CONNECTING WATER TO LIFE

January 10, 2024

Mr. Jim Totten, General Manager
Lost Pines Groundwater Conservation District
317 E. Hempstead Street
Giddings, TX 78942

RE: Northern Lee County Carrizo Groundwater Management Zone Investigation
Lost Pines Groundwater Conservation District

Dear Mr. Totten,

On January 18, 2023, the Lost Pines Groundwater Conservation District (LPGCD) Board of Directors approved the LRE Water ("LRE") project plan which comprised of aquifer science tasks, targeted groundwater studies, and hydrogeology consulting services to be performed over an 18-month period beginning on January 2nd, 2023. Included in this plan was the Northern Lee County Carrizo Groundwater Management Zone Investigation. LRE provides herein our results from this investigation as a series of figures that specifically inform on key hydrogeologic aspects of the Carrizo Sand formation within northern Lee County, TX.

Background

LRE understands that the LPGCD Board of Directors recognizes northern Lee County (Figure 1) as an area of concern. This is due to regional increases in pumping, accelerated water level declines, and reported changes in groundwater chemistry and temperature within the Carrizo Sand formation of the Carrizo-Wilcox Aquifer. The Carrizo-Wilcox is defined as a major aquifer by the Texas Water Development Board (TWDB) (George and Others, 2011), and serves as a primary source of groundwater for many landowners across Lee and Bastrop County (LPGCD, 2023).

Within northern Lee County, LPGCD estimates suggest that there may be as many as 150 total Carrizo Sand wells negatively impacted by regional increases in pumping within the Carrizo Sand formation (LPGCD, 2021). Prior LPGCD investigations have evaluated the levels of drawdown expected in Lee County as a result of Vista Ridge pumping (Donnely, 2021). The results presented within this document are intended to complement this early drawdown work and are based on new information collected through the investments that the LPGCD has made in scientific initiatives and studies.

Results

The results from this investigation are presented as a series of figures that highlight key hydrogeologic aspects of the Carrizo Sand formation.

Figure 1 provides an overview of the study area which is centered around northern Lee County and highlights key political boundaries such as the Lee county line and state highways.

Figure 2 includes the Geologic Atlas of Texas surface geology which provides reference to the Carrizo Sand outcrop (purple with red outline) and surface faults (bold black lines) associated with the regional Milano Fault Zone. The local area associated with the Tanglewood Graben is also annotated within this figure (Young and others, 2018).

Figure 3 illustrates the top of Carrizo Sand structure surface that outcrops (purple with red diagonal) at land surface in a northeasterly trending band and generally dips to the southeast. The area associated with the Tanglewood Graben can be identified by elevation fluctuations in high-low-high pattern for the area just northeast of Lexington and extending towards the Lee and Burleson county line. The data used to create this surface was collected and reviewed as part of the ongoing development of the LPGCD Hydrogeologic Model.

Figure 4 includes the depth to Carrizo Sand surface which shows that depth generally increases in a southeastward direction from less than 100 feet near the outcrop to over 1,000 feet south of Highway 21. This surface was created by identifying the difference between land surface elevation (USGS, 2021) and the Carrizo Sand structure surface (Figure 3).

Figure 5 includes the Carrizo Sand water level elevation surface which was developed as a composite surface using late 2022 and early 2023 water level measurements (Table 1). The associated measurements were collected by LPGCD staff and/or found within the TWDB Groundwater Database and are assumed accurately to be accurately classified and representative of the Carrizo Sand formation.

Figure 6 illustrates the available drawdown for the confined portion of the Carrizo Sand formation. In this instance, the available drawdown is the height which water rises under artesian pressure above Carrizo Sand formation in a water well. This figure was created by identifying the difference between the Carrizo Water level elevation surface (Figure 5) and the Carrizo Sand structure surface (Figure 3). For this reason, this figure is most reflective of Carrizo Sand available drawdown at the time of the measurements. Additionally, this presentation of available drawdown assumes steady state as it does not account for drawdown associated with pumping or well to well interference.

