



Attachment E – Hydrogeologic Evaluation Report



THORNHILL GROUP, INC.

Professional Hydrogeologists • Water Resources Specialists

July 19, 2023

Mr. Brad Ely
Ely Family Partnership, LP
P.O. Box 177
Hearne, Texas 77859

Re: Aquifer Evaluation Report –
Drilling/Production Permit Applications for Eight (8) New Simsboro Wells to be
Completed on Ely Family Partnership, LP Property, Robertson County, Texas

Dear Mr. Ely:

Per your request and in compliance with the rules of the Brazos Valley Groundwater Conservation District (BVGCD), Thornhill Group, Inc. (TGI) provides herein an evaluation of the projected effect of Ely Family Partnership, LP, herein referenced as Ely Family Partnership, completing eight (8) new wells into the Simsboro Aquifer underlying Ely Family Partnership Property in Robertson County, Texas and producing an annual allocation of 13,872 acre-feet per year.

The subject Ely Family Partnership Property includes several properties that form two separate contiguous tracts totaling approximately 1,874 acres of land; the northern property totals 1,411 acres and the southern property includes 462 acres. The Ely properties are located south to slightly southeast of the City of Hearne between Farm Road 50 (FM 50) and U.S. Highway 190/State Highway 6 (US 190/SH 6). The northern property boundary is about 2.15 miles south of downtown Hearne, while the southernmost boundary is 6 miles south-southeast of the City. The primary access road to Ely Family Partnership property is along River Ridge Drive off of Old Hearne Road, which is along the eastern boundary of the central portion of the farm. The Little Brazos River runs through the northern portion of the subject property and forms the western boundary of southern portions of the subject land.

TGI conducted its evaluations and prepared this report in compliance with the rules and guidelines provided by the BVGCD, specifically in Rule 8.4(b)(7)(B) for wells (and multiple wells) capable of producing 800 or more acre-feet per year. TGI's evaluations focused on assessing local aquifer conditions and parameters, and the extent to which production from the subject wells may influence other groundwater users in the BVGCD. TGI's evaluations are based on previous investigations conducted in the District, including permit applications and field-testing associated with several local landowners. Additionally, TGI relied upon reported

data, published reports, the applicable groundwater availability model (GAM), and TGI’s extensive experience with and knowledge of the Simsboro Aquifer in Central Texas, within the BVGCD, and particularly in Robertson County. Specifically, TGI’s work was conducted to accomplish the following goals:

- ❖ Assessing the local hydrogeologic setting, focusing on the physical characteristics and hydraulic parameters of the local Simsboro Aquifer;
- ❖ Estimating and calculating the potential short-term and long-term drawdown at each of the wells, including interference drawdown between wells;
- ❖ Evaluating potential interference drawdown from other pumpage in the area and predicting long-term water levels in the proposed well-field area;
- ❖ Establishing a target maximum proposed pumping rate for each well and for the aggregated well field;
- ❖ Modeling to assess the feasibility of the targeted pumping rate and the potential impacts (e.g., artesian pressure reduction) to the aquifer and other nearby well owners (e.g., drawdown); and,
- ❖ Providing this Hydrogeological Evaluation Report in compliance with District rules.

For convenience, applicable illustrations and supporting documentation are included in the following attachments:

- Attachment 1 – Figures
- Attachment 2 – Tables
- Attachment 3 – Reference Materials
- Attachment 4 – Selected References

Proposed Pumping Locations and Permit Pumping Rates

Figure 1 illustrates the locations for the proposed Simsboro wells on the Ely Family Partnership property. Proposed well identifications, coordinates, and estimated land-surface elevations in feet above mean sea level (MSL) as estimated from Google Earth are as follows:

Well Identification	Latitude*	Longitude*	Est. Land Surface Elevation
No. 1	96°35'40.04"W	30°50'36.07"N	260
No. 2	96°35'02.70"W	30°50'19.85"N	256
No. 3	96°34'24.84"W	30°50'17.37"N	256
No. 4	96°34'03.78"W	30°49'37.20"N	298
No. 5	96°34'18.42"W	30°49'23.43"N	256
No. 6	96°33'35.83"W	30°49'52.96"N	305
No. 7	96°48'55.99"W	30°44'19.75"N	352
No. 8	96°32'41.09"W	30°48'24.69"N	273

*Coordinate system is NAD83 State Plane Texas Central (feet)



The proposed production capacities in gallons per minute (gpm) and requested permit allocations in acre-feet per year are as follows:

<u>Well Identification</u>	<u>Maximum Pumping Rate</u>	<u>Annual Permit Allocation</u>
No. 1	1,150 gpm	1,484 acre-feet
No. 2	2,000 gpm	2,581 acre-feet
No. 3	850 gpm	1,097 acre-feet
No. 4	1,600 gpm	2,065 acre-feet
No. 5	1,100 gpm	1,419 acre-feet
No. 6	1,600 gpm	2,065 acre-feet
No. 7	1,400 gpm	1,807 acre-feet
No. 8	1,050 gpm	1,355 acre-feet
Total Annual Allocation		13,873 acre-feet

The radii attributed to the pumping rates for each of the wells lie within the Ely property boundaries. The nearest known existing wells completed into the Simsboro Aquifer are between 3,700 and 6,350 feet from the nearest proposed Simsboro well. The landowners will request in the permit application an internal waiver per BVGCD Rule 6.2 to allow for slight overlap between the radii of Well No. 5 and Well No. 4 (less than 850 feet) and between Well No. 6 and Well No. 4 (less than 350 feet). The proposed overlap of well radii will result in an additional 550 gpm of average combined pumping rate. As will be discussed later in this report, the slight overlap will have minimal effects on interference drawdown between the proposed Ely wells and will not significantly change impacts on surrounding wells. With an approved waiver, the proposed well locations comply with the BVGCD rules regarding spacing between wells and allocation of acreage per well.

Hydrogeologic Conditions and Aquifer Characteristics

Surface Geologic Setting

Figure 2 illustrates that the entire Ely Family Partnership property is underlain by downdip portions of the Carrizo-Wilcox Aquifer, a Major Aquifer delineated by the TWDB. Figure 3 shows that the northern approximately one-third of the property lies atop the Brazos River Alluvium Aquifer. The western portion of the middle section of the subject farm lies atop the Brazos River Alluvium Aquifer along the Little Brazos River and atop the outcrop of the Queen City Aquifer along the eastern part of the land. The southern portions of the Ely properties lie atop the downdip part of the Queen City. There are no other Major or Minor aquifers as identified by TWDB that occur beneath the subject properties.

Figure 4 is a Surface Geology Map for the Ely Family Partnership farm area. The alluvial and terrace deposits associated with the Brazos River occur at land surface across most of the property. The Queen City Formation subcrops the alluvial and terrace deposits and crops out across the eastern portions of the middle section of land. The Weches Formation crops out across the southern parts of the Ely property. The entire local sections of the Reklaw, Carrizo, and Wilcox Group (i.e., Calvert Bluff, Simsboro, and Hooper) occur beneath the subject properties.

