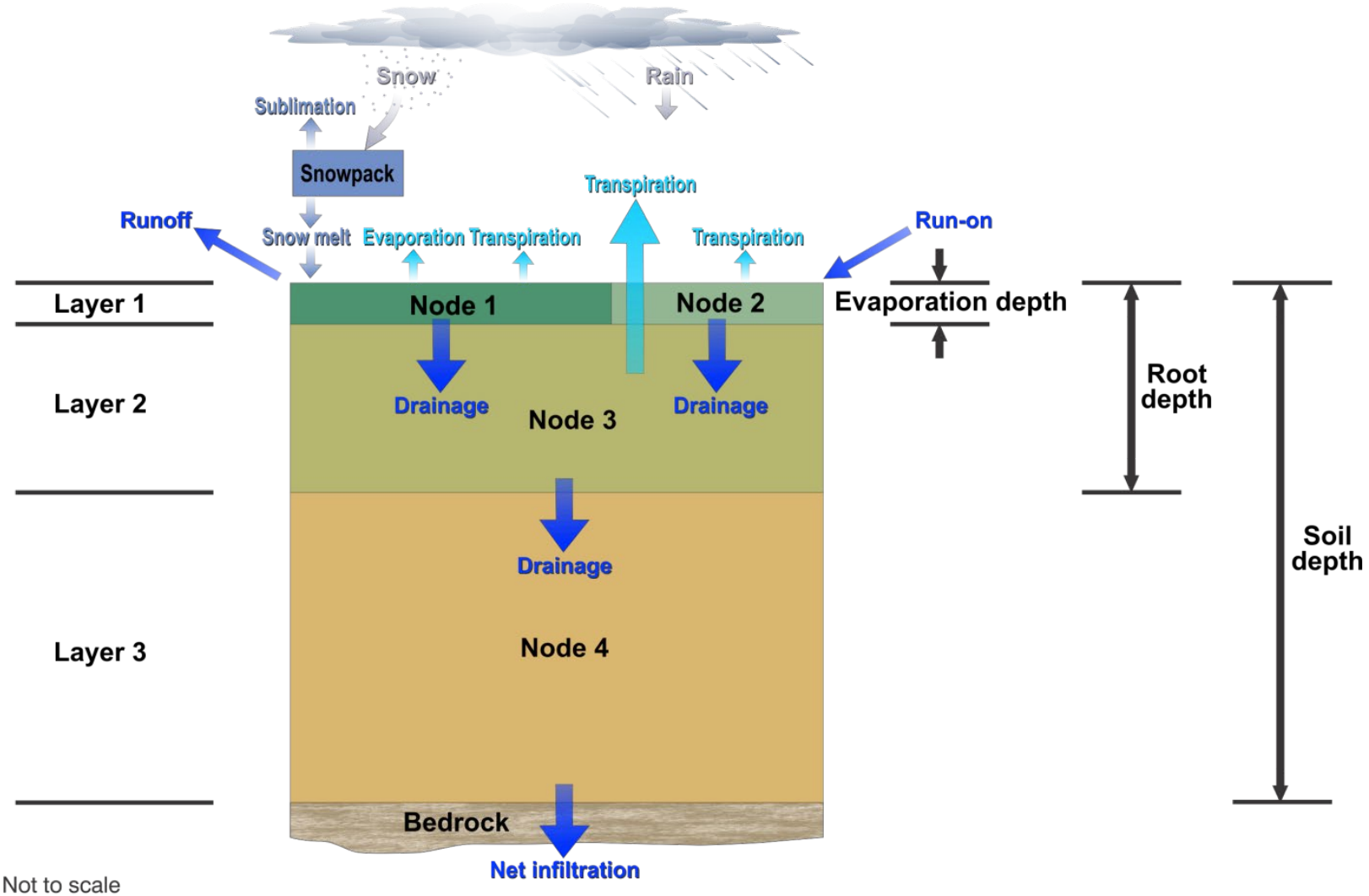
Water Levels With Watersheds



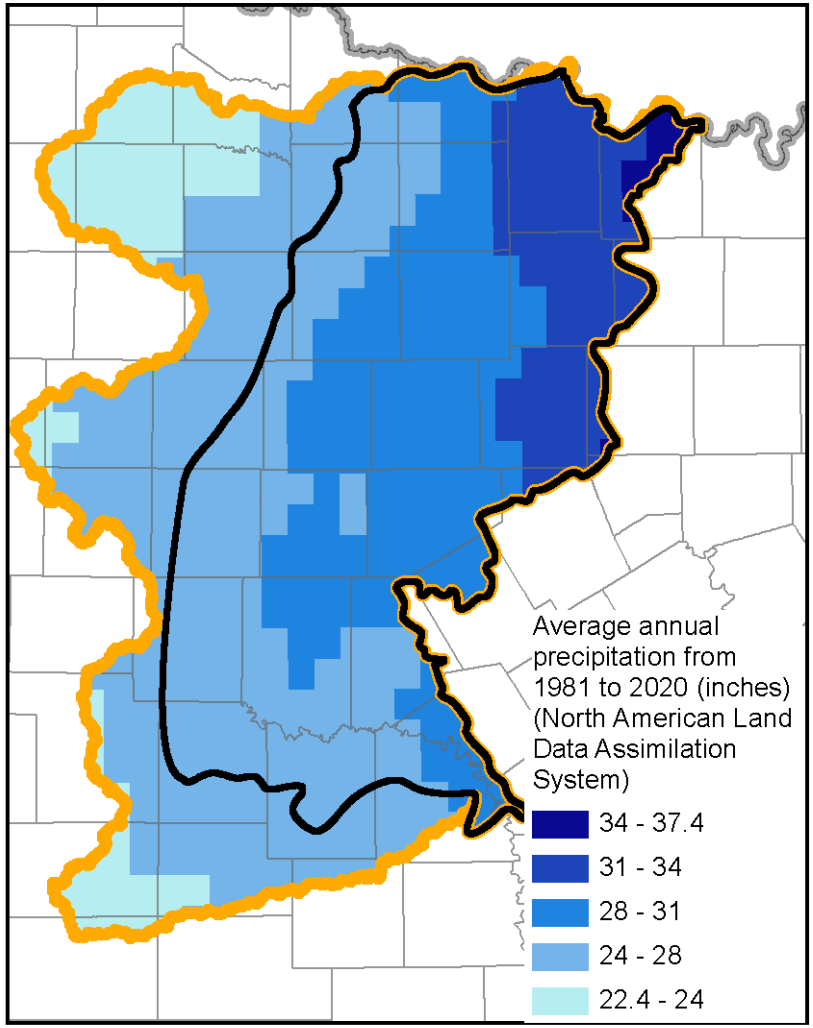
Water-Table Contours for Jones County – 1960s

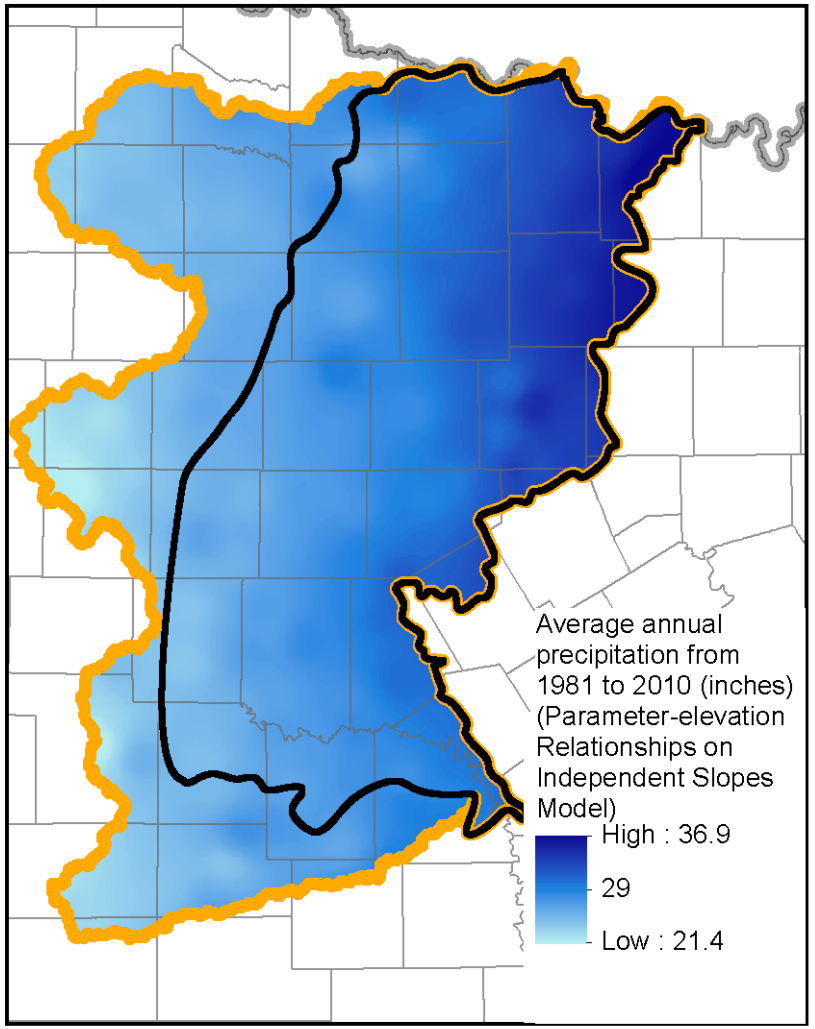


Groundwater Recharge – Distributed Parameter Watershed Model (DPWM)



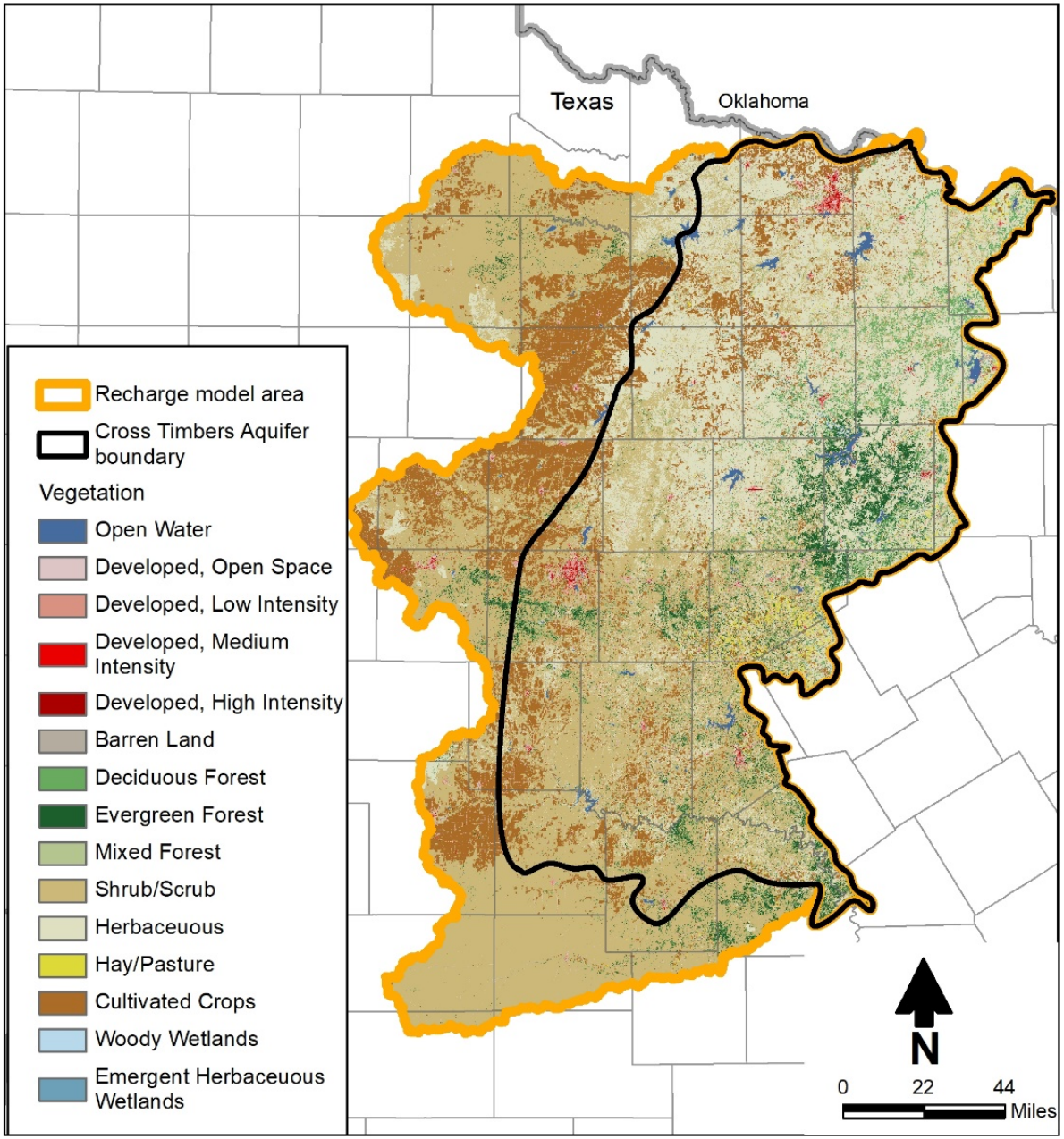
Comparison of PRISM and North American Land Data Assimilation System