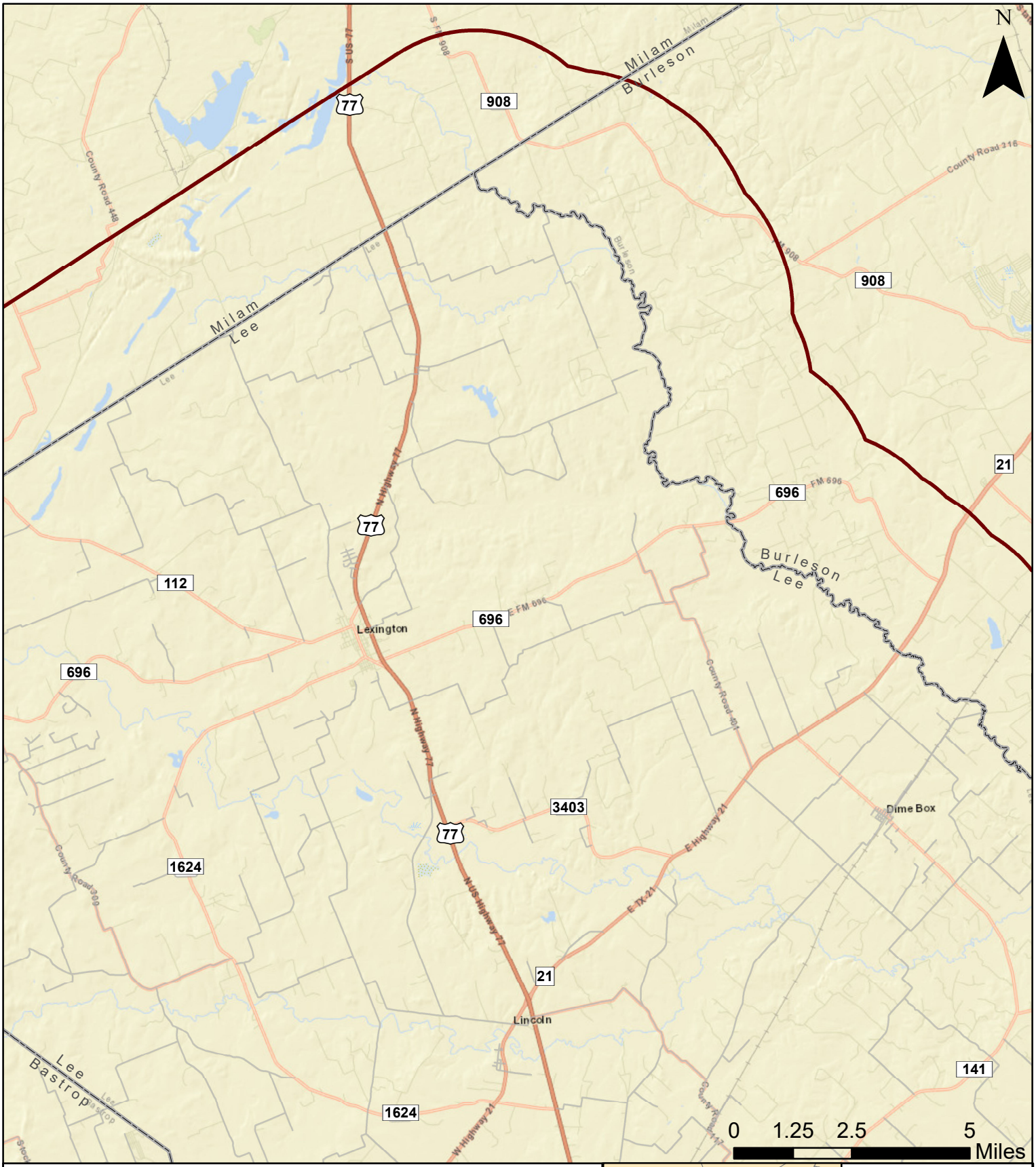
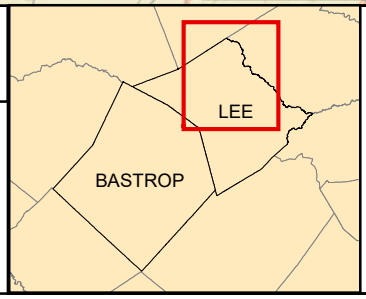


Figure 1 - Northern Lee County Study Area
Lost Pines Groundwater Conservation District

The study area illustrated within this figure includes northern Lee County, TX, and portions of Milam, Burleson and Bastrop counties. Lee and Bastrop reside within the Lost Pines Groundwater Conservation District which is tasked with managing, protecting and conserving the groundwater resources within their jurisdiction. These duties are to be performed while using the best available science as prescribed in Chapter 36 of the Texas Water Code.