Land surface elevation across the Ely properties generally ranges from 255 feet above mean sea level (MSL) in the floodplain and near the Little Brazos River to about 355 feet above MSL on eastern parts of the subject land. Geologic units dip generally from the north-northwest to the south-southeast and dip angles typically increase with depth in the geologic section. Locally, the dip along the base of the Wilcox Group is up to 140 to 145 feet per mile based on available maps (see Attachment 3). There are no faults mapped locally at land surface across the subject property. Based on available structural geology maps and GAM datasets estimates of the elevations and thicknesses of hydrostratigraphic layers beneath the Ely property are summarized in the table below:

Layer	Elevation	Depth	Thickness
Land Surface	265 to 320 feet AMSL	Not Applicable	Not Applicable
Base of Alluvium	205 to 215 feet AMSL	55 to 105 feet BGL	55 to 105 feet
Base of Weches	165 to 175 feet AMSL	100 to 155 feet BGL	40 to 50 feet
Base of Queen City	-63 to +129 MSL	135 to 385 feet BGL	40 to 230 feet
Base of Reklaw	5 to 188 feet BMSL	270 to 510 feet BGL	125 to 135 feet
Base of Carrizo	120 to 390 feet BMSL	385 to 710 feet BGL	115 to 205 feet
Base of Calvert Bluff	1,020 to 1,355 feet BMSL	1,285 to 1,675 feet BGL	900 to 965 feet
Base of Simsboro	1,565 to 1,950 feet BMSL	1,830 to 2,270 feet BGL	550 to 600 feet
Base of Hooper	2,175 to 2,705 feet BMSL	2,440 to 3,025 feet BGL	610 to 750 feet

Aquifer Conditions and Hydraulic Parameters

This report focuses on proposed permitted production from the Simsboro Aquifer. The top of the Simsboro Formation is estimated to be at depths of between 1,270 and 1,700 feet BGL. Net sand thickness maps indicate productive sands of between 400 and 500 feet and potentially more. As most of the Simsboro Formation is comprised of sand, it is likely that Simsboro wells on the Ely properties will be between 1,800 and 2,300 feet deep. Figure 5 illustrates locations for registered and permitted Simsboro wells within five (5) miles of the proposed Ely wells. Attachment 4 provides available well records for selected nearby Simsboro wells. Figure 6 shows locations for registered and permitted Simsboro wells within one (1) mile of the proposed Ely wells locations. Figures 6a, 6b, and 6c provide the locations for Simsboro wells within one (1) mile of the proposed well locations on maps with a scale of 1"=1,000 feet per BVGCD Rules. Due to the depth and dip of the aquifer there are not a vast



number of local wells completed into the Simsboro. There is one Simsboro well mapped within one mile of the proposed wells. Simsboro wells are generally north of the Ely properties.

TGI extracted hydraulic data for the subject property and nearby areas from the currently-used version of the groundwater availability model (GAM) for the Central Portion of the Sparta, Queen City, and Carrizo-Wilcox Aquifers (Young, et al., 2018). The following table provides a summary of estimated parameters extracted from the GAM datasets to those derived by TGI for the local Carrizo and Simsboro aquifers across the Astin Farms property:

<u>Parameter</u>	<u>GAM</u>	
	<u>Estimates Range</u>	<u>TGI Estimates</u>
Sand Thickness	550 to 600 feet	400 to 500 feet
Hydraulic Conductivity	97 to 208 gpd/ft ²	150 to 250 gpd/ft ²
Transmissivity	54,825 to 123,540 gpd/ft	60,000 to 125,000 gpd/ft
Storage Coefficient	1.21 x 10 ⁻⁴ to 1.29 x 10 ⁻⁴	10 ⁻⁴

Figure 7 provides a hydrograph illustrating water-level measurements collected for TWDB Well No. 59-04-701 (i.e., BVGCD Well BVHU-0013 and City of Hearne Well No. 4) which is located within 3 ¼ miles of the northernmost proposed Ely well (see Figure 5). Water levels in the well declined by between 110 and 140 feet from 1979 to 2021. AGS reported artesian head decline of 81 feet between 1999 and 2023 in TWDB Well No. 59-04-701 (AGS, May 11, 2023). The AGS map shows between 70 and 80 feet of artesian head decline in the Simboro beneath the Ely properties from 2000 to 2023. Based on the updated data provided by AGS, current depths to water on the subject property will likely range from 150 to 250 feet BGL. Therefore, water levels will probably rise between 1,100 and 1,500 feet above the top of the aquifer in the new wells, verifying that the local Simsboro is under artesian or confined conditions with hundreds of feet of artesian head.

Projected Effects of Proposed Pumping

The immediate impacts from production will be artesian head decline (i.e., drawdown) at the pumping wells. As the wells pump, artesian pressure or potentiometric head around the wells will decline forming a cone of depression. As production continues the cone of depression will extend radially from the well field until an aquifer boundary is reached or the production rate reaches equilibrium with the captured groundwater flows. Due to the distance of the proposed wells from the outcrop of the aquifer, reduction in artesian pressure is the only anticipated measurable effect from the proposed pumping. The aquifer will remain completely full and there will be only an infinitesimal reduction in storage. Pumping from the Simsboro aquifers will cause some vertical leakage from overlying and underlying

zones. While leakage can serve to dampen drawdown due to boundary effects and inflows, the leakage will likely not result in any identifiable water-level changes or water-quality variations in any of the overlying or underlying zones.

[Drawdown Simulations Using the GAM](#)

TGI utilized the recently released revision and update of the Central Portion of the Sparta, Queen City, and Carrizo-Wilcox Aquifers GAM to calculate drawdown due to the proposed pumping for continuous pumping periods of one (1) year and 10 years from the Simsboro Aquifer. The Ely Family Partnership has requested a permit allocation for the Simsboro Aquifer of 13,872 acre-feet per year. Figure 8 and Figure 9 provide maps showing modeled drawdown contours after one (1) year and 10 years of pumping at the maximum authorized rate, respectively. Table 1 and Table 2 provide modeled drawdown at specific registered and permitted Simsboro well sites after one (1) year and 10 years of continuous pumping, respectively. The GAM predicts that Simsboro artesian pressure will decline by as much as 70 feet immediately adjacent to the Ely property boundaries and from 42 to 52 feet one (1) mile from the proposed wells within the first year of pumping. Declines during the initial year are simulated to be 18 to 29 feet five (5) miles of the wells. After 10 years of pumping the proposed Simsboro wells drawdown (i.e., artesian head decline) will be as much as 80 feet adjacent to the subject property and is simulated to range from 52 to 62 feet one (1) mile from the well locations. Simulated drawdown ranges from 25 to 42 feet five (5) miles from the wells. Based on the geologic structure, estimates of current artesian head, and drawdown calculated from the GAM simulations, the Simsboro aquifer will remain full and under artesian conditions in the well-field area and within the five-mile radius. Note that due to the depth of the local Simsboro and the prolific transmissivity the overlap of well radii (see Rule 6.2) on the Ely properties will not cause adverse interference drawdown effects on the Ely wells or on local wells. Local wells will continue to maintain hundreds of feet of artesian head.

[Drawdown Simulations Using Analytical Modeling](#)

Due to the scale and configuration of the GAM grid, the GAM probably does not provide accurate drawdown calculations for the specific well sites and areas in the immediate vicinity of the proposed well field. Therefore, for comparison purposes and per the BVGCD rules TGI used an analytical modeling program based on the Theis non-equilibrium equation to calculate theoretical potentiometric head declines at and surrounding the proposed production wells. TGI has used the Theis model for several previous submittals to the BVGCD as well as for evaluations and submittals to numerous districts across the State of Texas. The Theis model incorporates many assumptions, most of which are sufficiently satisfied in the local Simsboro aquifer. However, the Theis model assumes an aquifer that is uniform over an infinite area. To account for recharge boundaries and possible inter-aquifer leakage into the producing aquifers, TGI modeled long-term pumping (i.e., from one to 10 years) by incorporating a leaky artesian storage coefficient. However, it is likely that, while the Theis

model likely provides more reliable results within and near the well field, it probably overstates drawdown at distance from the pumping center. Also, the Theis model is more accurate for shorter pumping durations; therefore, the 10-year calculation likely overestimates drawdown from the well fields.

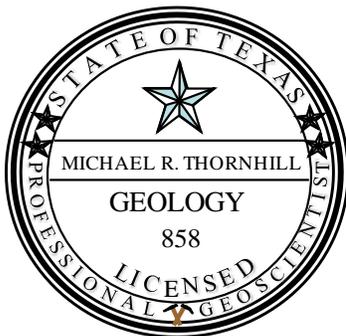
Figure 10 and Figure 11 provide drawdown contours from Theis calculations due to pumping the Simsboro wells proposed for t after one (1) and 10 years, respectively. Table 1 and Table 2 provide drawdown values at specific well locations. The analytical model calculated artesian pressure declines of as much as 95 feet adjacent to the subject property after one (1) year of pumping. Drawdown at a distance of one (1) mile was modeled to be 70 to 85 feet after the first year of pumping. At five (5) miles away the drawdown calculation resulted in 48 to 55 feet of artesian pressure decline after a year of pumping at the annual allocation rate. After 10 years the calculated drawdown at the Ely property lines is as much as 105 feet and the drawdown at a distance of a mile was modeled to be 80 to 94 feet. The drawdown at five (5) miles was modeled to be between 57 and 63 feet.