Vegetation

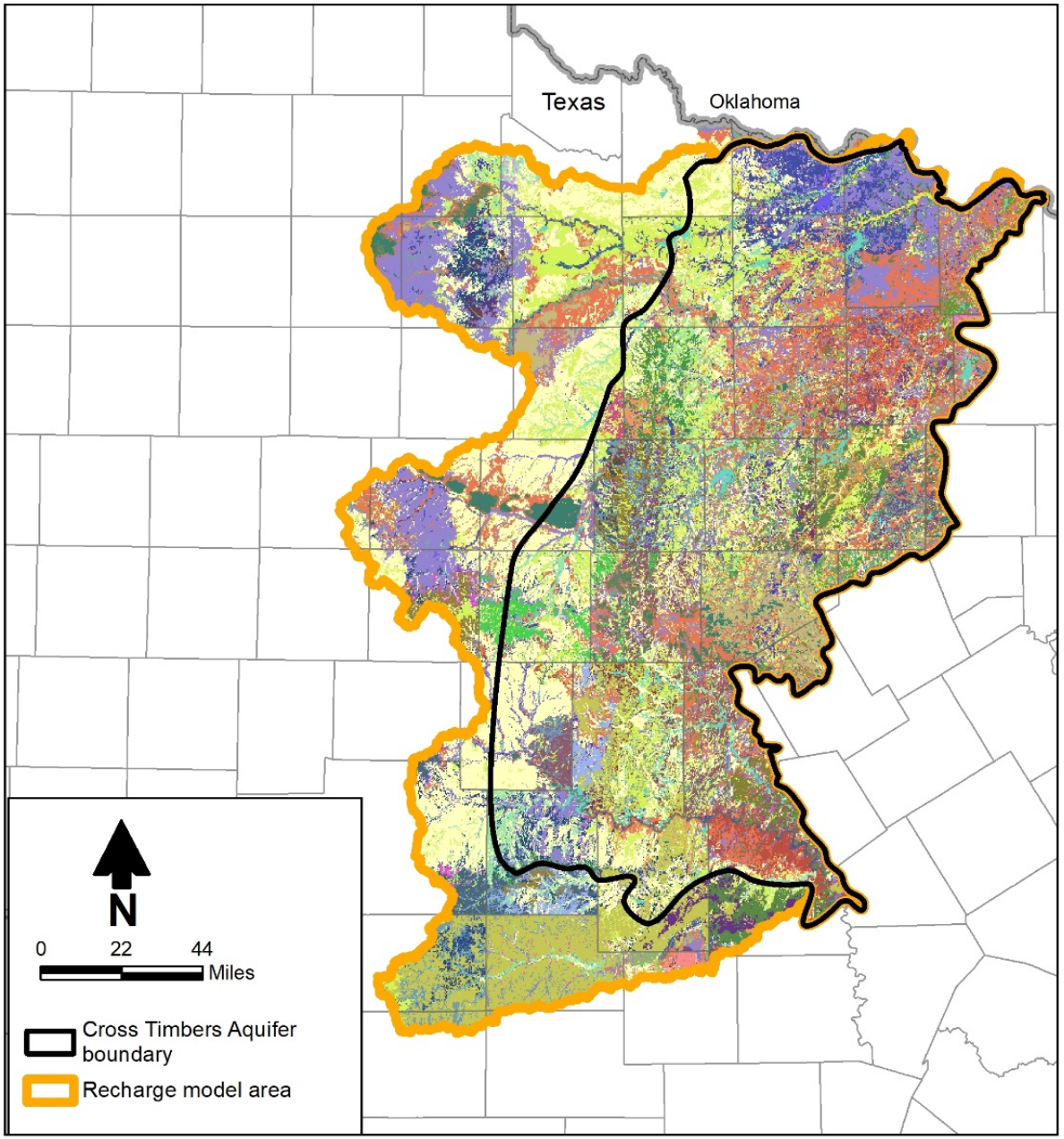
National Land Cover Database



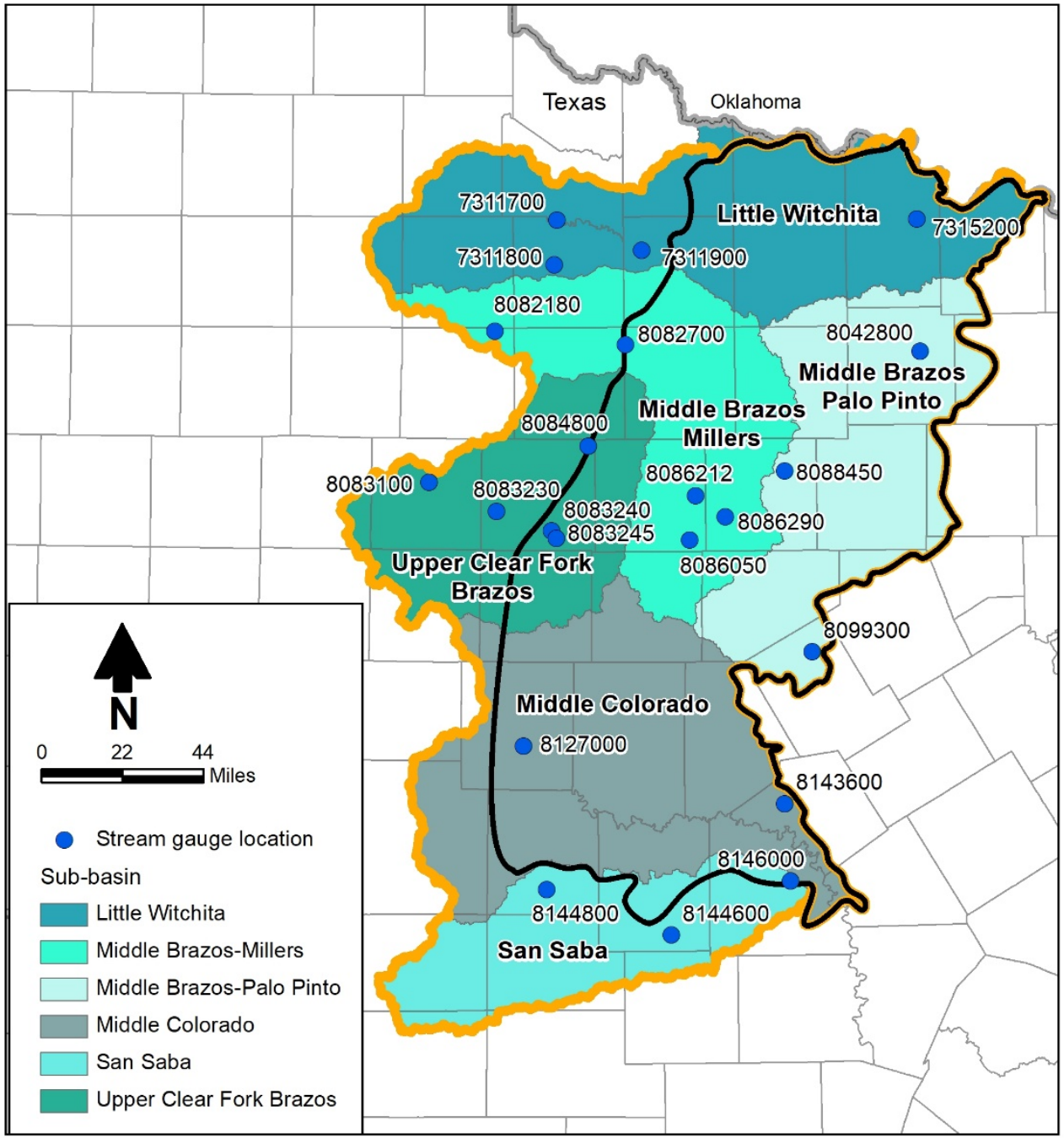
Soils

SSURGO – US Department of Agriculture

~ 2,500 map units; grouped to 61 based on texture

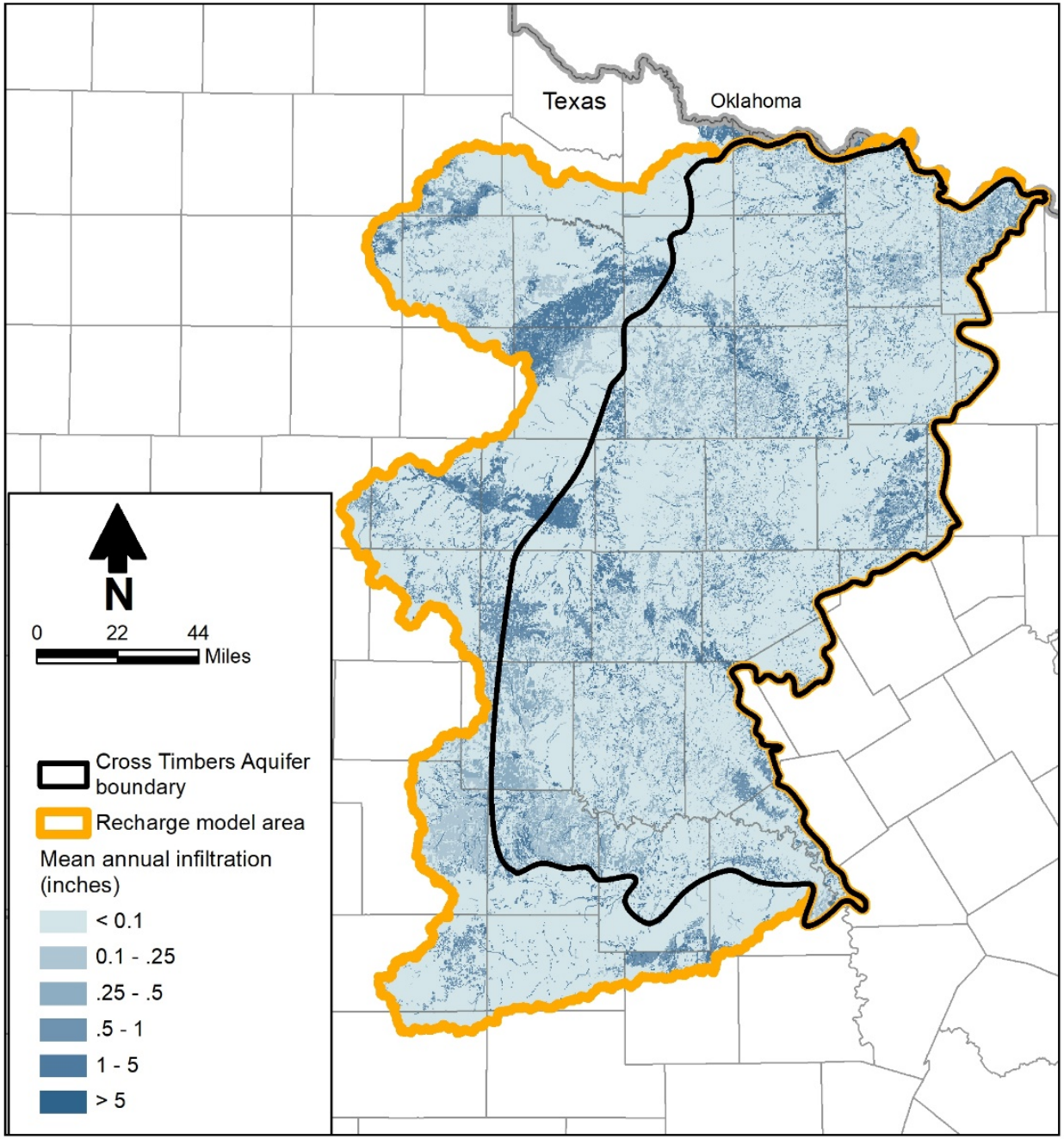


Six Recharge Models



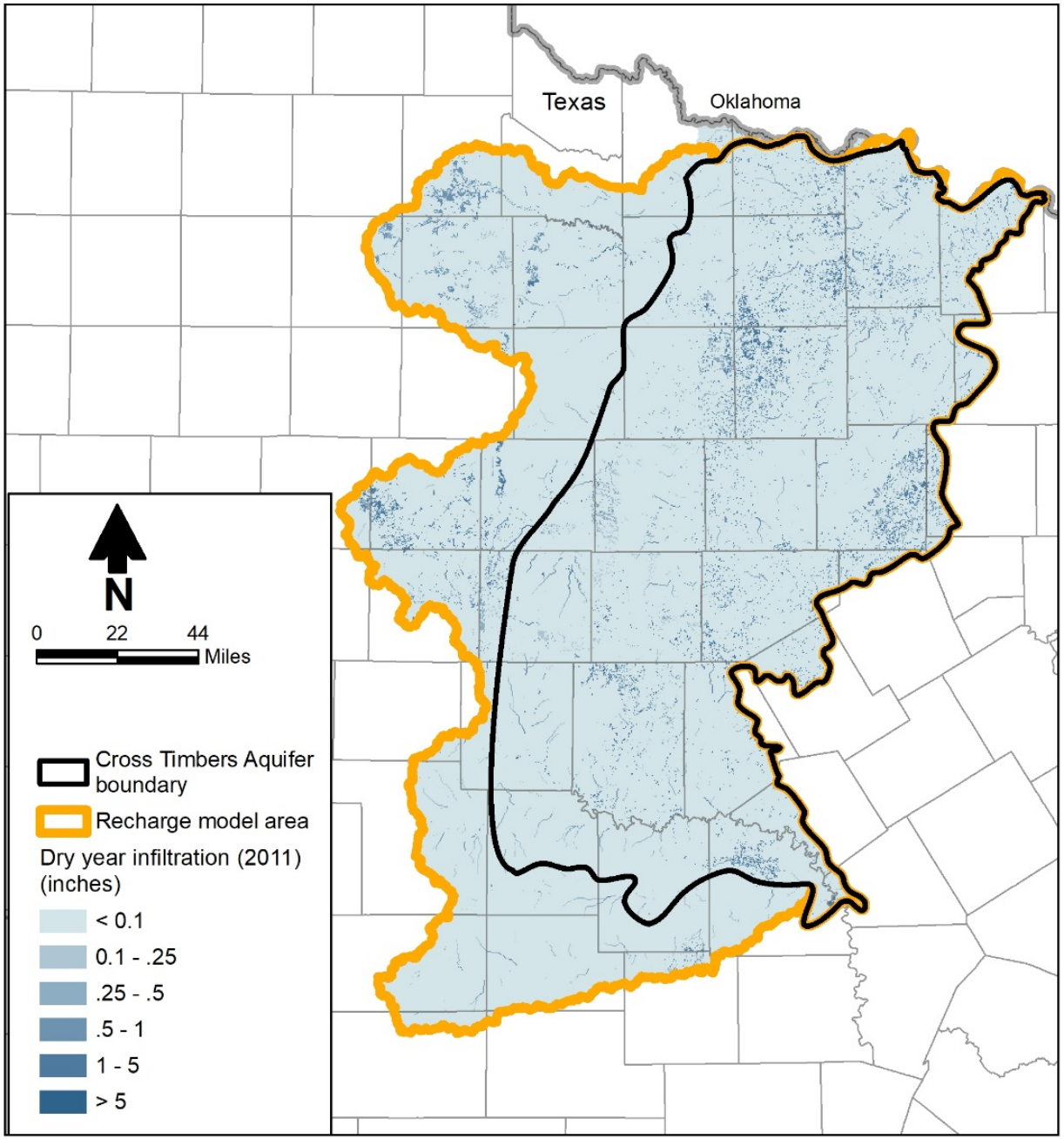
Average 1981-2020

25.5 – 31 inches/yr



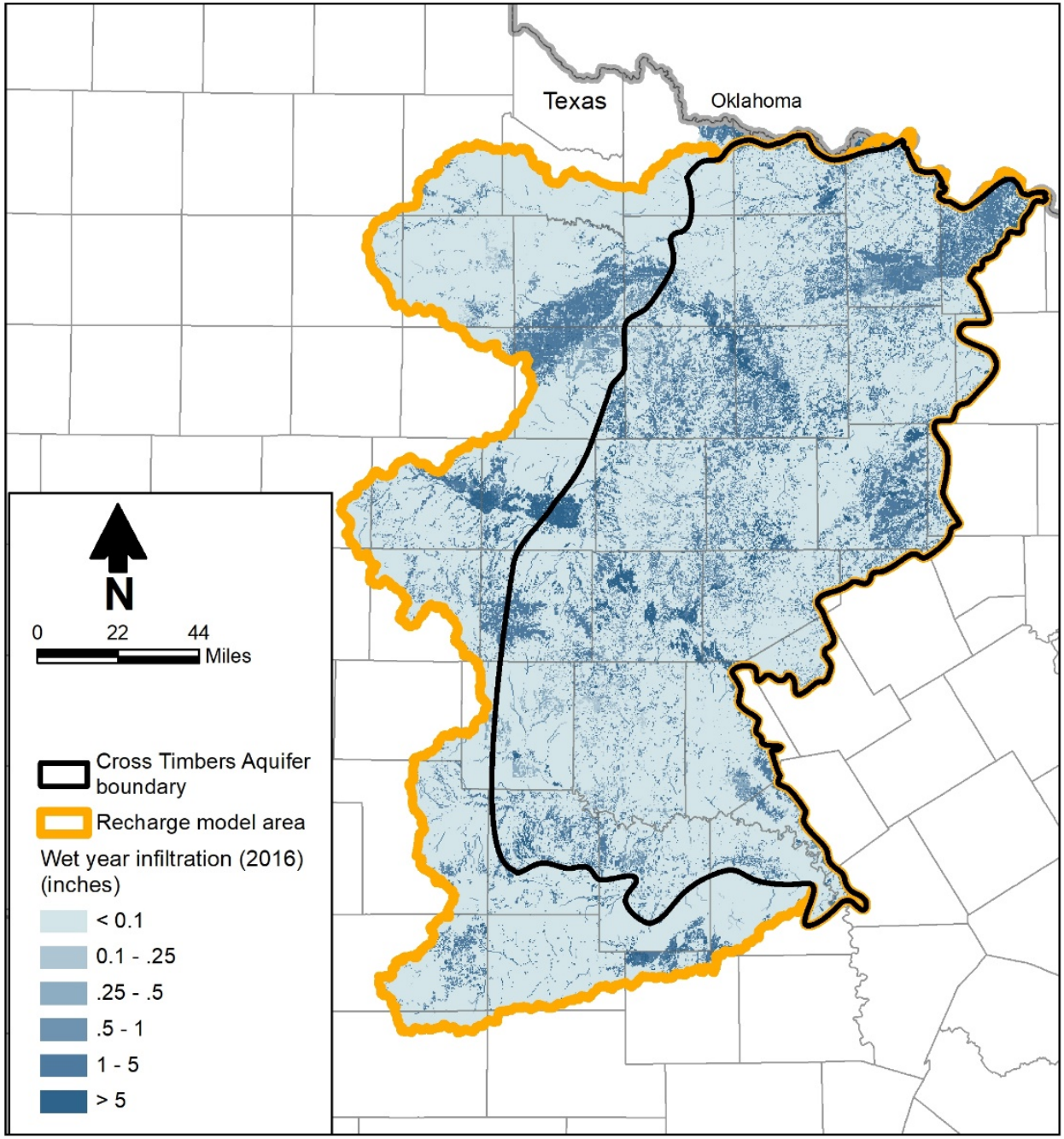
“Dry” Year 2011

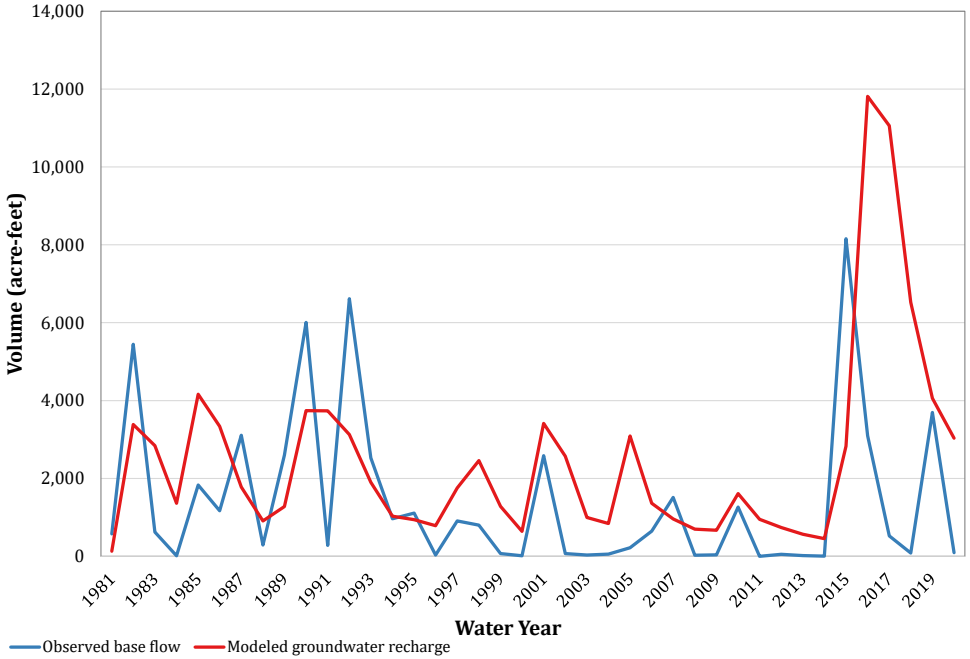
8.25 – 13.5 inches/yr

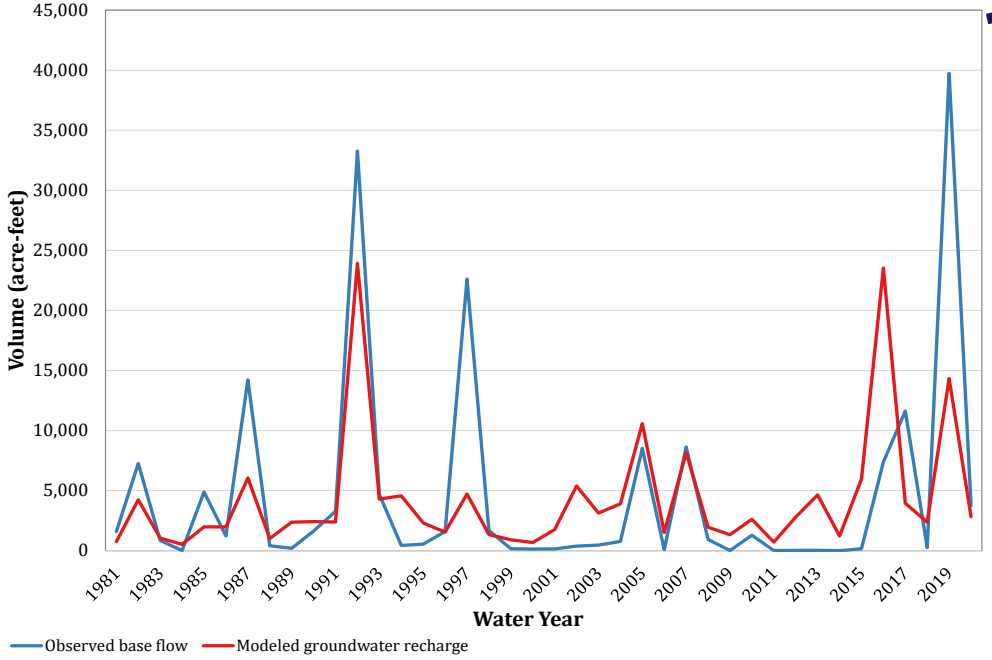


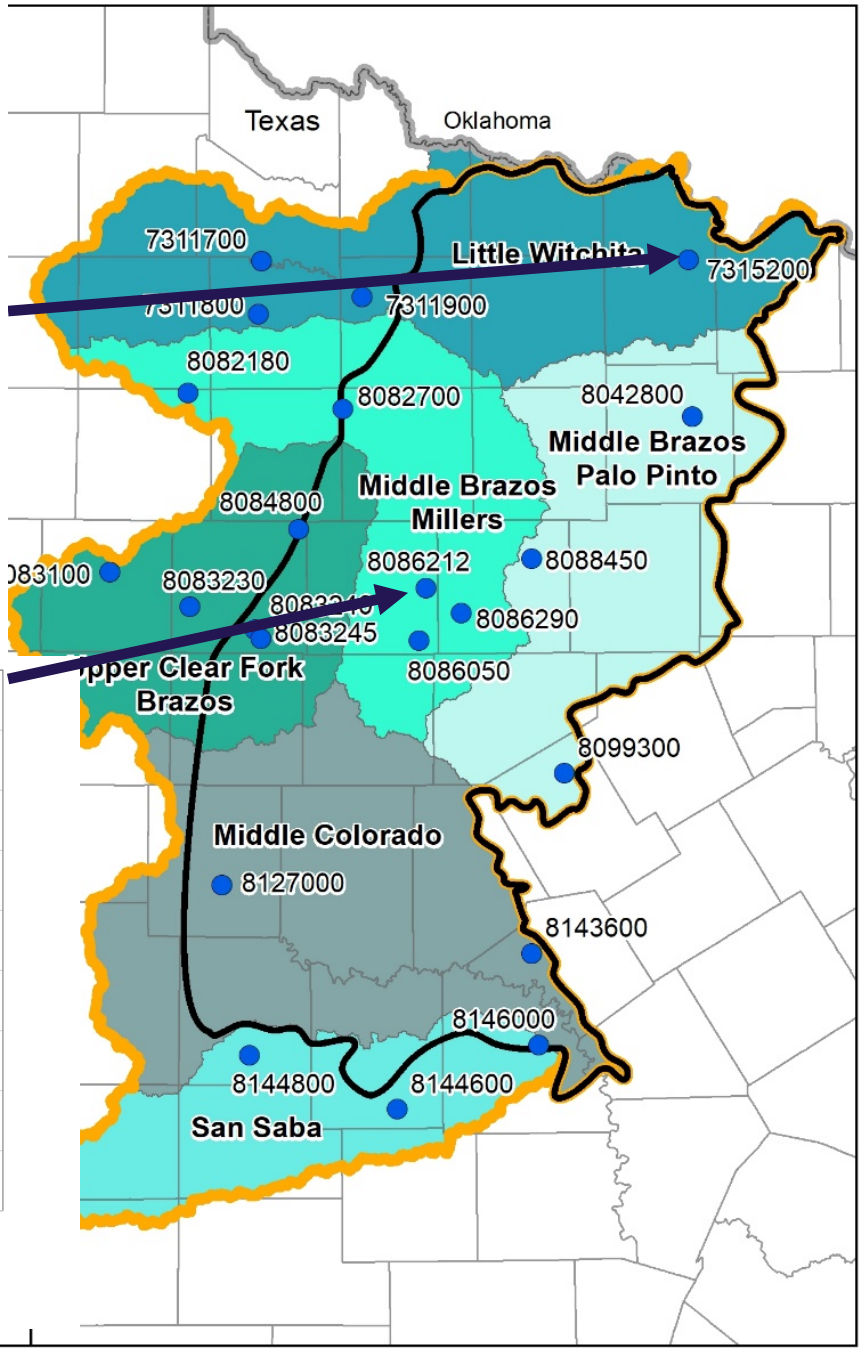
“Wet” Year 2016

37 – 47 inches/yr



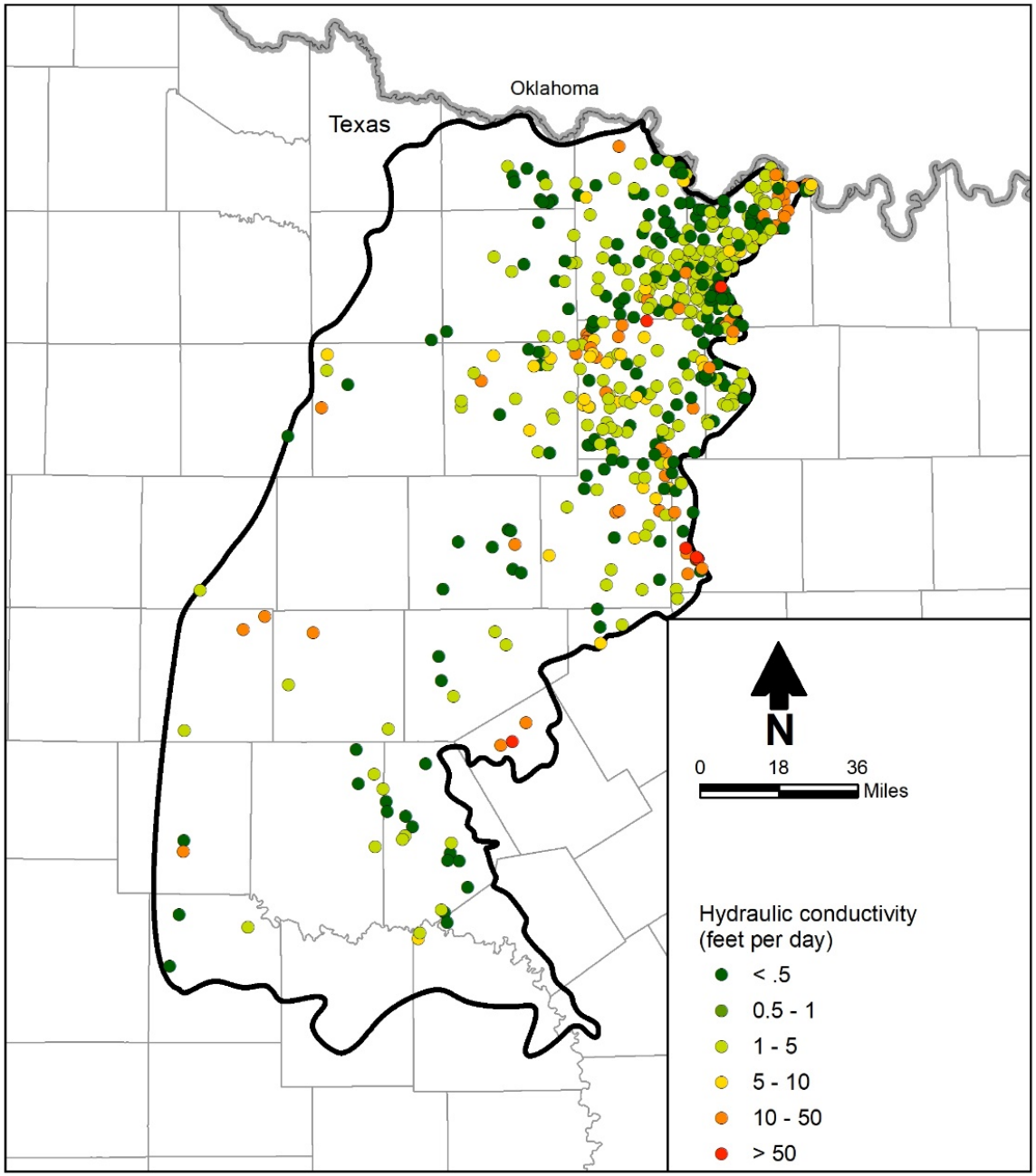

14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Volume (acre-feet)
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
Water Year
Observed base flow
Modeled groundwater recharge


45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Volume (acre-feet)
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
Water Year
Observed base flow
Modeled groundwater recharge


Texas
Oklahoma
7311700
7311800
7311900
Little Witchita
7315200
8082180
8082700
8042800
Middle Brazos
Palo Pinto
Middle Brazos
Millers
8084800
8086212
8088450
8083100
8083230
8086290
8083245
8086050
Brazos
8099300
Middle Colorado
8127000
8143600
8146000
8144800
8144600
San Saba

Model	Precip (inches)	Recharge (inches)	% Average Annual Precip	Recharge Excluding Alluvium (inches)	% Average Annual Precip
Little Wichita, Upper Clear Fork-Brazos	37.08	0.75	2.03	0.53	1.43
Middle Brazos-Millers	42.29	1.20	2.84	0.92	2.18
Middle Brazos-Palo Pinto	47.21	0.95	2.02	0.74	1.56
Middle Colorado	41.56	0.62	1.48	0.53	1.28
San Saba	39.71	0.56	1.42	0.49	1.24
Upper Clear Fork-Brazos	39.47	0.94	2.38	0.85	2.16