Legend

- County Line
- Study Area

LRE WATER

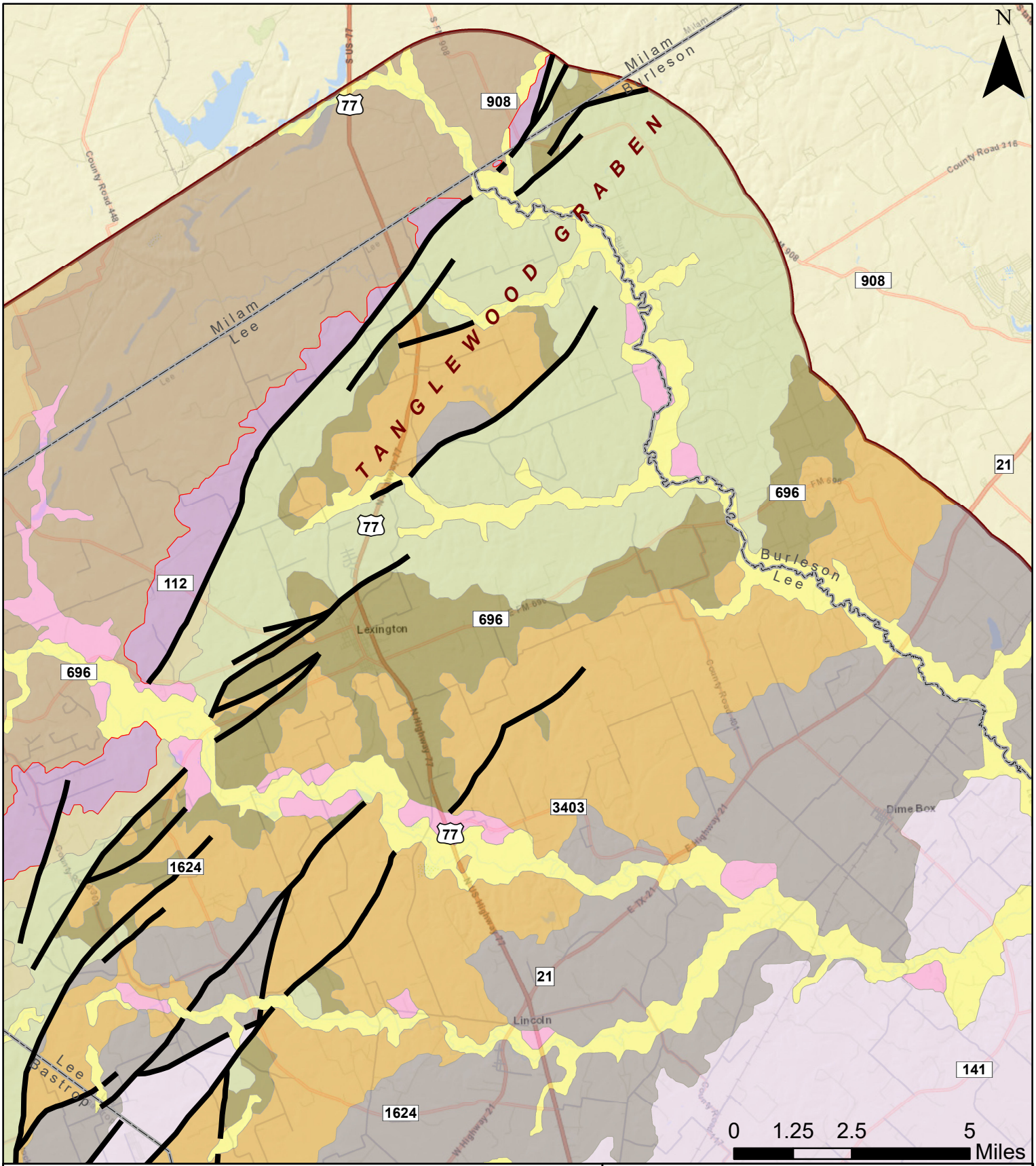


Figure 2 - Northern Lee County Surface Geology
Lost Pines Groundwater Conservation District

The geologic data illustrated within this figure was obtained from the Geologic Database of Texas (Stoeser and others, 2007). Depicted is the surface geology of northern Lee County, TX.

The Carrizo Sand is illustrated as a shade of purple with red outline. Faults are also present within the study area and are illustrated as bold black lines which propagate through the study area in a northeasterly trend. Locally within northern Lee County, the Tanglewood Graben is present.