Conclusions

Based on our review of the BVGCD rules and the work conducted as described herein, TGI concludes the following:

- ❖ The proposed wells and pumping amounts for the Ely Family Partnership property can be completed and produced in accordance with the well spacing and production-based acreage (i.e., allocation) rules set forth by the BVGCD;
- ❖ The predicted drawdown derived from the Theis analytical model are more accurate than the GAM predictions for the proposed well sites and areas near the well field;
- ❖ GAM-predicted drawdown probably provides a more reasonable estimate of future impacts at greater distances from the proposed well field and for longer time periods. The updated GAM predicts significantly less drawdown regionally than the previous version of the GAM; and,
- ❖ Production from the proposed pumping will cause only infinitesimal reduction in aquifer storage as the local Simsboro Aquifer will stay completely full and groundwater in the formation will remain under considerable artesian pressure within the well-field areas and the five-mile study radius.

We very much appreciate the opportunity to assist you in our specialty. If you have any questions, please call.



Sincerely,
THORNHILL GROUP, INC.



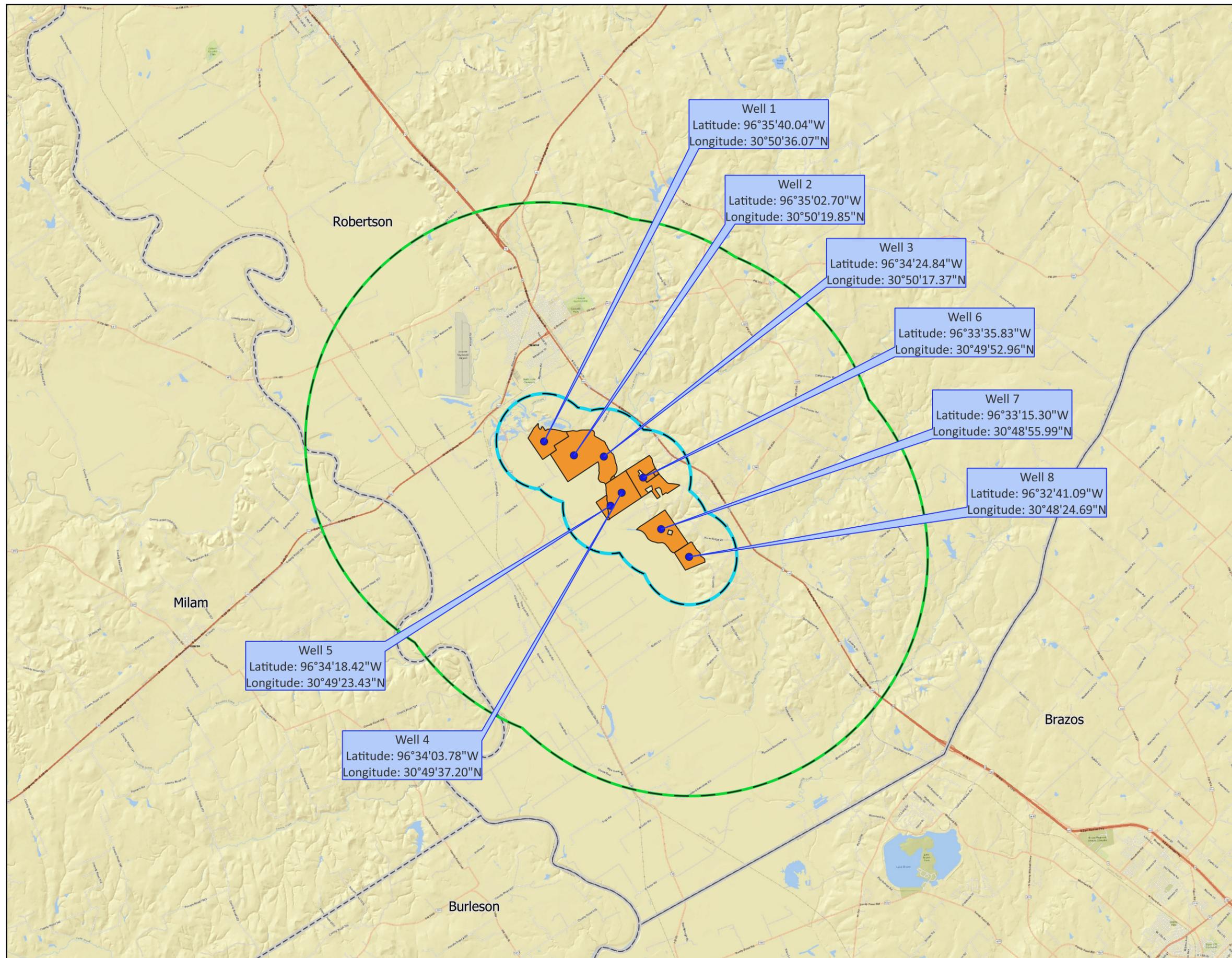
Michael R. Thornhill, P.G.
President

The seal appearing on this document was authorized by Michael R. Thornhill, P.G. on July 19, 2023.

Attachments



ATTACHMENT 1 –
FIGURES



Explanation

- Proposed Wells
- 1 Mile Radius from Well Locations
- 5 Mile Radius from Well Locations
- Ely Property
- Counties



Ely Family Partnership, LP

Figure 1:
Location Map

Well 1
Latitude: 96°35'40.04"W
Longitude: 30°50'36.07"N

Well 2
Latitude: 96°35'02.70"W
Longitude: 30°50'19.85"N

Well 3
Latitude: 96°34'24.84"W
Longitude: 30°50'17.37"N

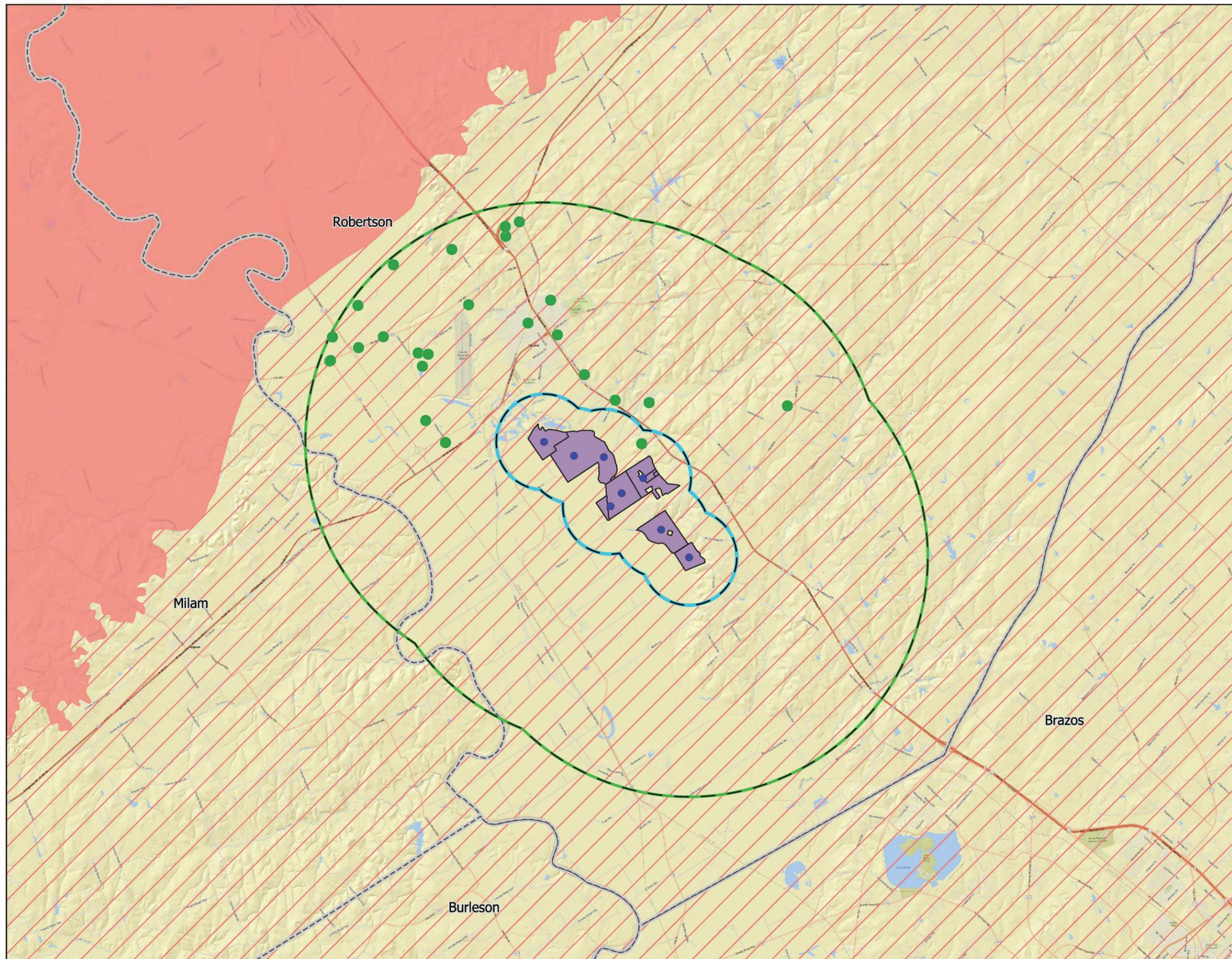
Well 6
Latitude: 96°33'35.83"W
Longitude: 30°49'52.96"N