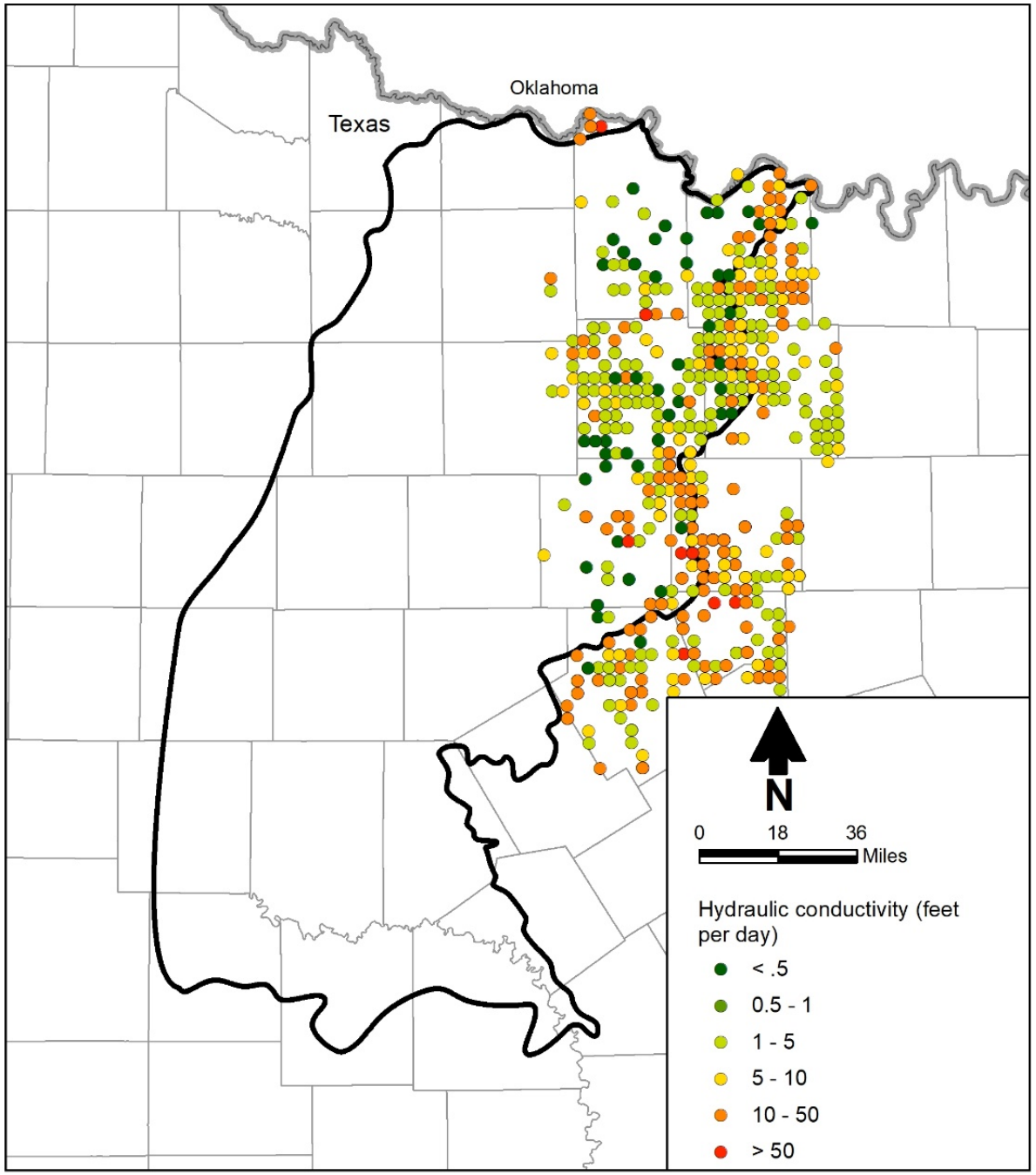
Hydraulic Conductivity (TDLR electronic data)



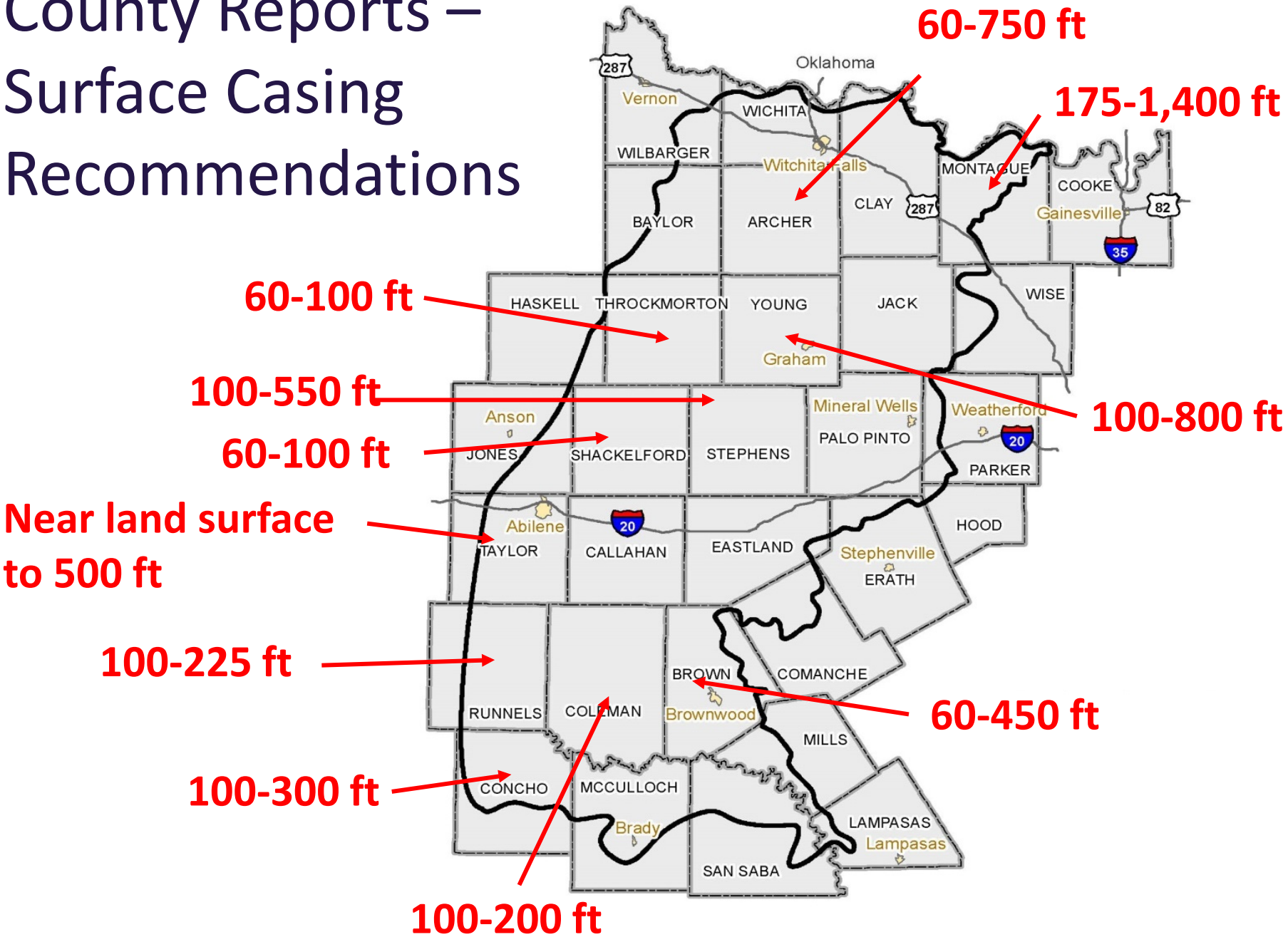
Hydraulic Conductivity Summary

Layer	No. of Wells	5th percentile	95th percentile	Median
2	5	—	—	0.83
3	46	0.014	20.6	0.48
4	207	0.08	16	0.78
5	75	0.03	16	1.9
6	75	0.023	12.1	0.93
7	31	0.06	18.5	0.89
8	60	0.013	78.2	5.0

Analysis of Data from Nicot and others (2013)



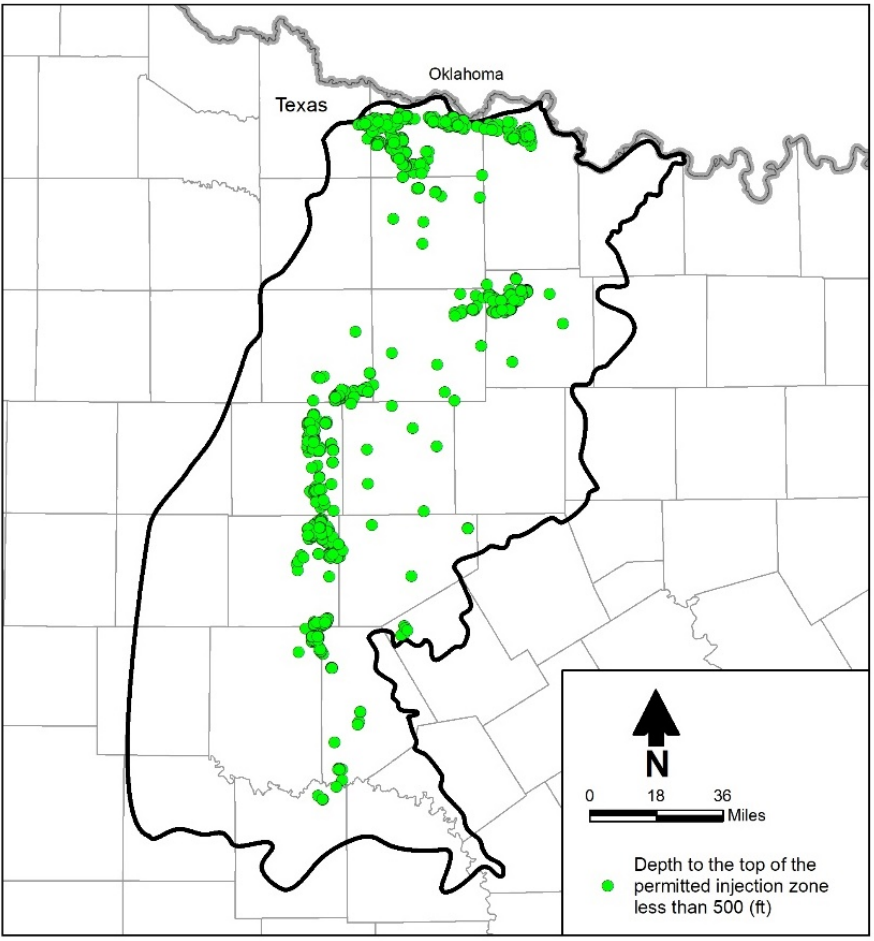
County Reports – Surface Casing Recommendations