Legend

- Alluvium
- Terrace deposits
- Yegua-Jackson
- Cook Mountain
- Sparta Sand
- Weches
- Queen City Sand
- Reklaw
- Carrizo Sand
- Calvert Bluff
- Simsboro
- Fault
- County Line
- Study Area

LRE WATER

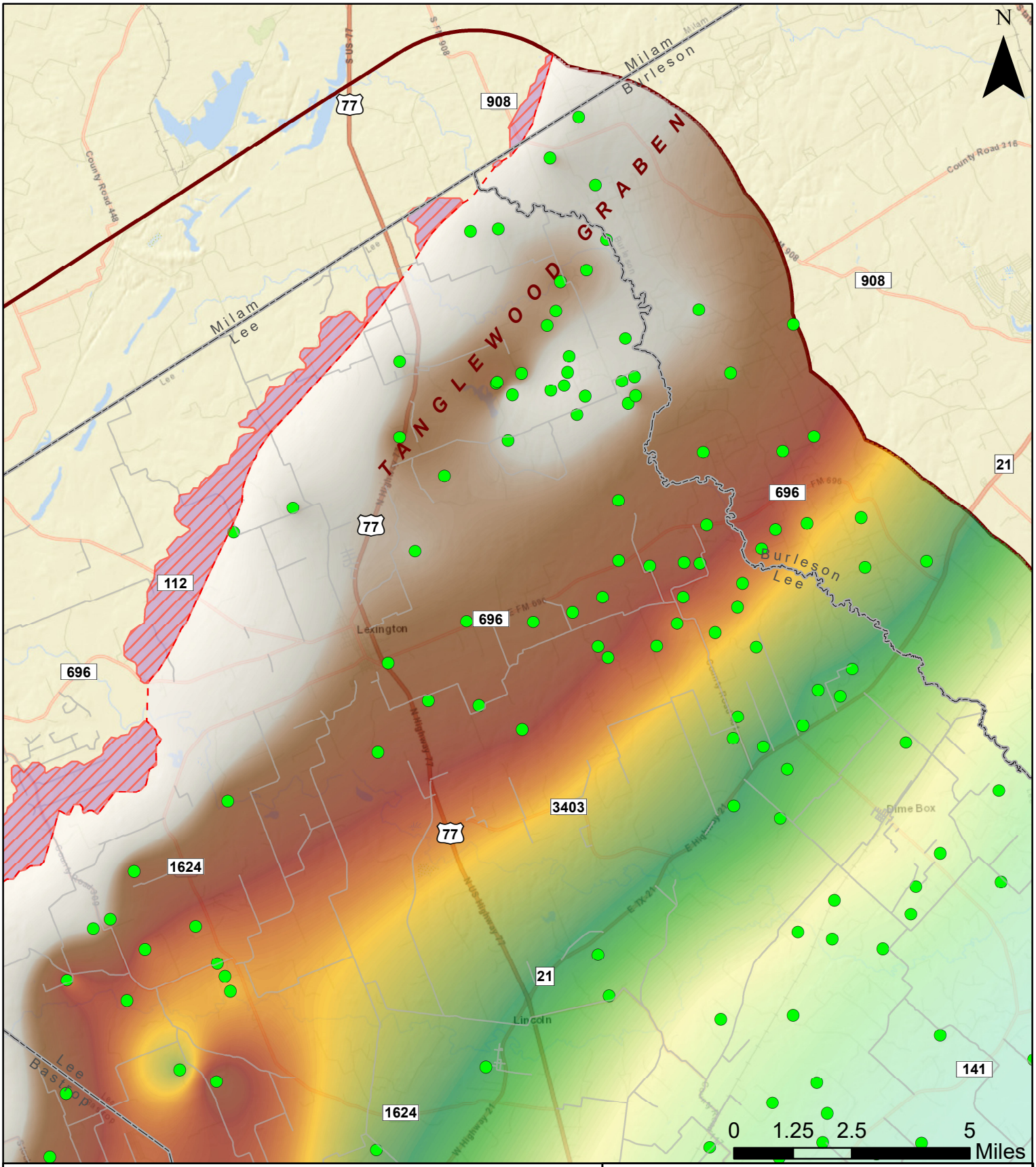


Figure 3 - Top of Carrizo Sand Structure
Lost Pines Groundwater Conservation District

The top of Carrizo Sand geologic structure was developed using stratigraphic well control points that have been curated by LRE Water through the development of the District's Hydrogeologic Model.

In northern Lee County the Carrizo Sand outcrops in a northeasterly trending band (purple with red diagonal), and generally dips to the southeast. Effects of the Tanglewood Graben and associated faulting are visible within this surface in the area just north of Lexington and east of Highway 77.