Well 7
Latitude: 96°33'15.30"W
Longitude: 30°48'55.99"N

Well 8
Latitude: 96°32'41.09"W
Longitude: 30°48'24.69"N

Well 5
Latitude: 96°34'18.42"W
Longitude: 30°49'23.43"N

Well 4
Latitude: 96°34'03.78"W
Longitude: 30°49'37.20"N



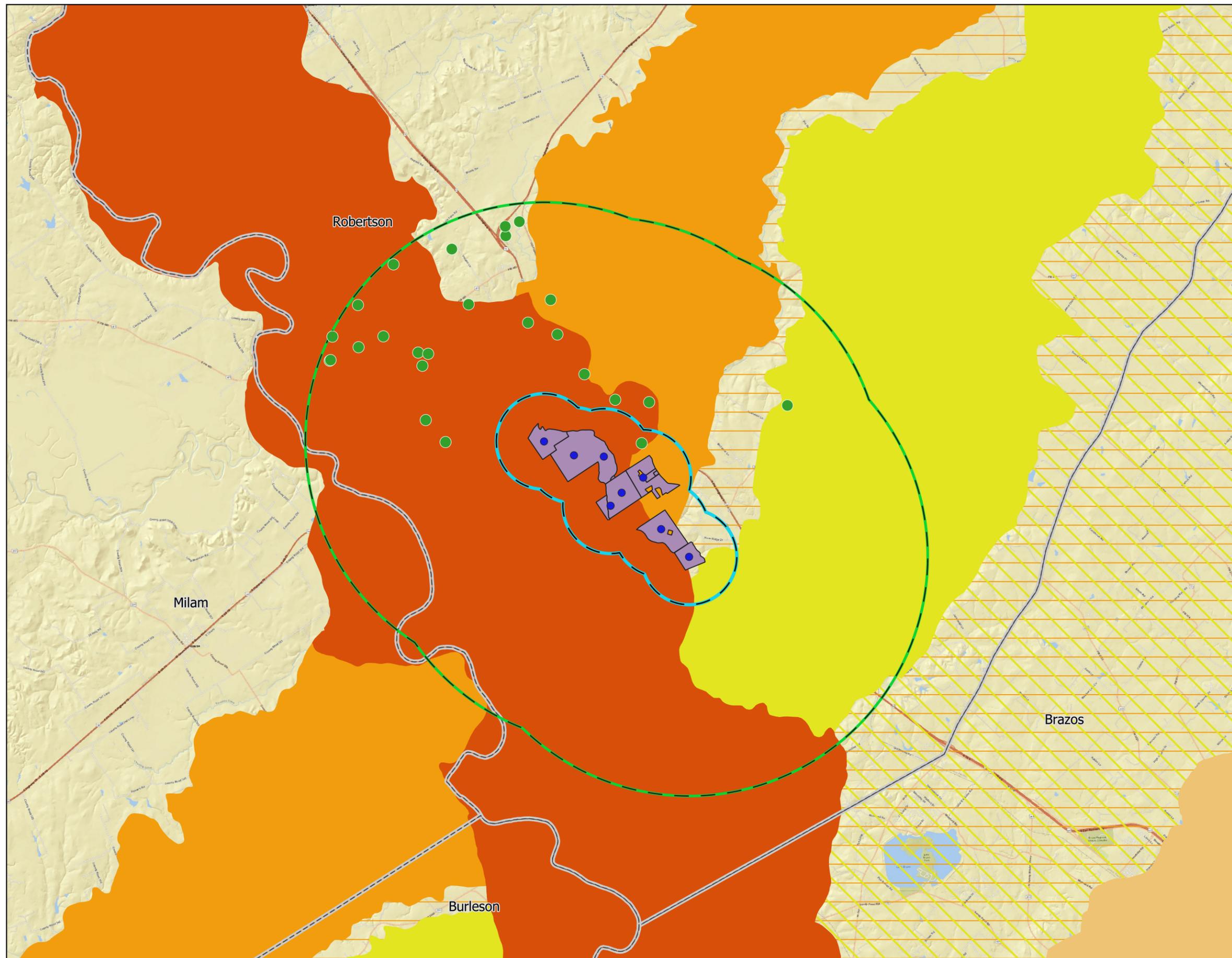
Explanation

- Proposed Wells
- 1 Mile Radius from Well Locations
- 5 Mile Radius from Well Locations
- Ely Property
- ▭ Counties
- Major Aquifers**
- Carrizo - Wilcox (outcrop)
- ▨ Carrizo - Wilcox (subcrop)
- BVGCD Reported Wells w/in 5 Miles**
- Simsboro