Aquifer Thickness

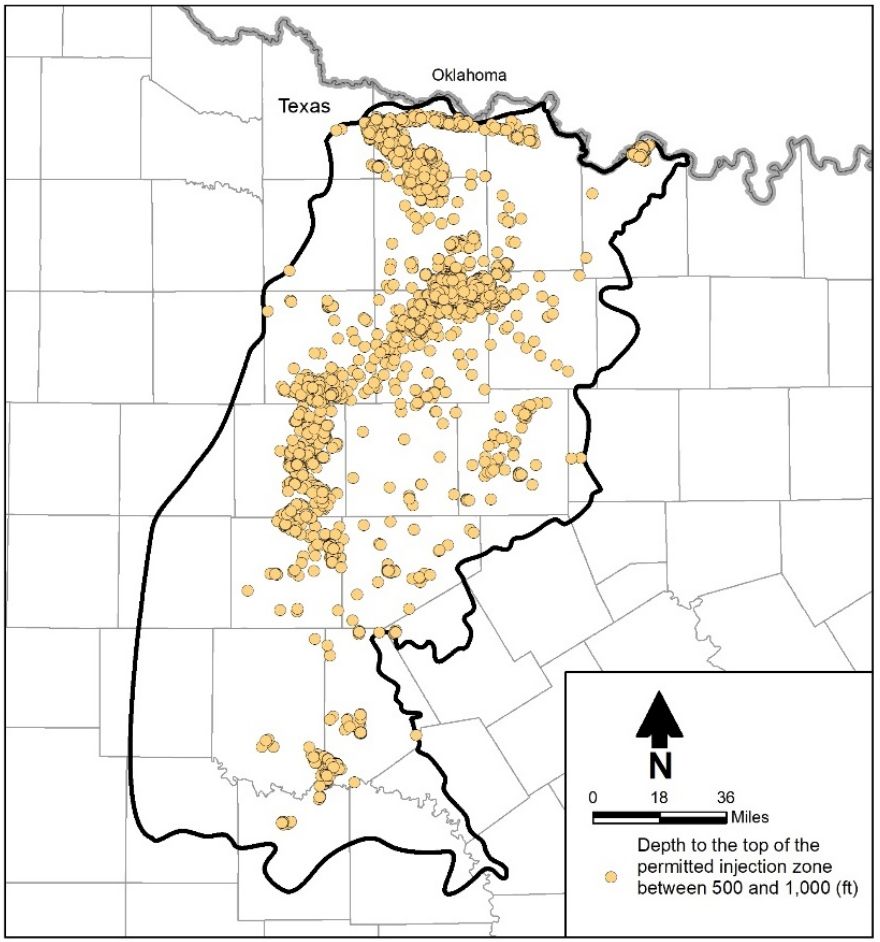
Top of Injection zone

< 500 ft

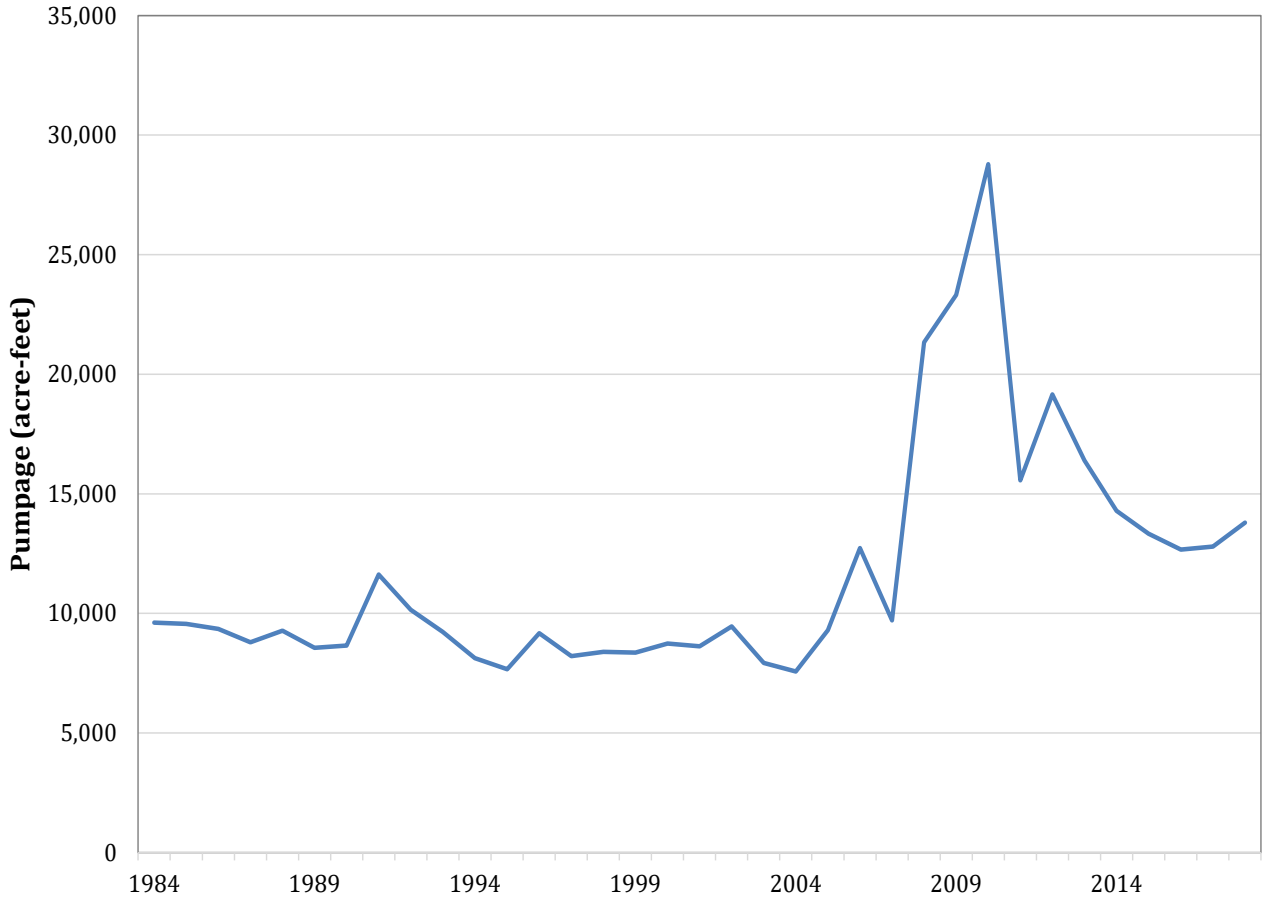


Top of injection zone

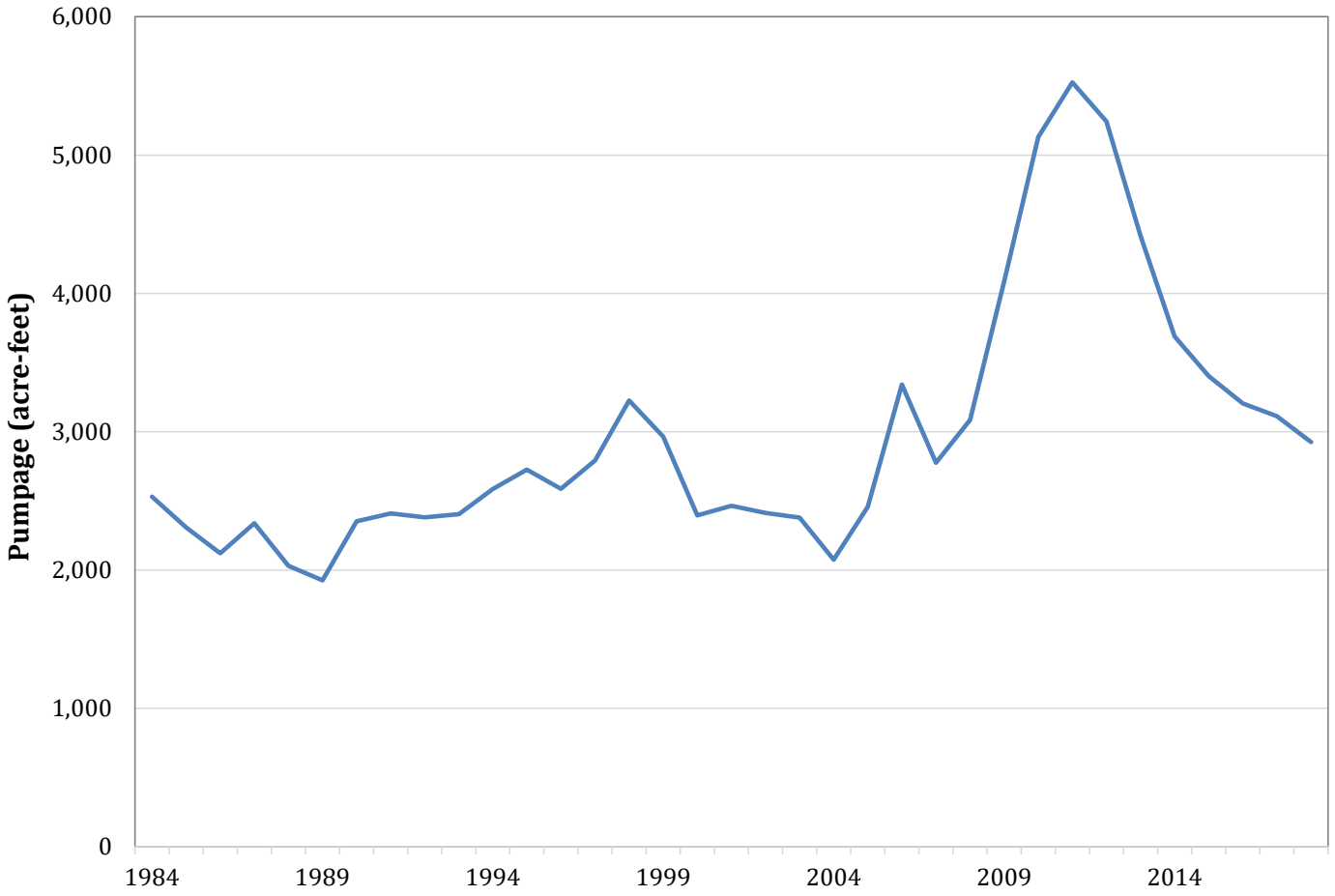
500 -1,000 ft



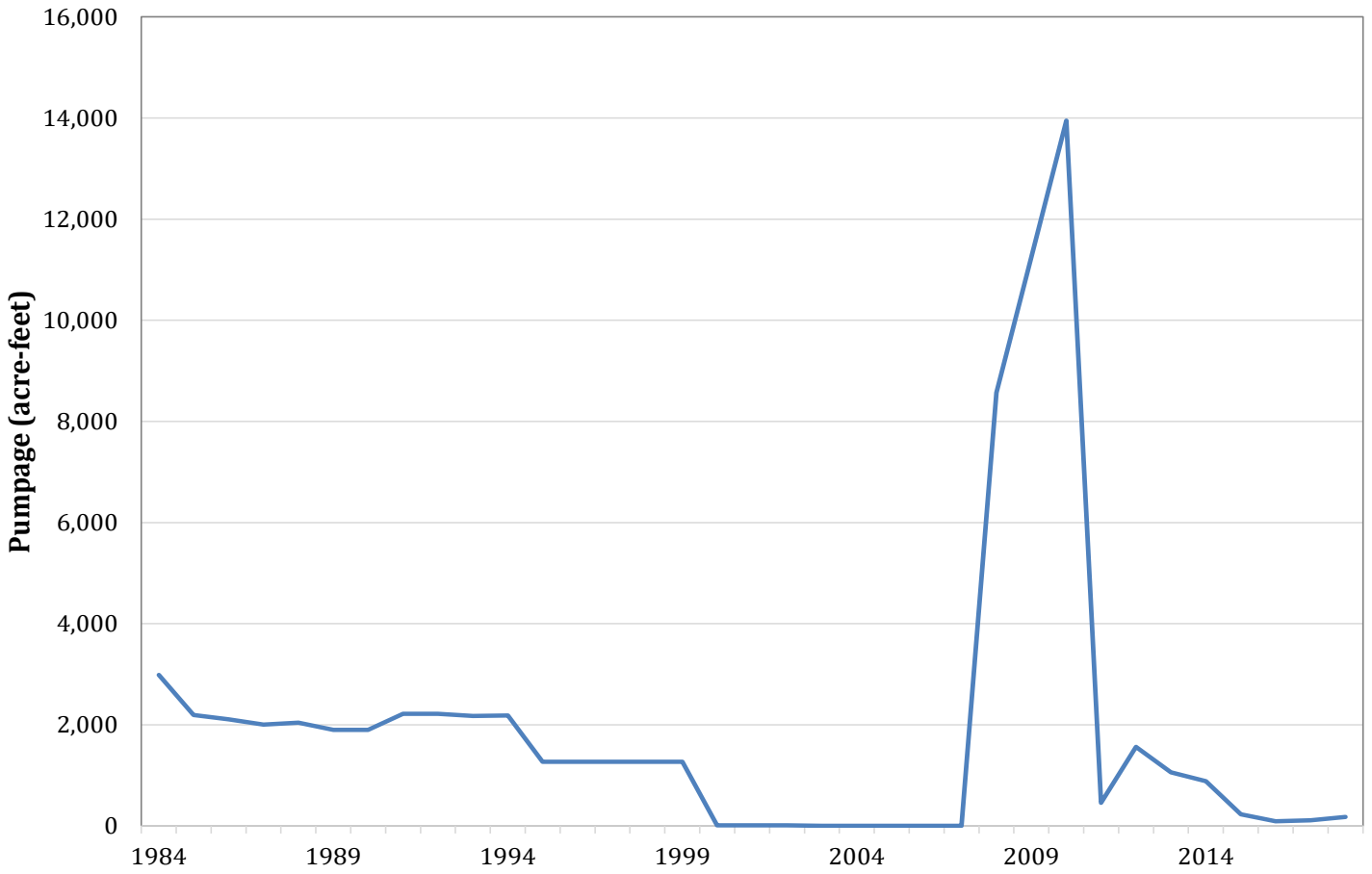
Total Groundwater Pumping



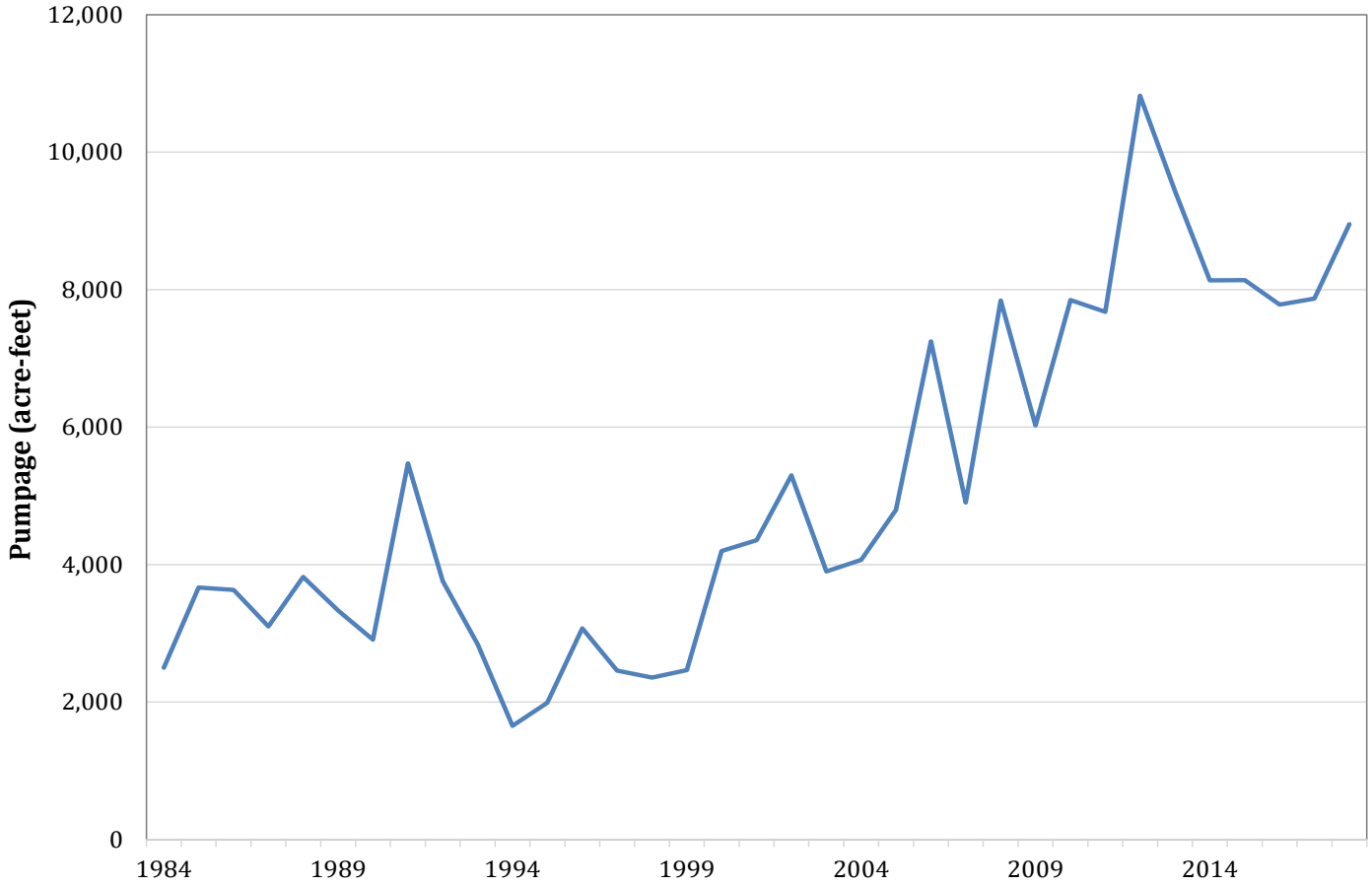
Municipal Groundwater Pumping



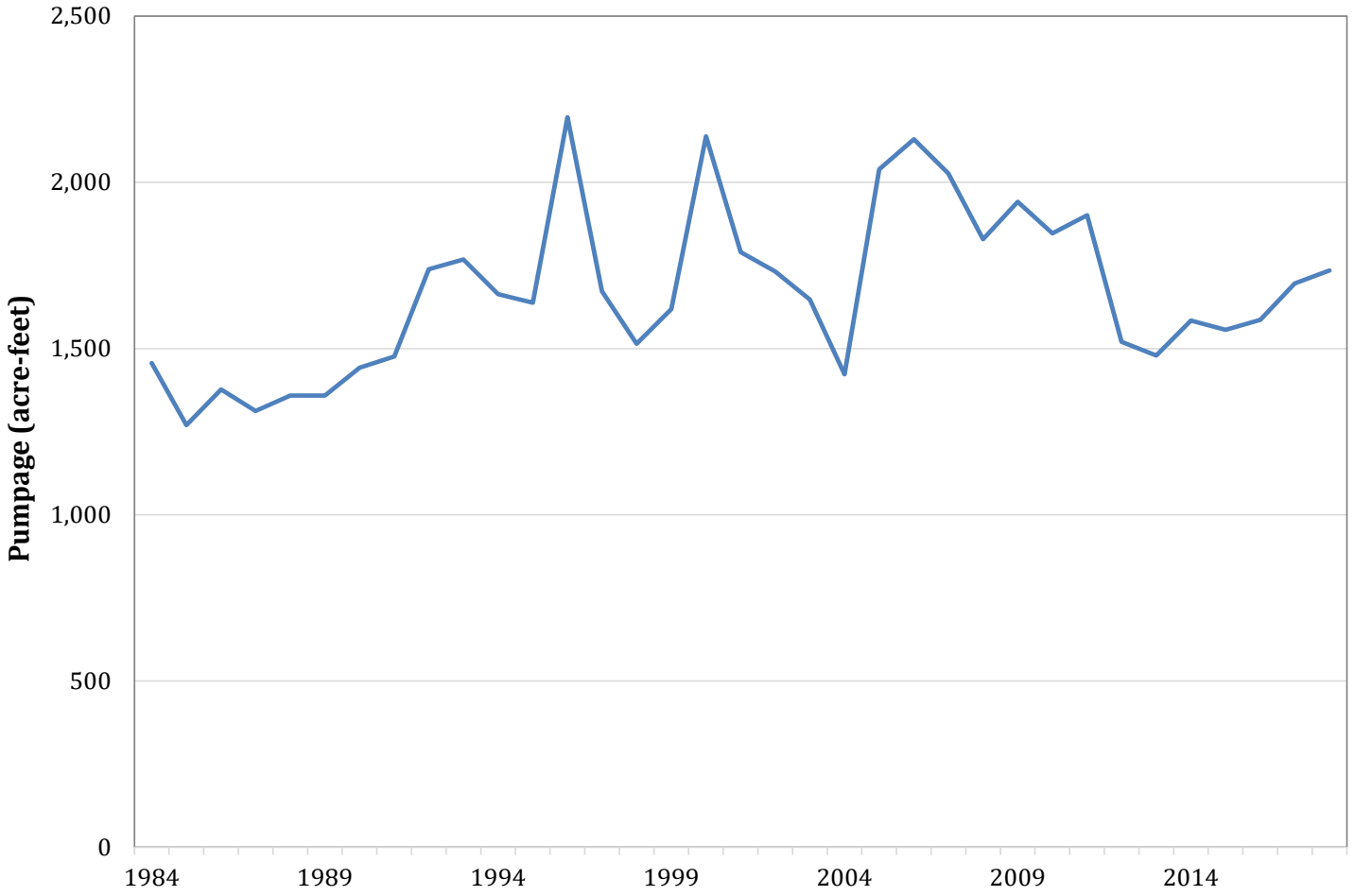
Mining Groundwater Pumping



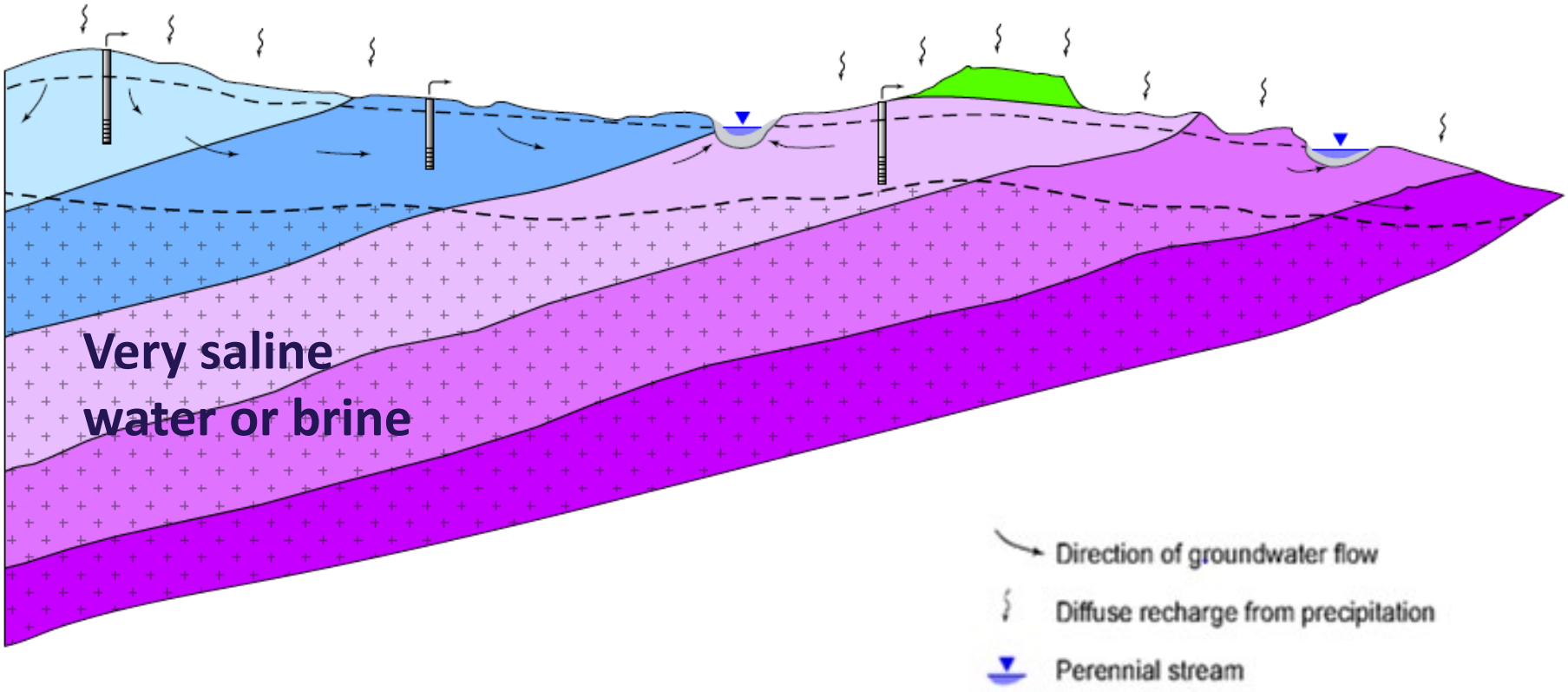
Irrigation Groundwater Pumping



Livestock Groundwater Pumping



Conceptual Model



Thoughts/Recommendations for TWDB Consideration

1. Include Quaternary alluvium as formal part of the Cross Timbers Aquifer