Legend

Top of Carrizo Sand Elevation (a.m.s.l)

561 Feet

-1,833 Feet

- Carrizo Sand Outcrop
- Stratigraphic Well Control
- County Line
- Study Area

LRE WATER

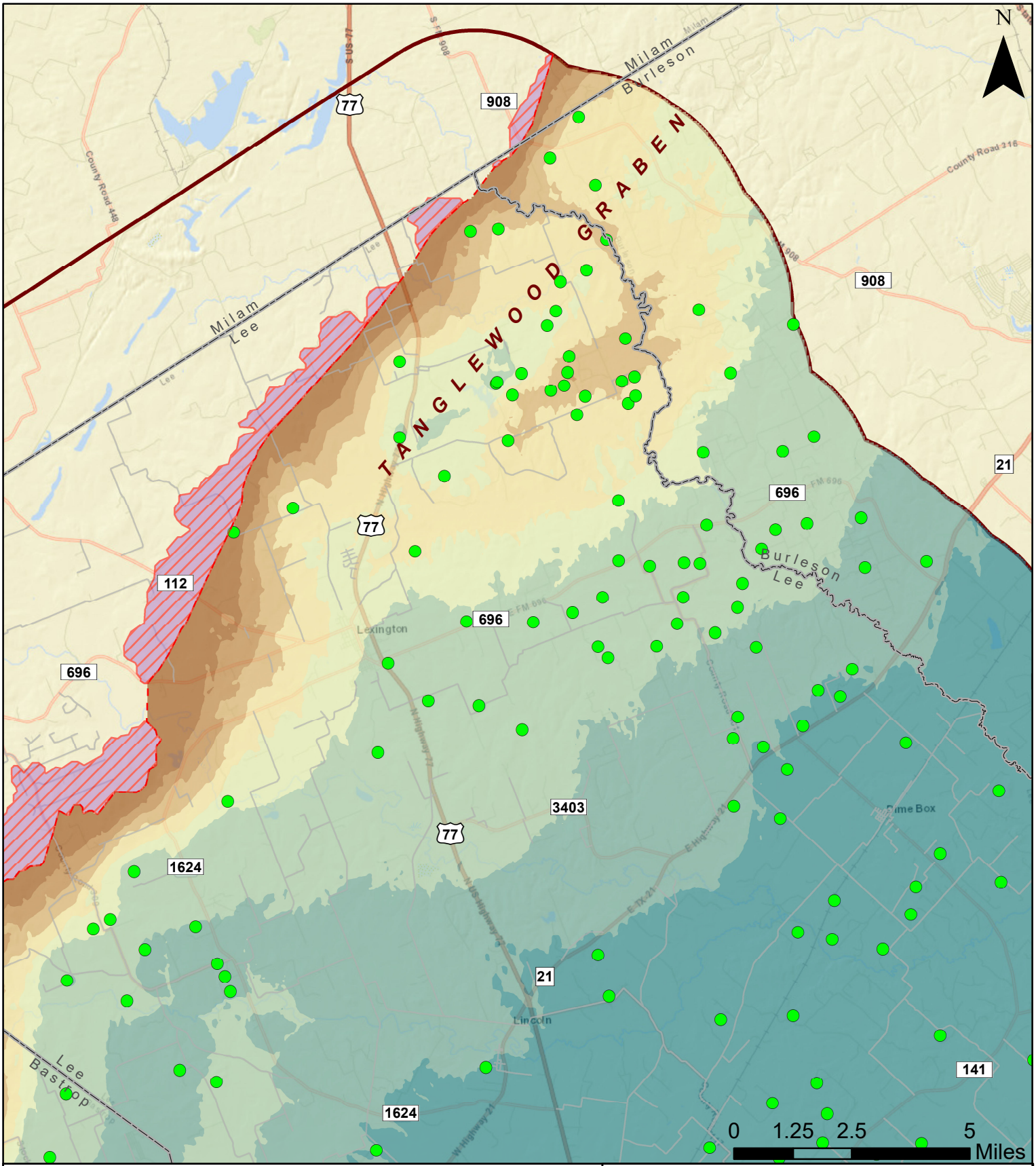


Figure 4 - Depth to Top of Carrizo Sand
Lost Pines Groundwater Conservation District

The depth to top of Carrizo Sand surface was developed using stratigraphic well control points that have been curated by LRE Water through the development of the District's Hydrogeologic Model.

In northern Lee County the Carrizo Sand outcrops in a northeasterly trending band (purple with red diagonal). The depth to Carrizo Sand generally increases in a southeastward direction from less than 100 feet near the outcrop to over 1,000 feet south of Highway 21.