Ely Family Partnership, LP

Figure 2:
Major Aquifers

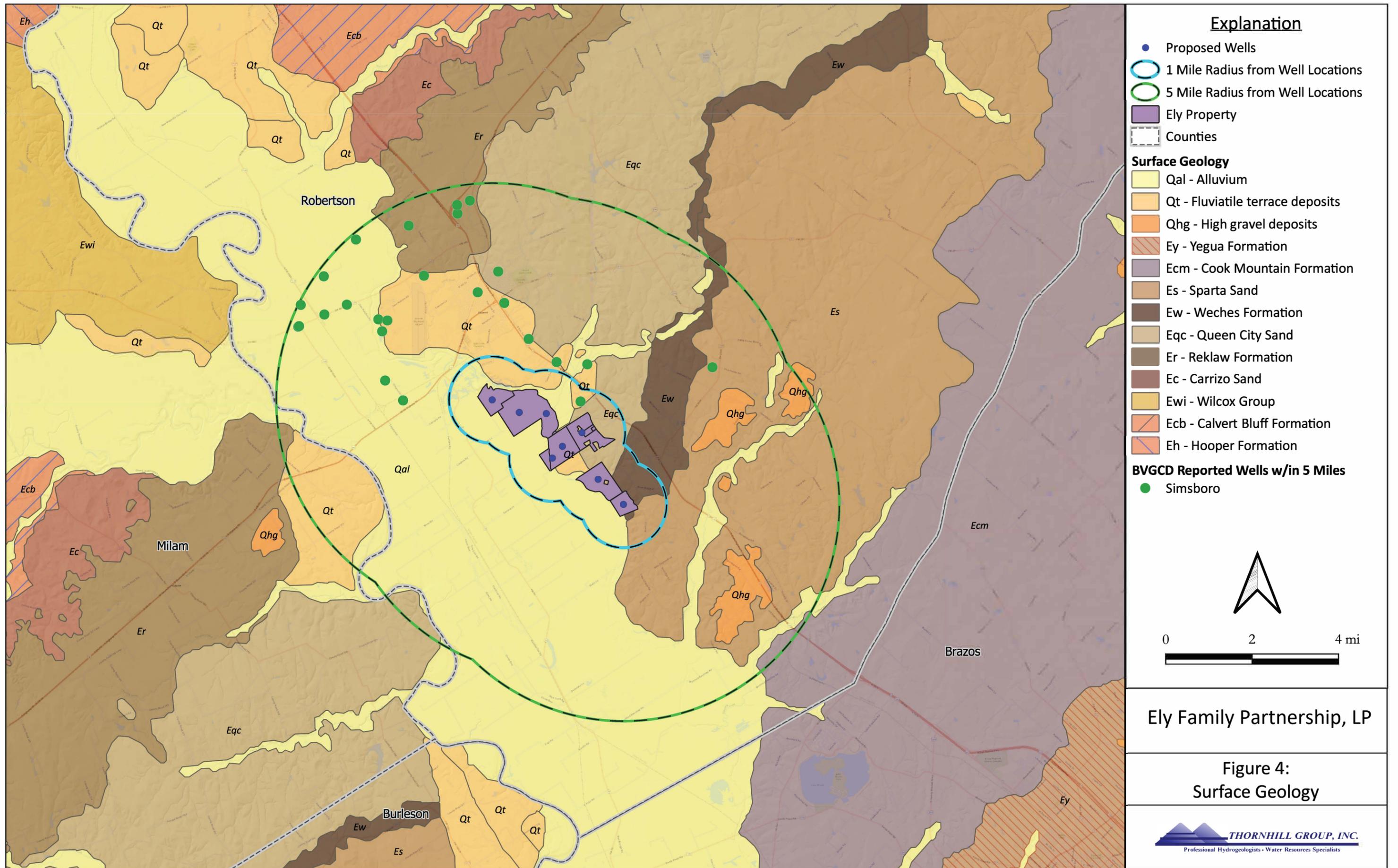


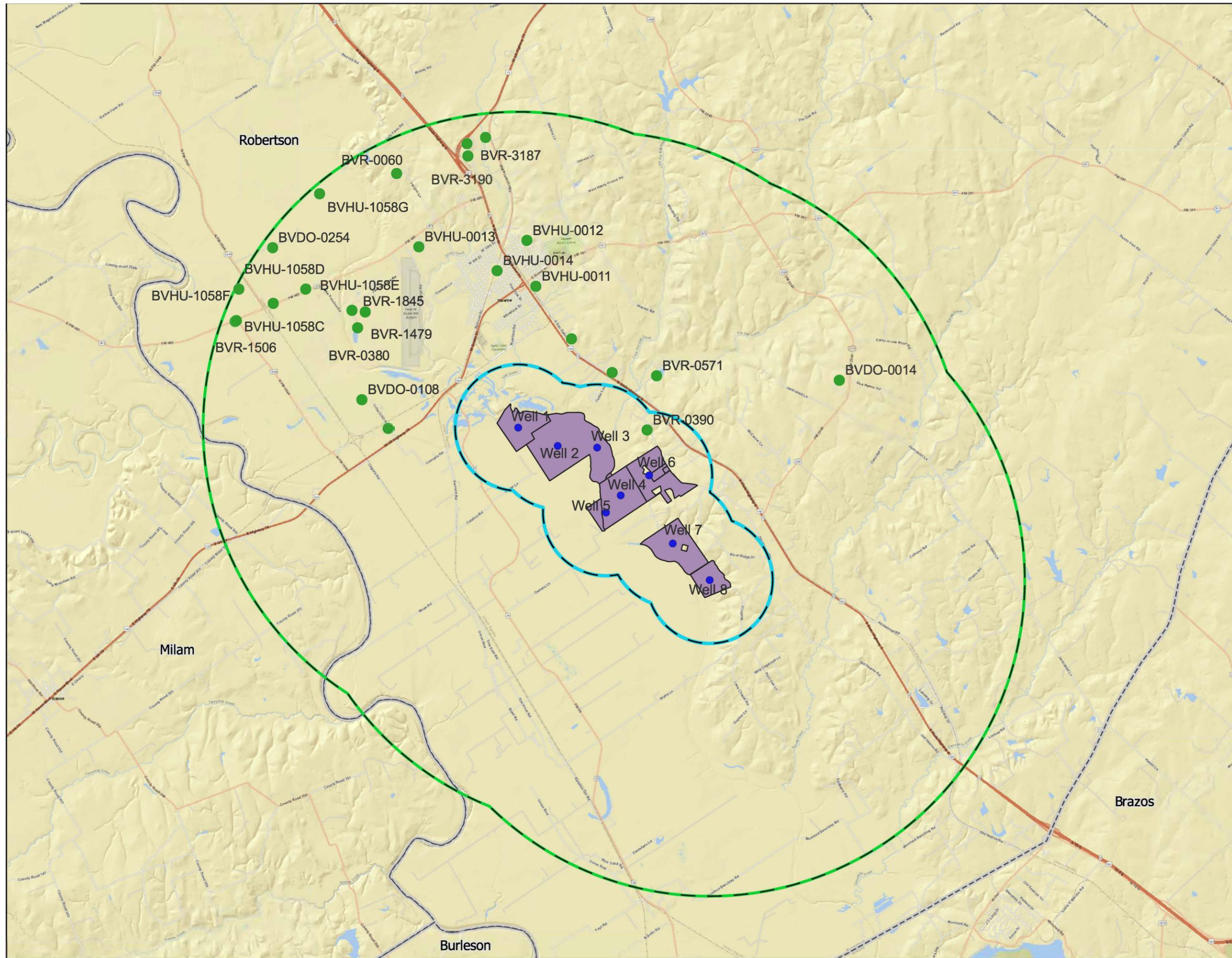
Explanation

- Proposed Wells
- 1 Mile Radius from Well Locations
- 5 Mile Radius from Well Locations
- Ely Property
- ▭ Counties
- Minor Aquifers**
- Brazos River Alluvium
- Queen City (outcrop)
- Queen City (subcrop)
- Sparta (outcrop)
- Sparta (subcrop)
- Yegua Jackson
- BVGCD Reported Wells w/in 5 Miles**
- Simsboro