2. Develop a base of aquifer map
3. Northern aquifer extent at the Red River should be sufficient
4. Create formal aquifer subcrop designation below the Northern Trinity to the east
5. Extend western aquifer boundary to coincide with the Blaine Aquifer boundary

Texas Water Development Board

Thank you!

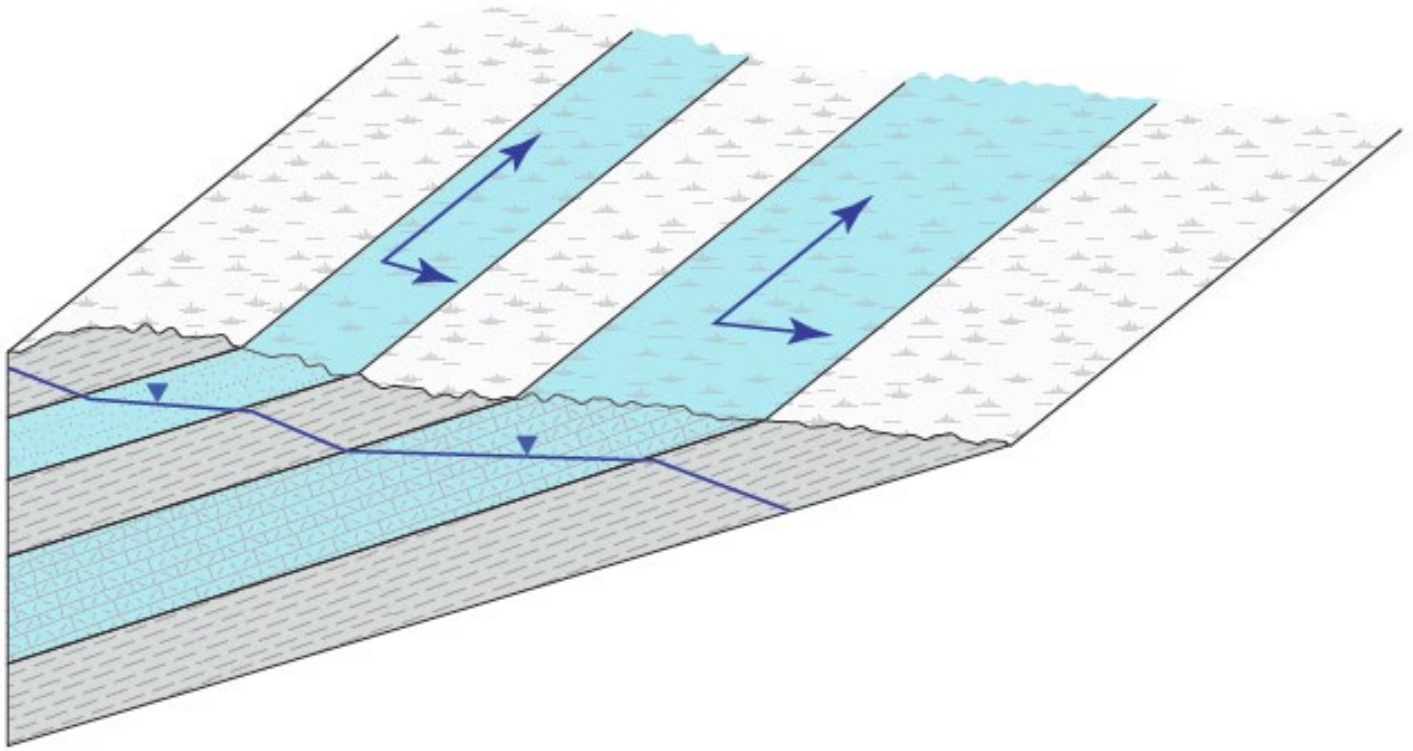
DBS&A engineering geoscience hydrology

DBS&A
Daniel B. Stephens & Associates, Inc.
a Geo-Logic Company

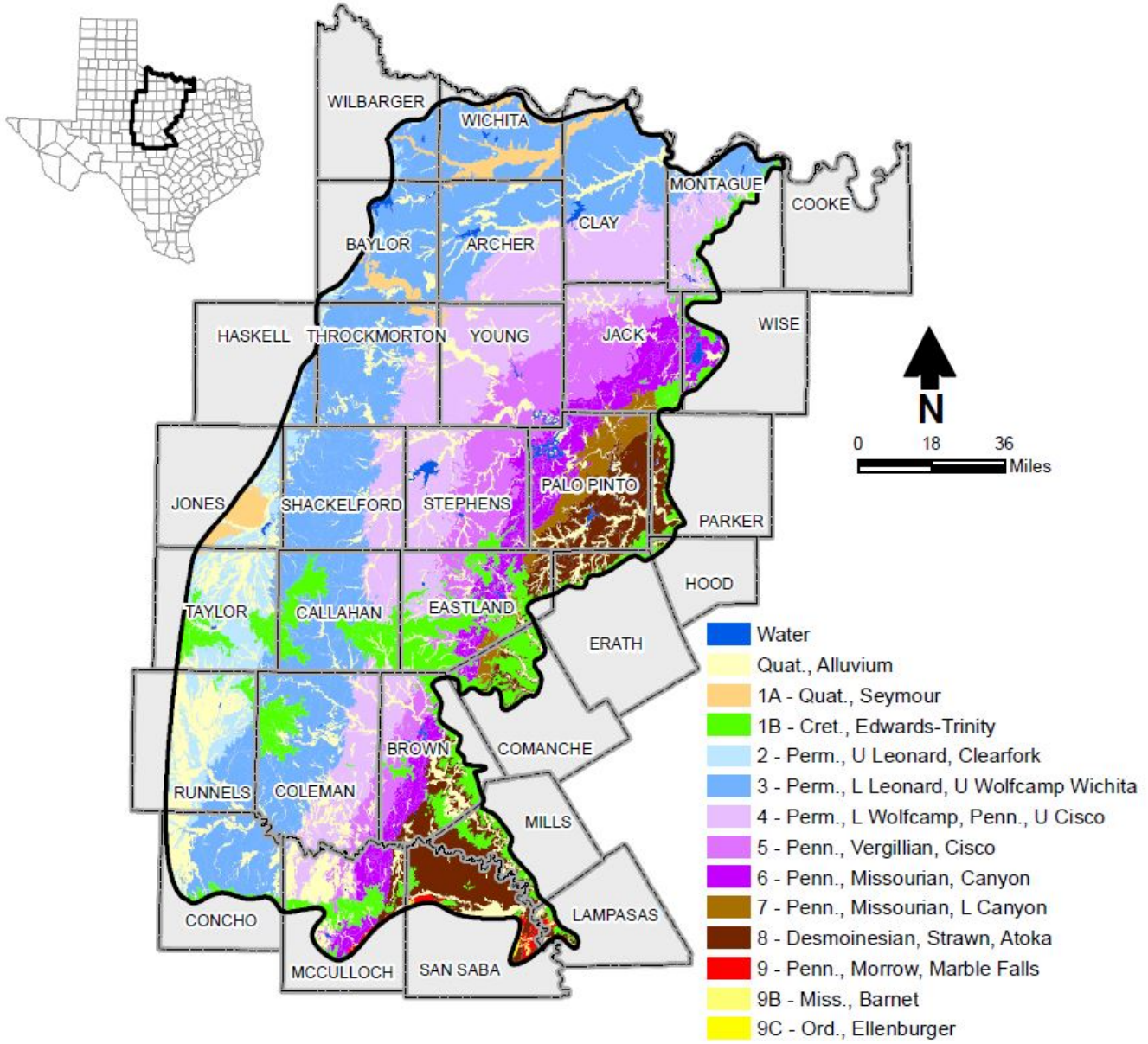
Allan R. Standen LLC
Groundwater & Natural Resource Consulting

Blanton & Associates, Inc.
Environmental Consulting • Planning • Project Management