Legend

Depth to Carrizo Sand

Feet below surface

- < 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 750
- 751 - 1,000
- > 1,000

- Stratigraphic Well Control
- County Line
- Study Area

LRE WATER

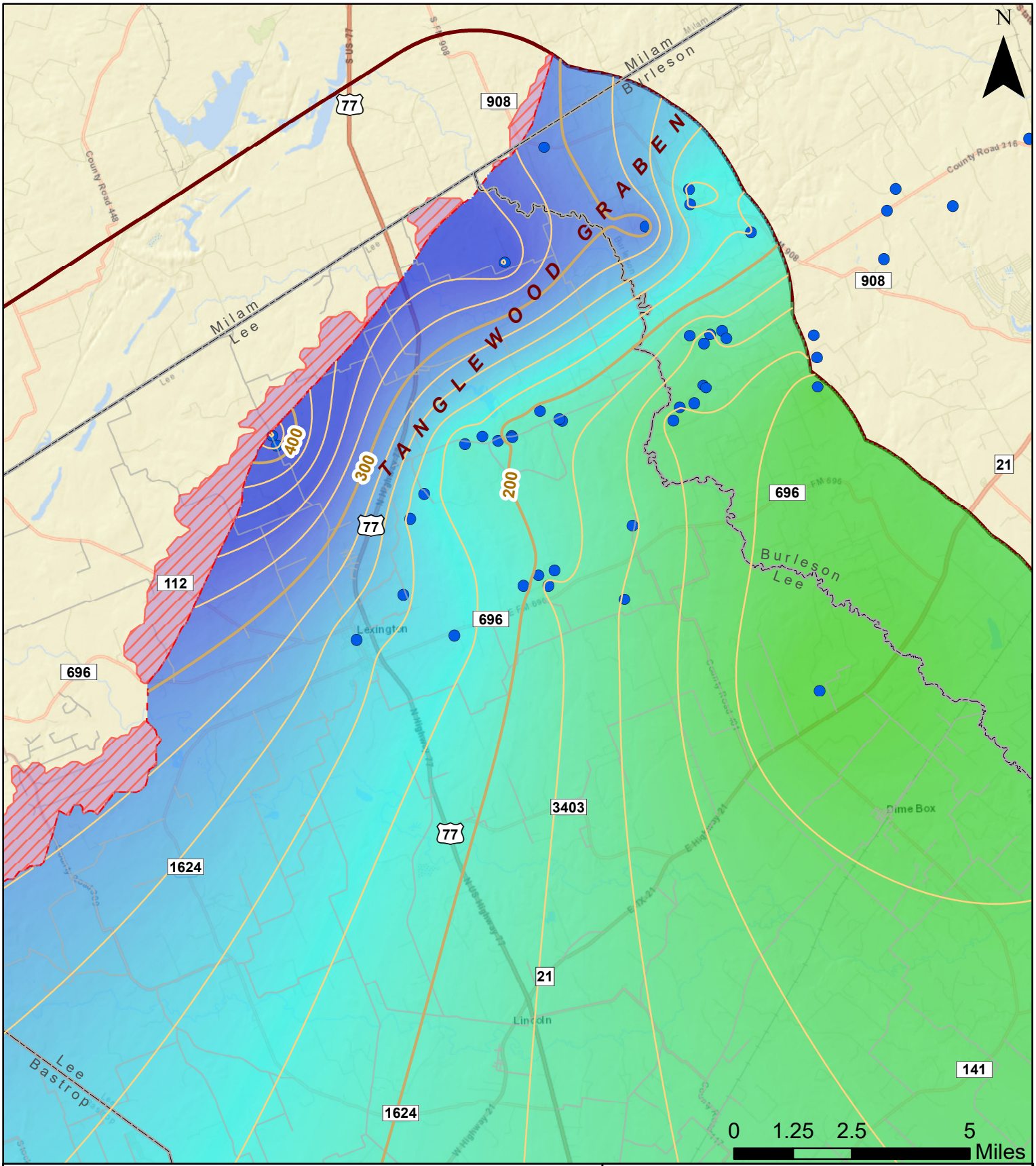


Figure 5 - Carrizo Sand Water Level Elevation Surface Lost Pines Groundwater Conservation District

The Carrizo Sand water level elevation surface was developed from water levels collected between late 2022 and early 2023. Water level measurements were obtained from the Lost Pines Monitoring Database and Texas Water Development Board Groundwater Database. Measurements used as part of this analysis may not be reflective of current conditions and are assumed to be representative of the Carrizo Sand formation. The referenced water level measurements are included in Table 1 of this memo.