**Figure 3:
Minor Aquifers**





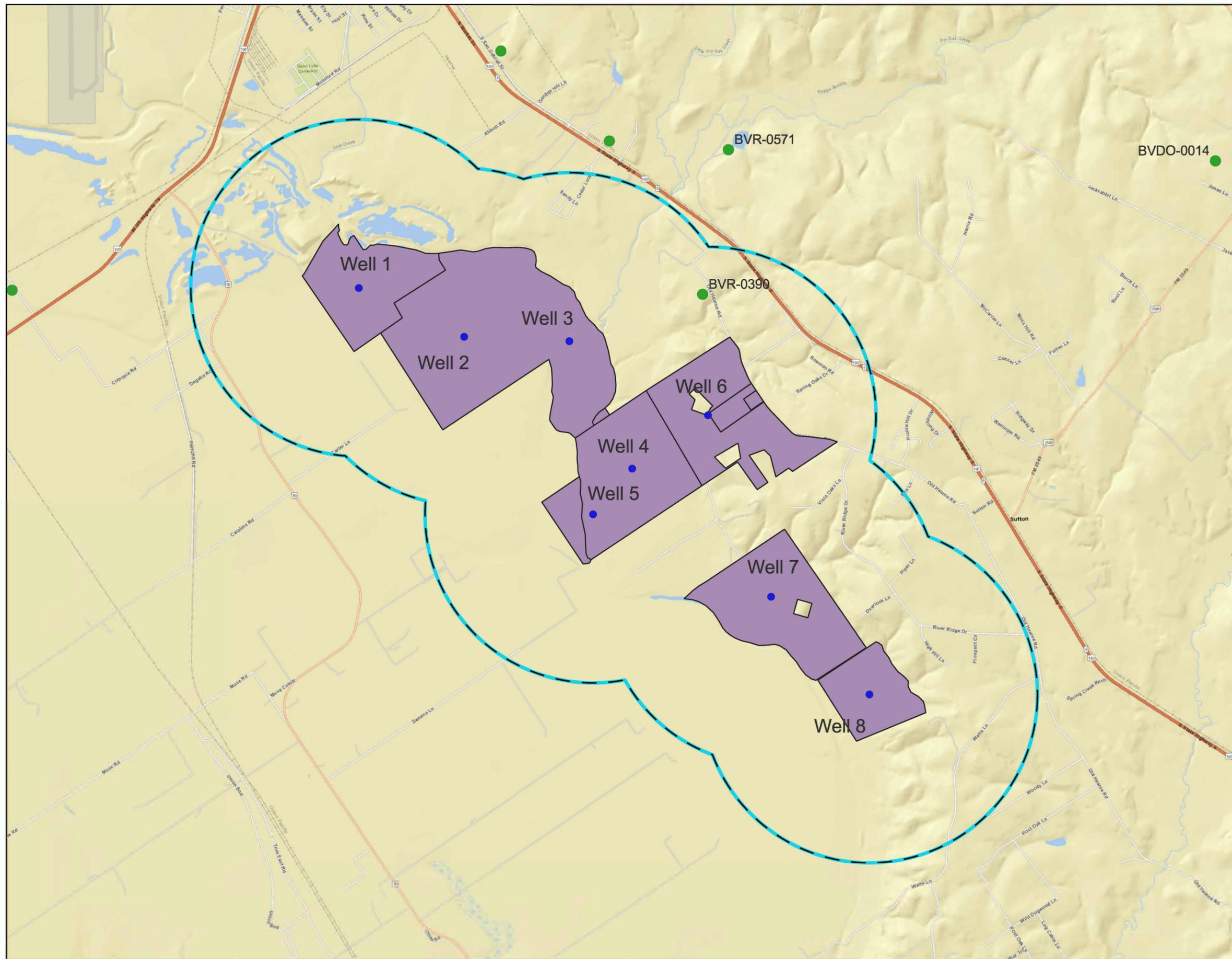
Explanation

- Proposed Wells
- 1 Mile Radius from Well Locations
- 5 Mile Radius from Well Locations
- Ely Property
- Counties
- BVGCD Reported Wells w/in 5 Miles**
- Simsboro



Ely Family Partnership, LP

Figure 5: Well Locations w/in 5 Miles of Proposed Wells



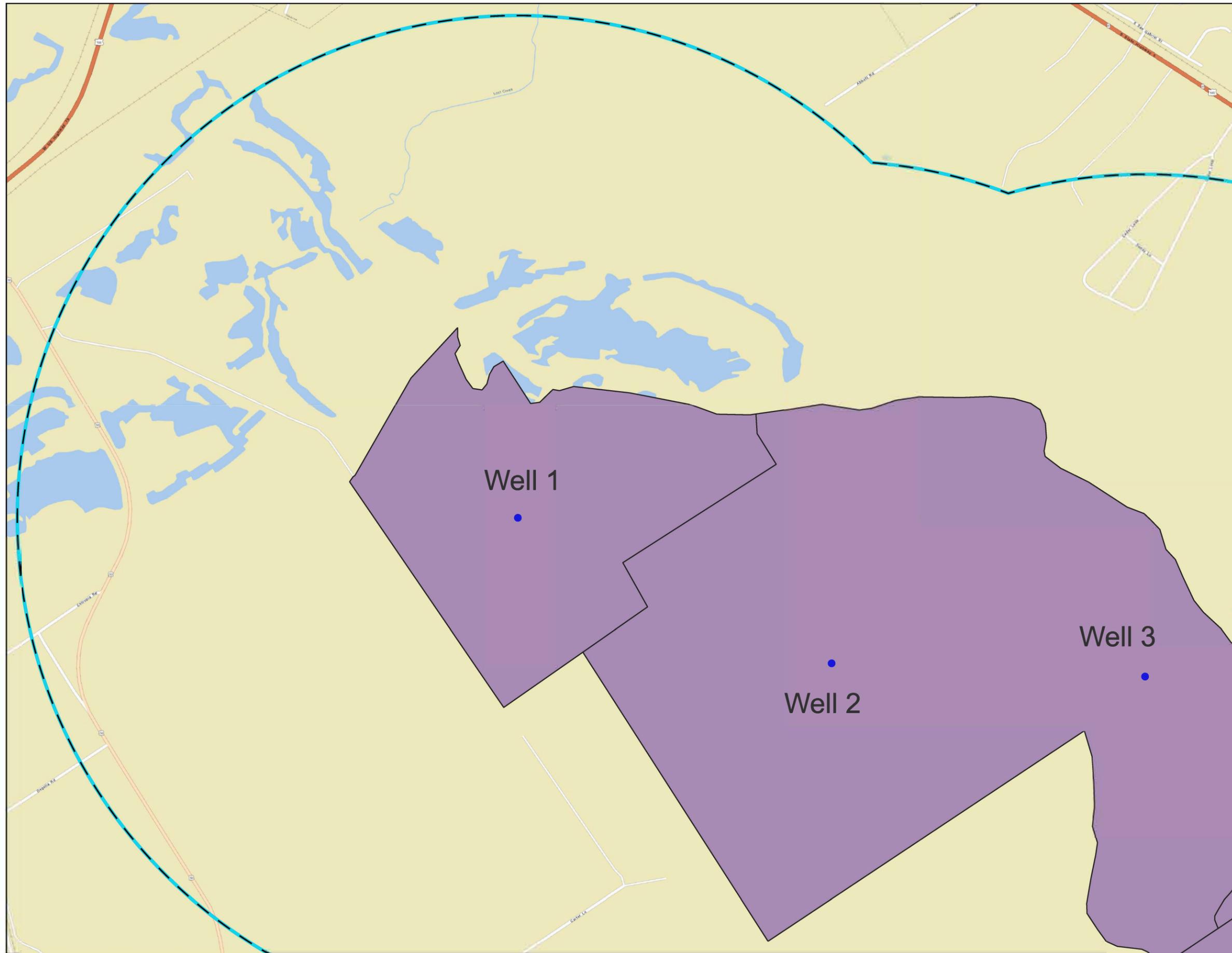
Explanation

- Proposed Wells
- 1 Mile Radius from Well Locations
- 5 Mile Radius from Well Locations
- Ely Property
- ▭ Counties
- BVGCD Reported Wells w/in 5 Miles**
- Simsboro