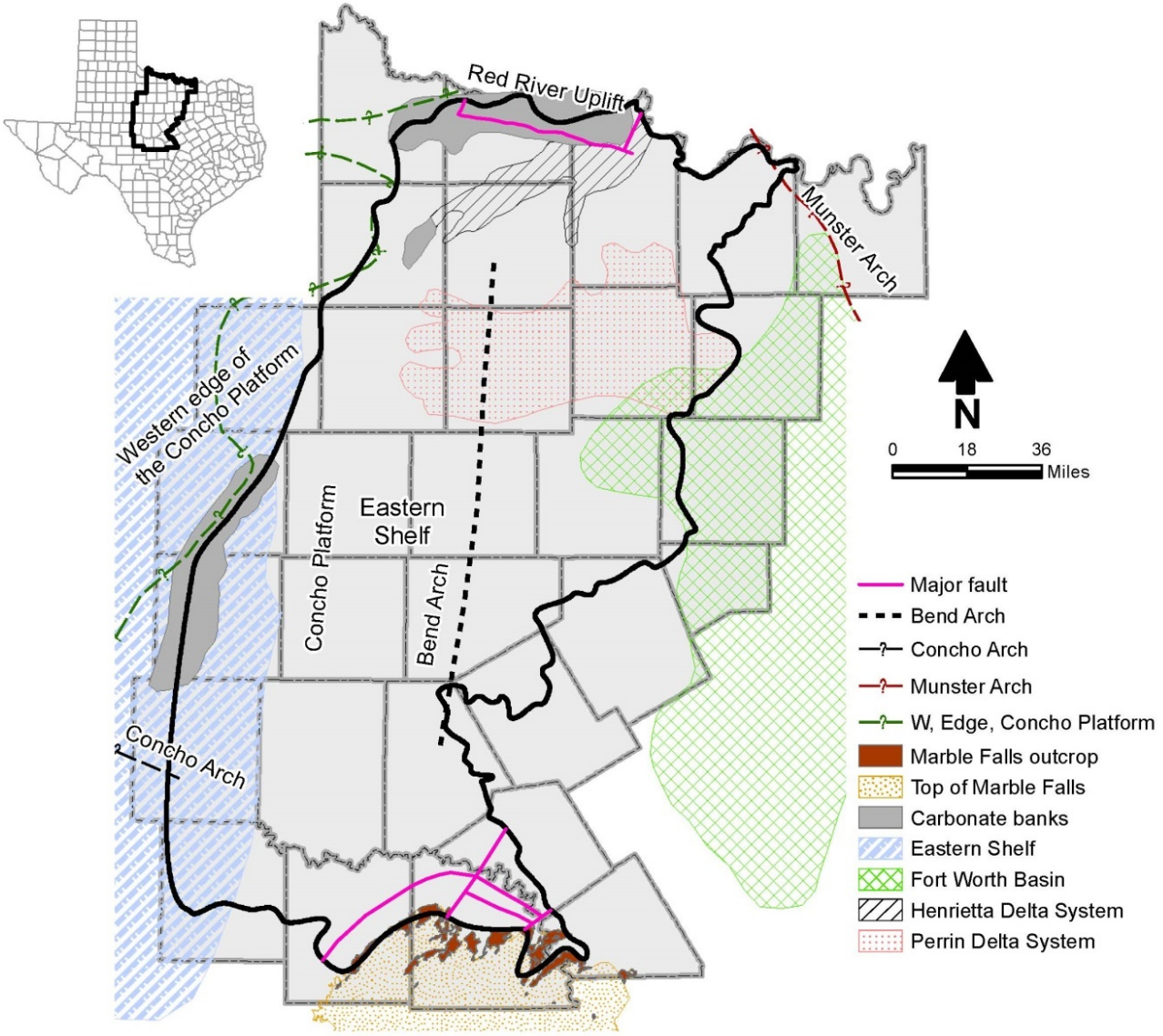
Conceptual Model

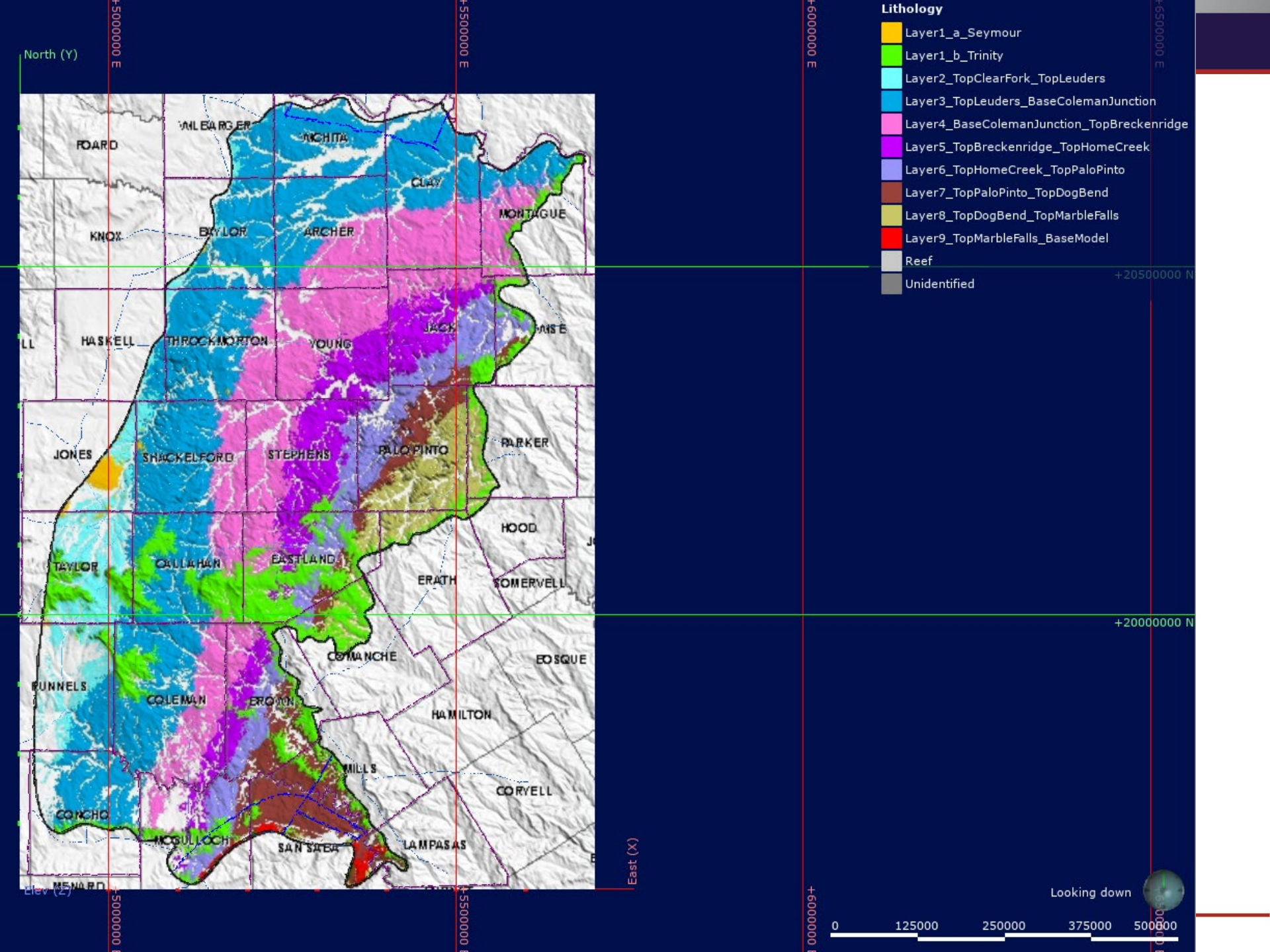


Surface Geology

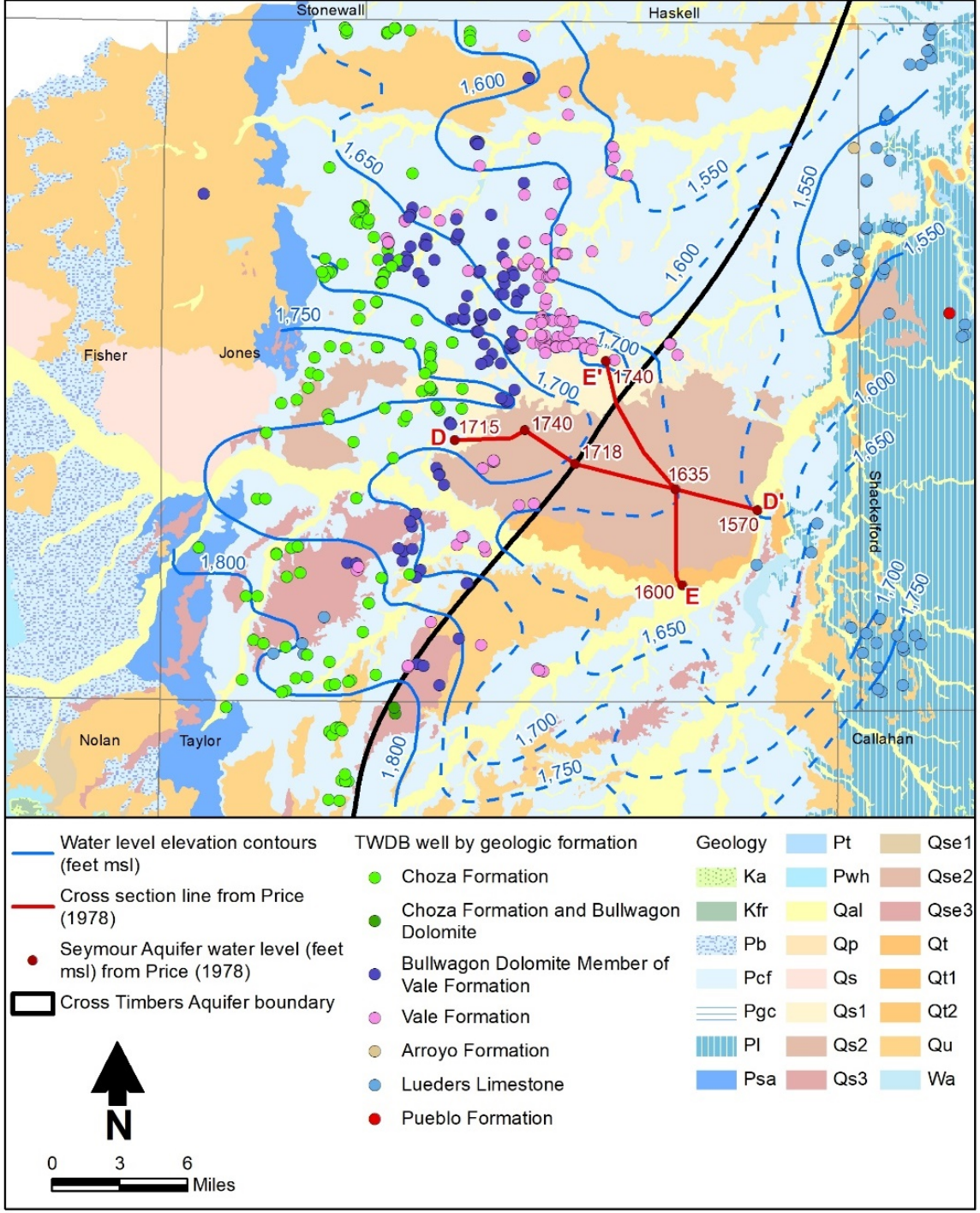


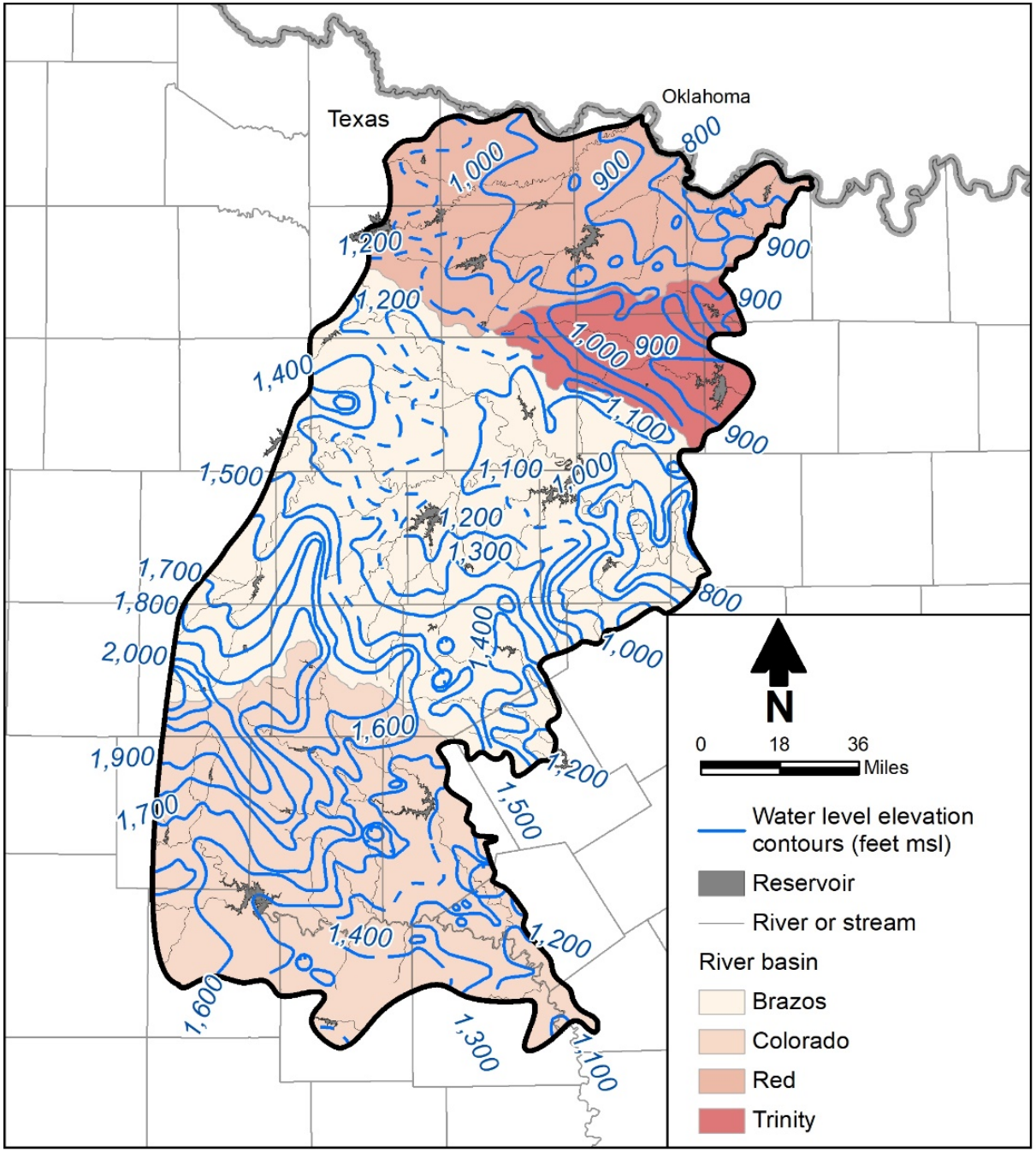
Geologic Structure

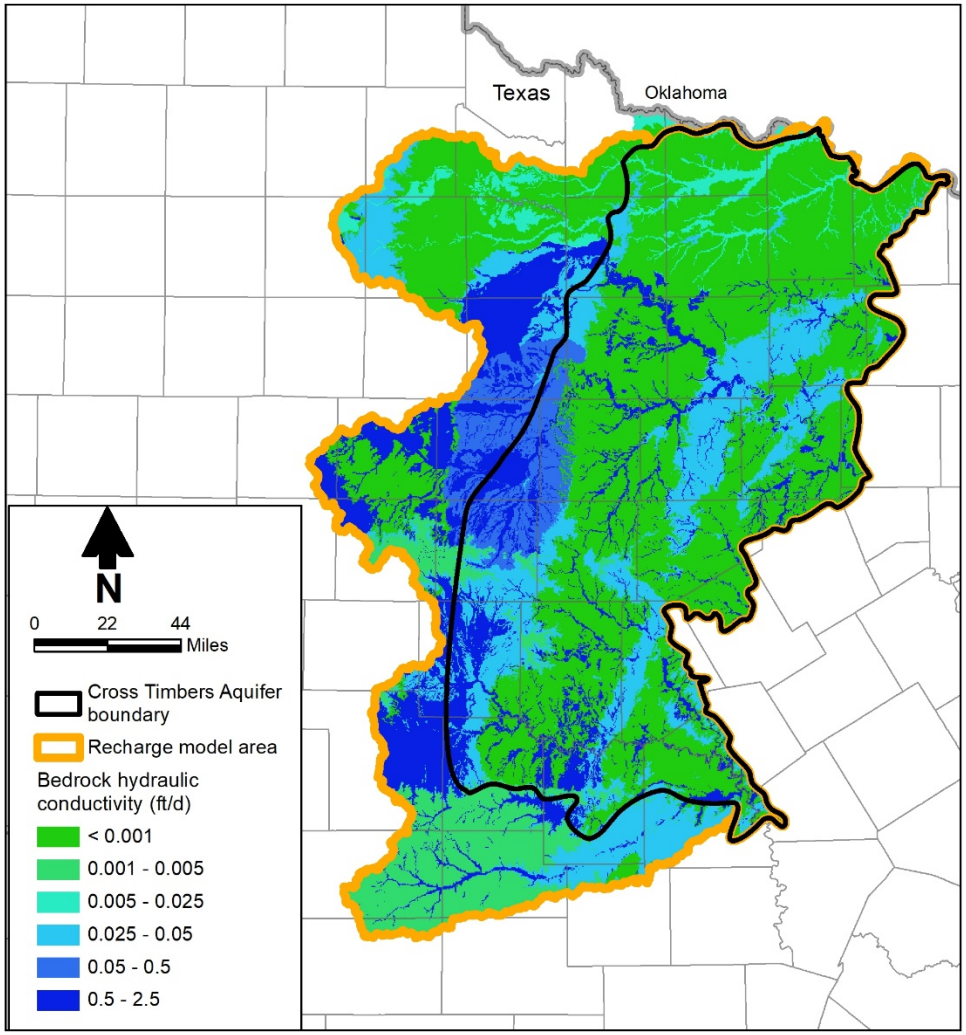



Lithology
Layer1_a_Seymour
Layer1_b_Trinity
Layer2_TopClearFork_TopLeuders
Layer3_TopLeuders_BaseColemanJunction
Layer4_BaseColemanJunction_TopBreckenridge
Layer5_TopBreckenridge_TopHomeCreek
Layer6_TopHomeCreek_TopPaloPinto
Layer7_TopPaloPinto_TopDogBend
Layer8_TopDogBend_TopMarbleFalls
Layer9_TopMarbleFalls_BaseModel
Reef
Unidentified
North (Y)
East (X)
Elev (Z)
+20500000 N
+20000000 N
Looking down
0
125000
250000
375000
500000
FOARD
KNOX
BAYLOR
ARCHER
CLAY
MONTAGUE
HASKELL
THROCKMORTON
YOUNG
JACK
JONES
SHACKELFORD
STEPHENS
PALO PINTO
PARKER
HOOD
TAYLOR
CALLAHAN
EASTLAND
ERATH
SOMERVELL
COMANCHE
BOSQUE
RUNNELS
COLEMAN
BROWN
HAMILTON
MILLS
CORYELL
CONCHO
MCCULLOCH
SAN SABA
LAMPASAS
MENARD