Legend

Carrizo Sand Water Level

Feet (a.m.s.l)

443 Feet

83 Feet

Water Level Contour

Water Level Measurement

Carrizo Sand Outcrop

County Line

Study Area

LRE WATER

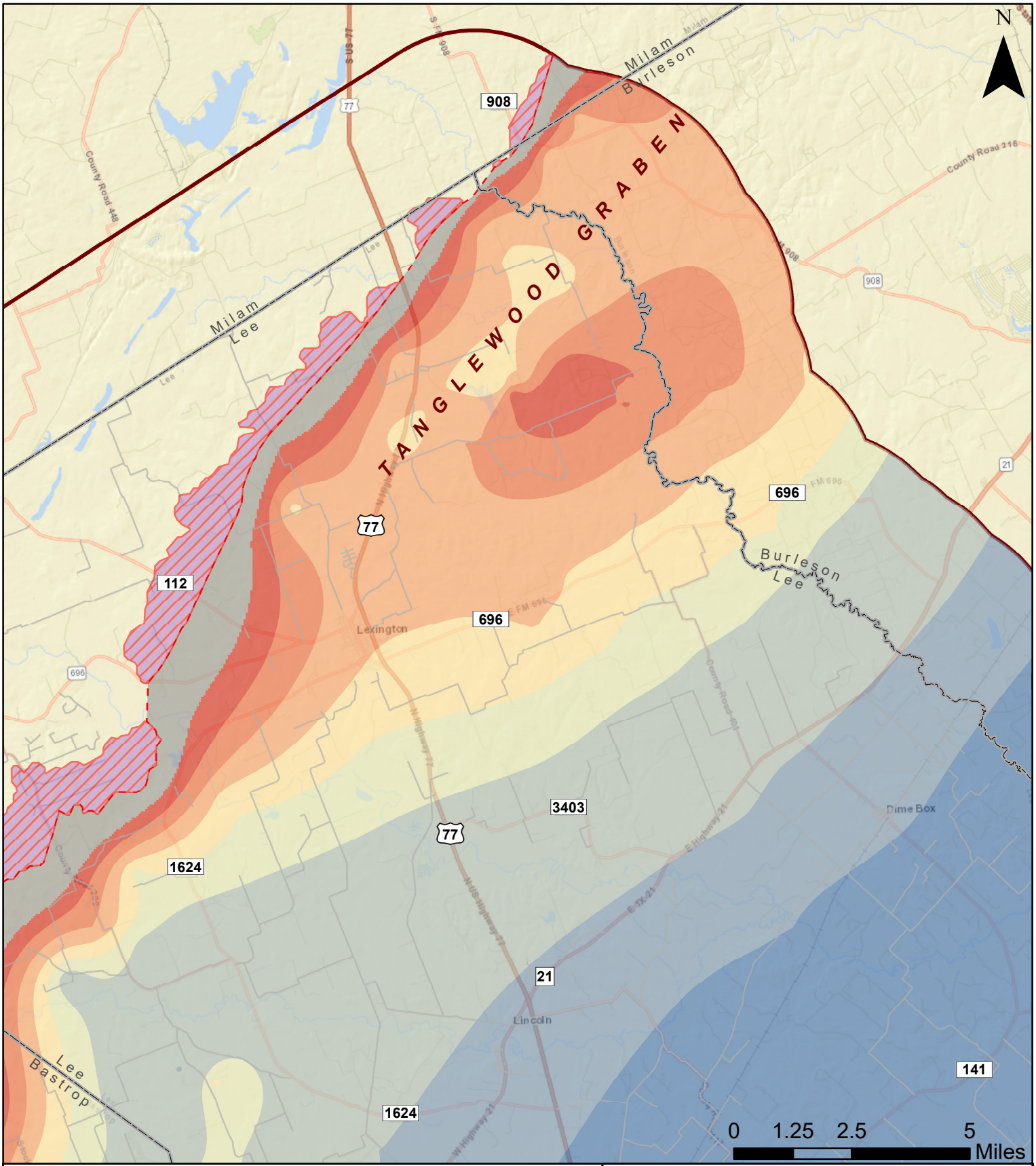


Figure 6 - Confined Carrizo Sand Available Drawdown Lost Pines Groundwater Conservation District

The confined Carrizo Sand available drawdown surface was developed as the difference between the water level and Carrizo Sand elevation surfaces. This data assumes static water level across the aquifer and does not consider active pumping or well interference.

In northern Lee County, available drawdown generally increases away from the outcrop in a southeasterly direction from less than 100 feet to more than 750 feet south of Highway 21. An exception is within the Tanglewood Graben area where the underlying structure provides a local control on availability.

Legend

Confined Carrizo Sand Available Drawdown (Ft.)