Ely Family Partnership, LP

Figure 6: Well Locations w/in 1 Mile of Proposed Wells



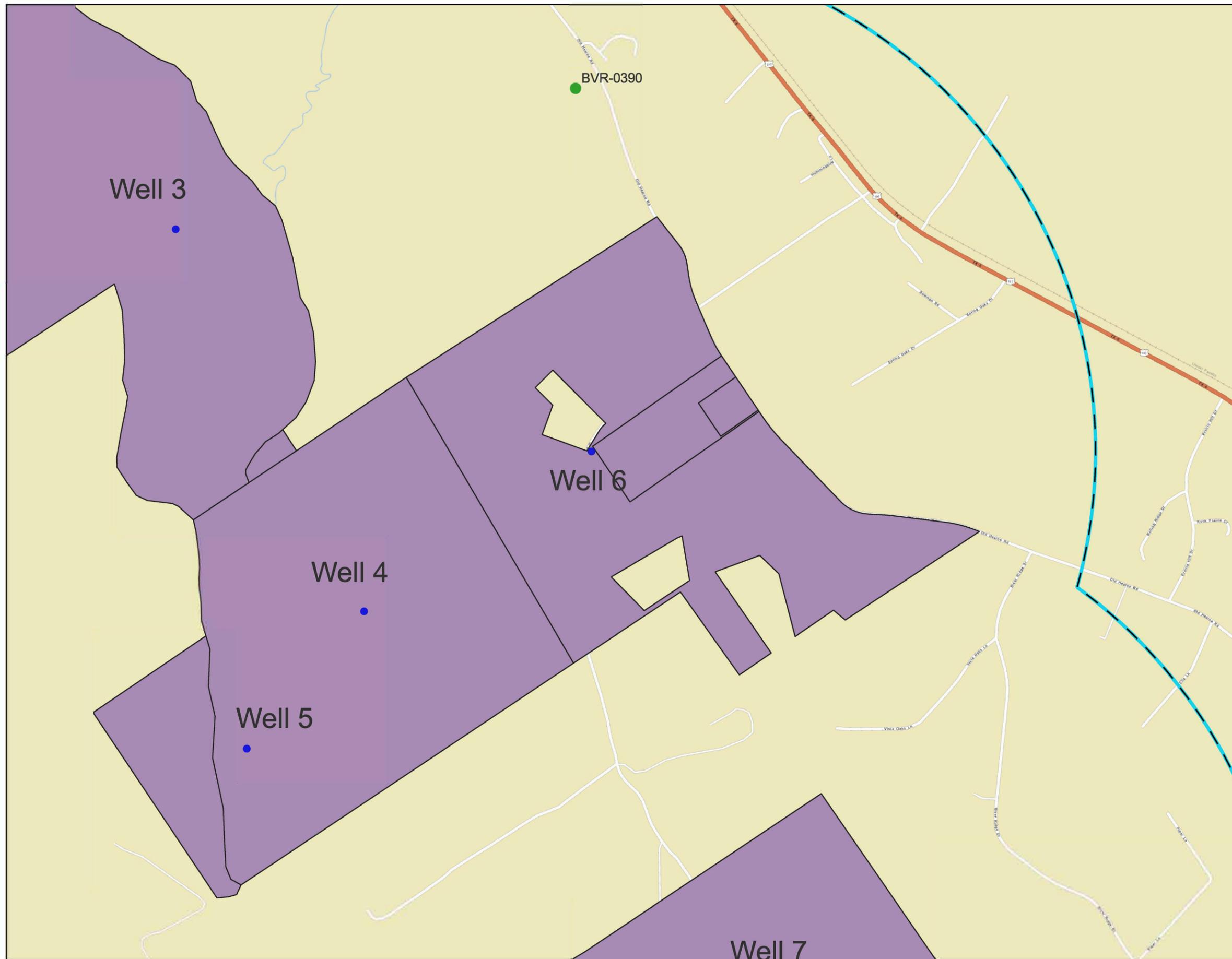
Explanation

- Proposed Wells
- 1 Mile Radius from Well Locations
- 5 Mile Radius from Well Locations
- Ely Property
- Counties



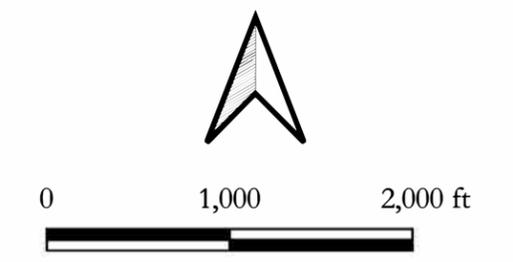
Ely Family Partnership, LP

Figure 6a: Well Locations w/in
1 Mile of Proposed Wells



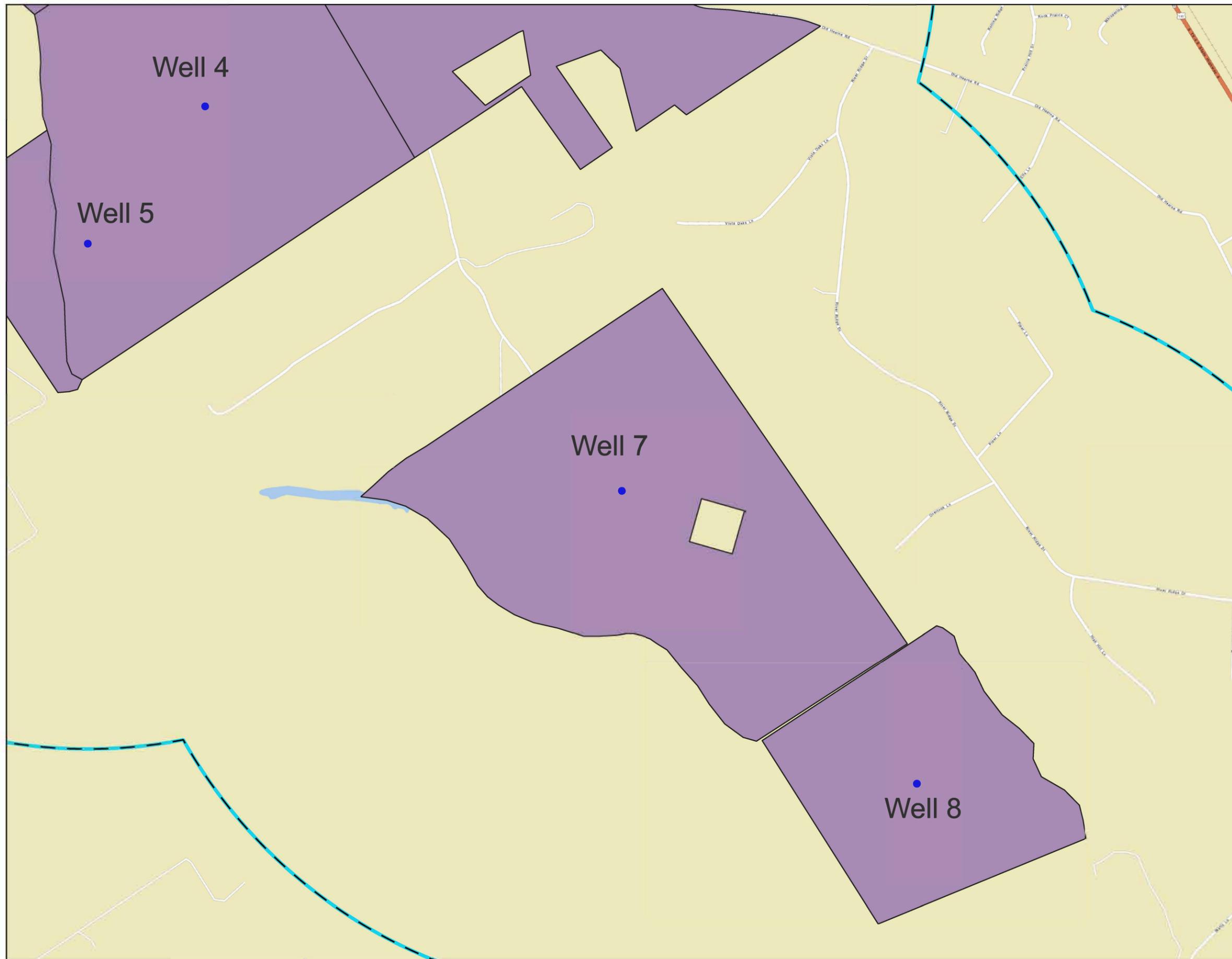
Explanation

- Proposed Wells
- 1 Mile Radius from Well Locations
- 5 Mile Radius from Well Locations
- Ely Property
- ▭ Counties
- BVGCD Reported Wells w/in 5 Miles**
- Simsboro