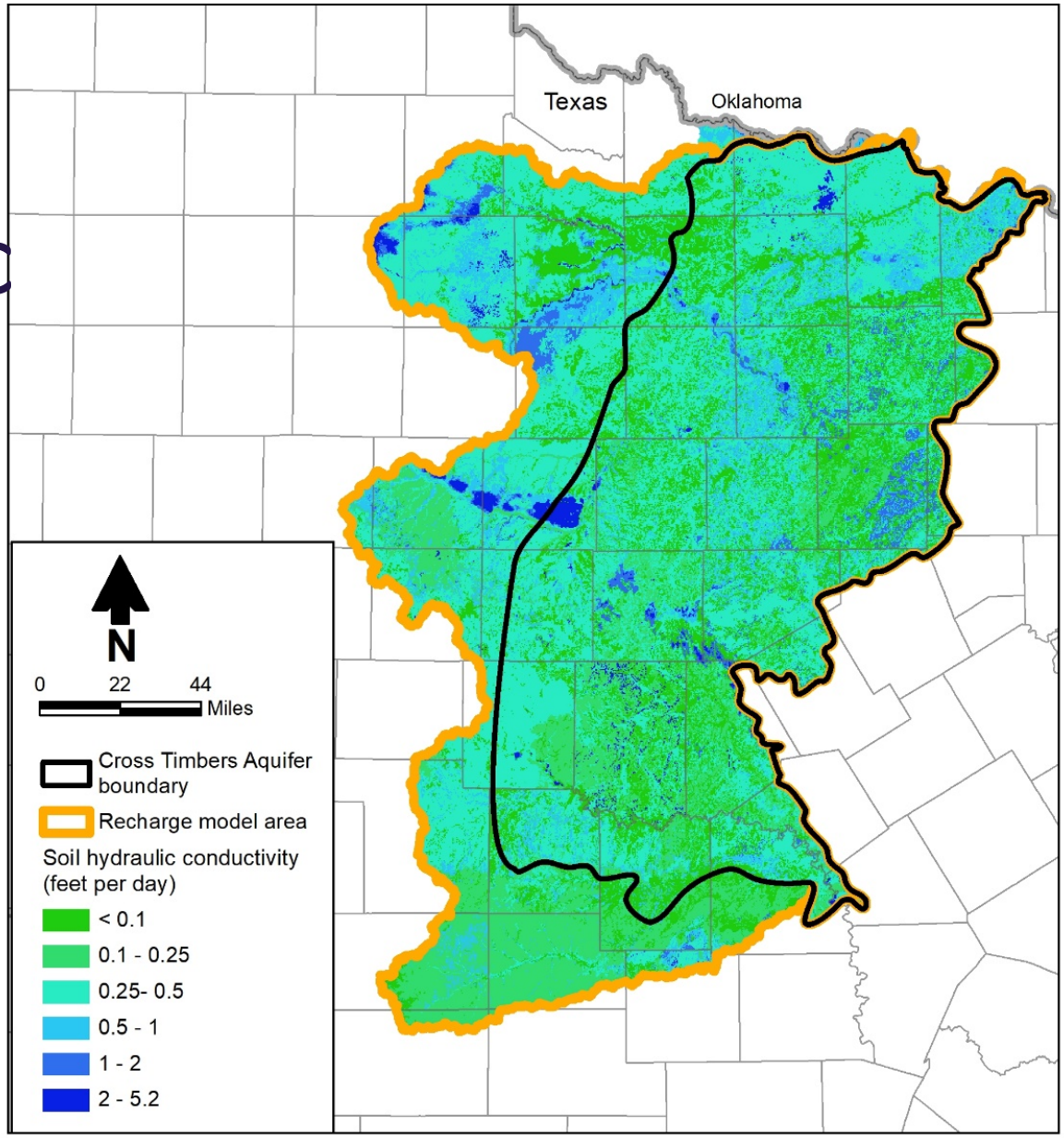
Jones County




Texas
Oklahoma
800
1,000
900
1,200
900
1,200
900
1,000
900
1,400
1,100
900
1,500
1,100
1,000
1,200
1,300
1,700
1,800
800
2,000
1,400
1,000
1,600
1,900
1,200
1,700
1,500
1,400
1,200
1,600
1,300
1,100
N
0
18
36
Miles
Water level elevation contours (feet msl)
Reservoir
River or stream
River basin
Brazos
Colorado
Red
Trinity


Texas
Oklahoma
N
0
22
44
Miles
Cross Timbers Aquifer boundary
Recharge model area
Bedrock hydraulic conductivity (ft/d)
< 0.001
0.001 - 0.005
0.005 - 0.025
0.025 - 0.05
0.05 - 0.5
0.5 - 2.5

Soil Hydraulic Conductivity



The Team ....

Geology/ Hydrostratigraphy	Vincent Clause Allan R. Standen – ARS, LLC
Recharge Modeling	Alan Lewis Todd Umstot
Pumping/ hydrogeology	Andy Donnelly
GIS/database	Kenny Calhoun
Stakeholder Advisory Forums	Velma Danielson – Blanton & Associates

M E M O R A N D U M
R E P O R T

TO: Robert Bradley, Texas Water Development Board

FROM: Neil Blandford, Daniel B. Stephens & Associates, Inc.

DATE: July 21, 2021

SUBJECT: MEMORANDUM REPORT – July 9, 2021 STAKEHOLDER ADVISORY FORUM

The team of Daniel B. Stephens & Associates, Inc. (DBS&A), Allan R. Standen LLC, and Blanton & Associates, Inc. (B&A) (collectively referred to as the DBS&A Team) held the third Stakeholder Advisory Forum (SAF) for the Cross Timbers Aquifer Conceptual Model Project on Friday, July 9, 2021.

1.0 Stakeholder Advisory Forum Background

By statute, the Texas Water Development Board (TWDB) is required to develop numerical groundwater flow models for the major and minor aquifers in Texas. The Cross Timbers Aquifer was designated as a new minor aquifer in December 2017. As a precursor to developing the Groundwater Availability Model (GAM), the DBS&A Team is developing the Conceptual Model for the Cross Timbers Aquifer to describe the best understanding of how groundwater moves through this system. Stakeholder participation is critical to the success of the TWDB GAM Program and development of these models. Section 2.0, Stakeholder Participation, of the TWDB GAM standards specify the TWDB's requirements for stakeholder participation.

The SAFs are designed to encourage participation in the project, and to provide an understandable and convenient means to comment and ask questions. The SAF held on July 9, 2021 was the last of three meetings scheduled for the project; a summary of the meeting is provided below.

2.0 Stakeholder Advisory Forum Overview

SAF Date: Friday, July 9, 2021

SAF Location: Upper Trinity Groundwater Conservation District
1859 West Highway 199
Springtown, TX 76082

SAF Notices: The TWDB preferred method of SAF notification is by email.[1] The DBS&A Team prepared email notices to announce the July 9, 2021 SAF. Using stakeholder contact information lists provided by TWDB staff, the team distributed notices by email on June 17, 2021 (23 days before the meeting) and sent a reminder email on July 2, 2021 (7 days before the meeting). Each email notice informed the stakeholders of the completion of the draft final report - "*Conceptual Model Report for the Cross Timbers Aquifer.*"

[1] One letter was sent by U.S. mail on June 17, 2021 to a stakeholder that did not have a valid email account.

SAF Purpose: The DBS&A Team held this final SAF to inform stakeholders on the completion of the draft Cross Timbers conceptual model. The purpose of this meeting was for the DBS&A Team to discuss the status of the project, provide an overview of the report, obtain input, and answer questions. New topics that were not covered in previous SAFs include: groundwater recharge, water levels, aquifer hydraulic properties, and water quality.

SAF Attendance: There were 19 attendees at the third SAF (10 stakeholders, one TWDB staff member, four Upper Trinity Groundwater District (UTGCD) staff excluding the General Manager and one board member, and four members of the DBS&A Team). The table below lists the attendees and their affiliations:

Name	Affiliation
Ray Brady	Groundwater Management Area 6
Robert Bradley	TWDB
Frank Hefner	Jack County
Terry Ward	Jack County
Honorable Keith Umphress	Jack County
Amy Bush	RMBJ Geo
Doug Shaw	UTGCD
Tracy Mesler	UTGCD
Jill Garcia	UTGCD
Leisha Mazanec	UTGCD
Jacob Dove	UTGCD
Blain Hicks	UTGCD
Randy Whiteman	Red River Authority
Peter Schulmeyer	Collier Consulting
Alyson McDonald	Collier Consulting
Neil Blandford	DBS&A,
Andrew Donnelly	DBS&A (virtual attendance)
Alicia Reinmund-Martinez	B&A
Katie Welch	B&A

SAF Format: The SAF commenced at 11:03 AM. Neil Blandford, Project Manager, DBS&A Team, officially opened the meeting by first welcoming everyone to the meeting and introducing the Honorable Keith Umphress, County Judge – Jack County.

Robert Bradley, Project Manager, TWDB, provided a brief overview of the GAM Program including the purpose and importance of the SAFs, as well as the July 23, 2021 deadline for comments on the draft final report of the Cross Timbers Aquifer conceptual model.

Mr. Blandford provided an overview of the project background and the agenda for the meeting. He noted again that comments on the draft final report are due by July 23rd and that the final report will be submitted to TWDB by September 30th. He then provided a summary of the geographic extent of the Cross Timbers Aquifer, as well as an explanation of the geology as incorporated in the conceptual model of the aquifer.

Mr. Blandford then described various figures regarding the general characteristics of the aquifer, including net-sand isopach maps, hydrographs, and water level contours. The hydrographs, water level contours, and water level data from the 1960's, indicate

that water levels across the Cross Timbers Aquifer are relatively steady and that the aquifer is a rainfall driven system.

Next, Mr. Blandford detailed the process the DBS&A Team used to create a recharge model for the Cross Timbers Aquifer. The model simulates how much rainfall infiltrates the subsurface and reaches the water table, using interpolation precipitation from the North American Land Data Assimilation System (NLDAS), mapped vegetation, mapped soils and multiple additional model inputs as described in the draft report. Mr. Blandford provided examples of the simulated recharge for wet, dry and average conditions.

Mr. Blandford then discussed the low hydraulic conductivity and low yield of the aquifer, as well as the abrupt change from fresh to saline water at a shallow depth. Additionally, he discussed the pumping values and indicated that pumping for municipal, mining, and irrigation purposes are trending upward, although none of the pumping amounts are large. Lastly, when discussing the conceptual model, Mr. Blandford stated that stream channels are the primary method for discharge from the aquifer.

Mr. Blandford finished the presentation with a summary and recommendations regarding the Cross Timbers Aquifer for the TWDB to consider. First, he noted that Quaternary Alluvium should be included as part of the Cross Timbers Aquifer. He also stated that a base aquifer map, depicting the saline zone of the aquifer, should be developed. Additionally, Mr. Blandford suggested that the northern boundary of the Cross Timbers Aquifer should extend to the Red River, and that the western boundary should extend to the Blaine Aquifer boundary. He then noted the importance of creating a formal subcrop designation below the Northern Trinity Aquifer to the east.

Appendix A contains the meeting sign-in sheets and **Appendix B** contains the attendee list with affiliations.

Summary of SAF Questions and Answers, and Comments and Observations:

After the presentation concluded, the Mr. Blandford and Mr. Bradley responded to several questions and comments. The following summarizes their responses:

Question 1. Will you model saltwater migration into the zone of production?

Response: No, water quality is not part of this study. However, the TWDB Brackish Resources Aquifer Characterization System (BRACS) program will include the Cross Timbers Aquifer as a part of its study. Additionally, there is no record of water going bad, and there could be a low permeability barrier impeding upward migration of saline water.

Question 2. What are the next steps for the numerical model for the Cross Timbers Aquifer?

Response: The next steps include gathering comments and finalizing the draft report on the conceptual model. A final report will then be sent to TWDB. Mr. Bradley responded that there is no schedule at this time to begin the development of the numerical model for the Cross Timbers Aquifer, but that he would share the interest in the numerical model to Ms. Cindy Ridgeway, Manager of the Groundwater Availability Modeling group at TWDB. Mr. Blandford then mentioned the need for the BRACS-type study to delineate the base of aquifer, which may or may not be part of the numerical model development process.

Question 3. How long will it take, and what will it cost, to complete the numerical model (GAM) for the Cross Timbers Aquifer? Is the delay a staff or budget issue?

Response: There is currently no schedule for the GAM model and no timeline for when it will be completed.

Question 4. There were multiple questions related to salinity levels in the aquifer, including: How is salinity related to the model and the base of the aquifer? Will it require more drilling or testing?

Response: Mr. Blandford responded to the salinity question by stating that previous researchers referenced oil and gas logs to determine the depth at which saline water occurs. He also stated that the salinity data is not well documented, and that more information is needed to create a base of aquifer map considering the highly saline water and brine. Additionally, Mr. Blandford noted that a BRACS-type study is needed to get a full picture of water quality for the Cross Timbers Aquifer. Lastly, he stated his belief the study needed could be conducted using existing data.

In addition to his previous response regarding salinity, Mr. Blandford noted that aquifer thickness, recharge, and the salinity base of the aquifer need to be delineated to create an accurate model. He also reiterated a statement made during the presentation, that for the Cross Timbers Aquifer pumping is small compared to recharge and that the aquifer as a whole is not a pumping driven system.

Question 5. Is there any delineation where there is not production of groundwater?

Response: Mr. Blandford stated that they have not delineated where there is not production of groundwater. Mr. Blandford then referred to a determination made during the study, stating that the aquifer appears to be a hydraulically connected system, but with very little water production overall. He also noted however, that "dry" holes are typically not logged and included in the data sources.

Comment 1. Several comments relayed concern over the timeline for creating the numerical model. A board member for the UTGCD stated that growth is coming out of the DFW metroplex and will result in an increase in groundwater use. He stated that there is a need to develop the GAM, and that the GAM would be a useful tool. Additionally, he expressed concern that the GAM will not be available for the next cycle of joint planning.

Response: Mr. Bradley noted again that he will speak to Ms. Ridgeway, as well as other members of the modeling group. He will keep UTGCD updated.

Comment 2. There were various comments made regarding drilling in the Cross Timbers Aquifer, noting that there are small pockets where substantial pumping occurs.

Response: Mr. Blandford noted that, when looking at the aquifer in its entirety, pumping is a small fraction of the total discharge, and that pumping values are small compared to recharge. He also noted that there are places where more significant pumping might occur.

Comment 3: A board member of UTGCD stated that in Wilbarger County there are no producible wells; he also mentioned that the majority of the pumping occurs in Montague County.

Response: Mr. Blandford first noted that data only includes wells that actually produced water and created a data gap for wells that are not productive. He also stated that the Cross Timbers Aquifer is highly variable from Throckmorton to Montague counties, resulting in a geographic discrepancy in the amount of water produced across the aquifer.

Comment 4: Mr. Bradley reminded the group to submit comments by July 23rd.

Appendix A

Sign-In Sheets

Texas Water Development Board

Cross Timbers Aquifer Conceptual Model
Stakeholder Advisory Forum
Friday 9, 2021
Upper Trinity Groundwater Conservation District
1859 West Highway 199
Springtown, TX 76082

DBS&A Daniel B. Stephens & Associates, Inc. a Geo-Logic Company

SIGN-IN SHEET (please print)

NAME	AFFILIATION	MAILING ADDRESS/PHONE NO.	E-MAIL ADDRESS
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~~JACK~~ TERRY WARD	JACK CO	100 N Main Jacksboro TX	tjkward@gmail.com
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Cross Timbers Aquifer Conceptual Model Page ____ of ____

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a Geo-Logic Company

SIGN-IN SHEET (please print)

NAME	AFFILIATION	MAILING ADDRESS/PHONE NO.	E-MAIL ADDRESS
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Alicia Remmond-Martinez	B&A		
Katie Welch	B&A		
Tracy Mester	UTGCD Board member		

Cross Timbers Aquifer Conceptual Model

Page ____ of ____

Appendix B

Attendee List with Affiliations

Attendee List with Affiliations

	Name	Affiliation
1	Ray Brady	Groundwater Management Area 6
2	Robert Bradley	TWDB
3	Frank Hefner	Jack County
4	Terry Ward	Jack County
5	Honorable Keith Umphress	Jack County
6	Amy Bush	RMBJ Geo
7	Doug Shaw	UTGCD
8	Tracy Mesler	UTGCD
9	Jill Garcia	UTGCD
10	Leisha Mazanec	UTGCD
11	Jacob Dove	UTGCD
12	Blain Hicks	UTGCD
13	Randy Whiteman	Red River Authority
14	Peter Schulmeyer	Collier Consulting
15	Alyson McDonald	Collier Consulting
16	Neil Blandford	DBS&A
17	Andrew Donnelly	DBS&A (virtual attendance)
18	Alicia Reinmund-Martinez	B&A
19	Katie Welch	B&A