- < 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 750
- 751 - 1,000
- > 1,000
- Semi- / Unconfined

- Carrizo Sand Outcrop
- County Line
- Study Area

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Table 1. Carrizo Sand Water Level Measurements

LPGCD ID	State Well Number	Elevation (Ft.)	Measurement Date	Water Level Depth (Ft.)	Water Level Elevation (Ft.)
59-33-6-0021	5933610	394	1/20/2023	230	164
58-40-9-0002	-	463	7/8/2022	220	243
59-33-4-0022	5933110	369	7/13/2023	146	225
59-25-8-0020	5925808	433	3/2/2022	71	362
59-33-2-0018	5933210	456	4/4/2023	268	188
59-33-2-0022	5933211	463	4/4/2023	277	186
59-34-7-0018	5934704	404	7/22/2022	321	83
59-33-5-0007	5933503	463	4/24/2023	255	208
59-33-2-0019	5933212	410	6/30/2023	201	209
59-33-2-0024	5933213	381	6/30/2023	201	180
59-33-5-0011	5933504	413	3/28/2023	241	172
59-33-4-0023	5933404	482	3/23/2023	239	243
59-33-1-0030	5933112	430	3/30/2023	215	215
59-33-1-0032	-	453	4/23/2023	260	193
59-33-2-0027	-	371	3/31/2023	167	204
59-33-4-0024	-	417	7/13/2023	182	235
59-33-6-0024	-	400	3/29/2023	241	159
59-33-5-0016	-	423	1/30/2023	228	195
59-33-2-0031	-	443	7/31/2023	250	193
58-40-3-0021	-	449	5/23/2023	24	425
58-40-3-0023	-	472	5/23/2023	29	443
59-33-7-0027	-	466	1/30/2023	234	232
59-33-5-0019	-	453	3/29/2023	256	197
-	5925502	423	4/10/2023	117	306
-	5925610	423	3/15/2023	208	215
-	5925611	433	4/4/2023	216	217
-	5925908	397	2/7/2023	220	177
-	5925909	375	1/13/2023	221	154
-	5925910	368	3/8/2023	214	154
-	5925911	450	3/10/2023	283	167
-	5925912	420	3/31/2023	104	316
-	5925913	357	3/7/2023	193	164
-	5926505	479	3/28/2023	317	162
-	5926506	552	3/23/2023	377	175
-	5926511	491	1/19/2023	256	235
-	5926609	462	3/22/2023	258	204
-	5926706	426	4/5/2023	205	221
-	5926707	457	3/21/2023	322	135
-	5926806	441	3/15/2023	312	159
-	5933305	351	3/6/2023	211	140
-	5933306	384	3/6/2023	241	143
-	5933308	370	3/6/2023	227	143
-	5933309	354	2/14/2022	195	159
-	5933310	341	4/18/2023	209	132
-	5934106	440	3/17/2023	344	96
-	5934109	437	3/31/2023	288	149

Discussion

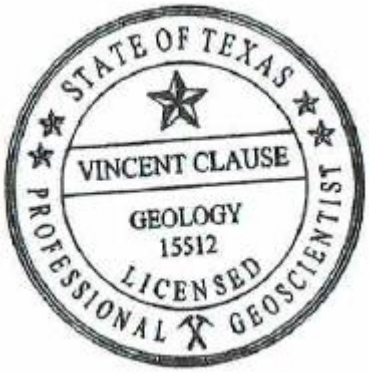
The results from this investigation are generally consistent with prior research of the Carrizo Sand formation. As part of the investments that LPGCD has made to improve upon the understanding of the aquifers within their jurisdiction, additional detail has been provided to this discussion. Specifically, the Carrizo Sand is better defined across the study area, the Tanglewood Graben is more accurately represented, and a composite Carrizo Sand water level surface was developed. This data ultimately improves upon and provides the best understanding of available drawdown within the confined portion of the Carrizo Sand formation of northern Lee County.

LRE appreciates the opportunity to assist you with this effort. Please call me at (512) 906-8614 or email me at Vince.Clause@LREWater.com if you have any questions.

Sincerely,

LRE Water

1/10/24



Vince Clause, PG #15512
Texas Groundwater Lead | Project Manager
LRE Water, LLC TBPG Firm No. 50516

References:

Donnelly, A., (2021). Draft Results – Estimated Vista Ridge Drawdowns in Northern Lee County. Daniel B. Stephens & Associates.

George, P. G., Mace, R. E., & Petrossian, R. (2011). *Aquifers of Texas* (Vol. 380, pp. 1-182). Austin, TX: Texas Water Development Board.

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