Ely Family Partnership, LP

Figure 6b: Well Locations w/in 1 Mile of Proposed Wells



Explanation

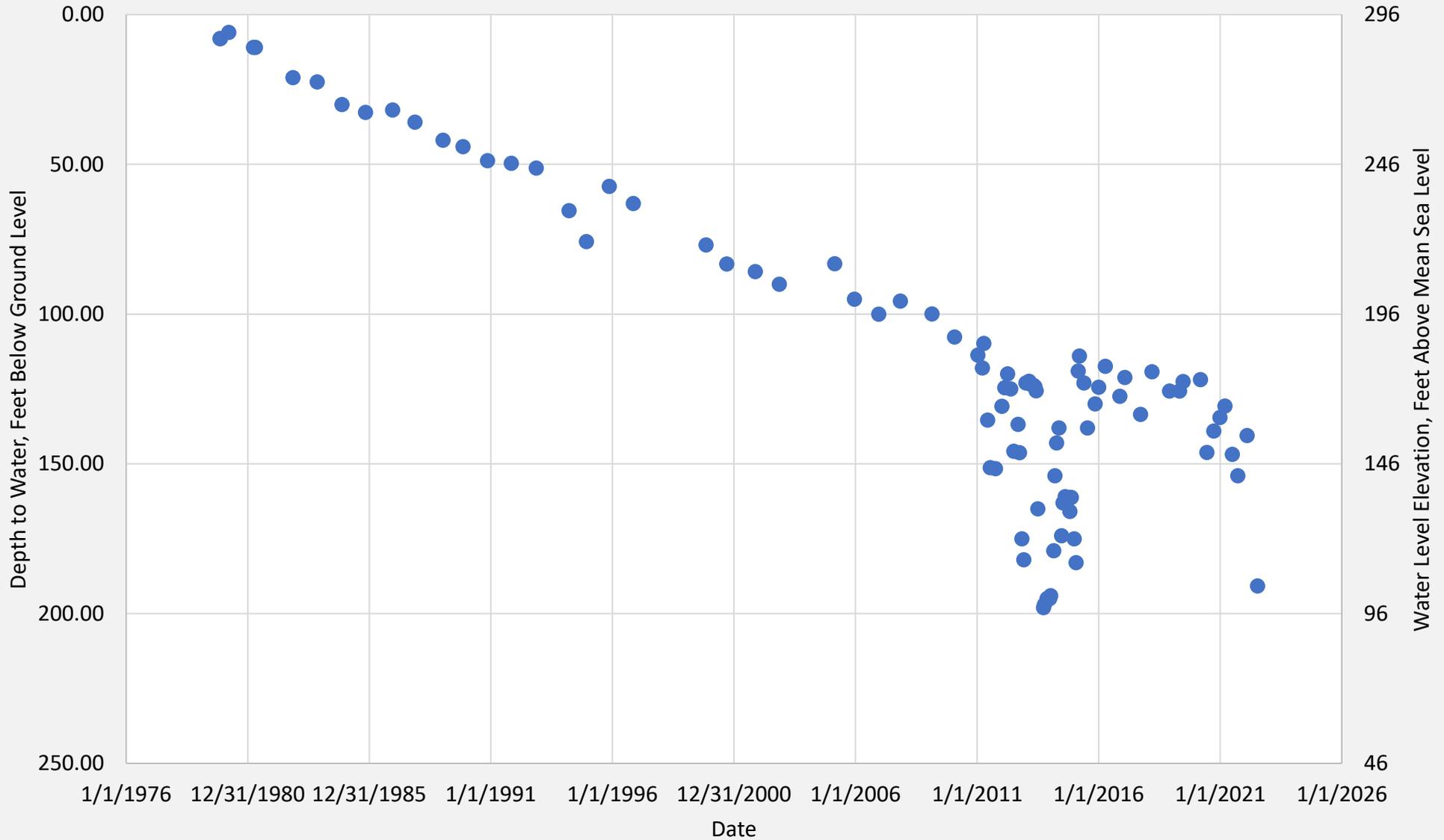
- Proposed Wells
- 1 Mile Radius from Well Locations
- Ely Property
- Counties

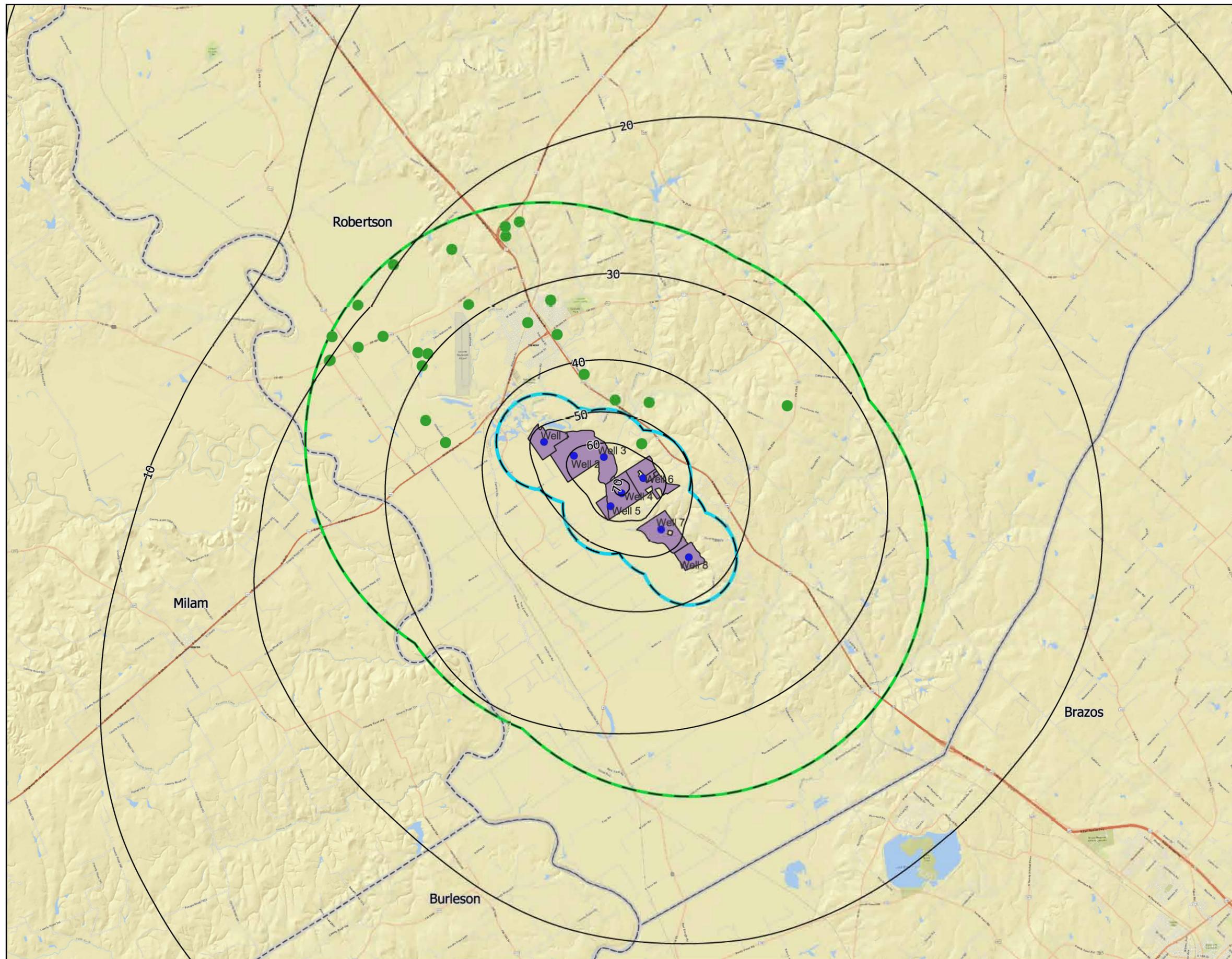


Ely Family Partnership, LP

Figure 6c: Well Locations w/in 1 Mile of Proposed Wells

Figure 7 – City of Hearne Well No. 4
Texas Water Development Board Number 59-04-701



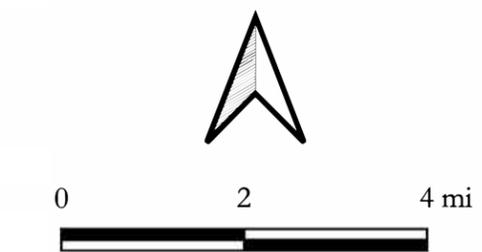


Explanation

- Proposed Wells
- 1 Mile Radius from Well Locations
- 5 Mile Radius from Well Locations
- 1-Year Modeled Drawdown - GAM
Contour Interval = 10 feet
- Ely Property
- Counties

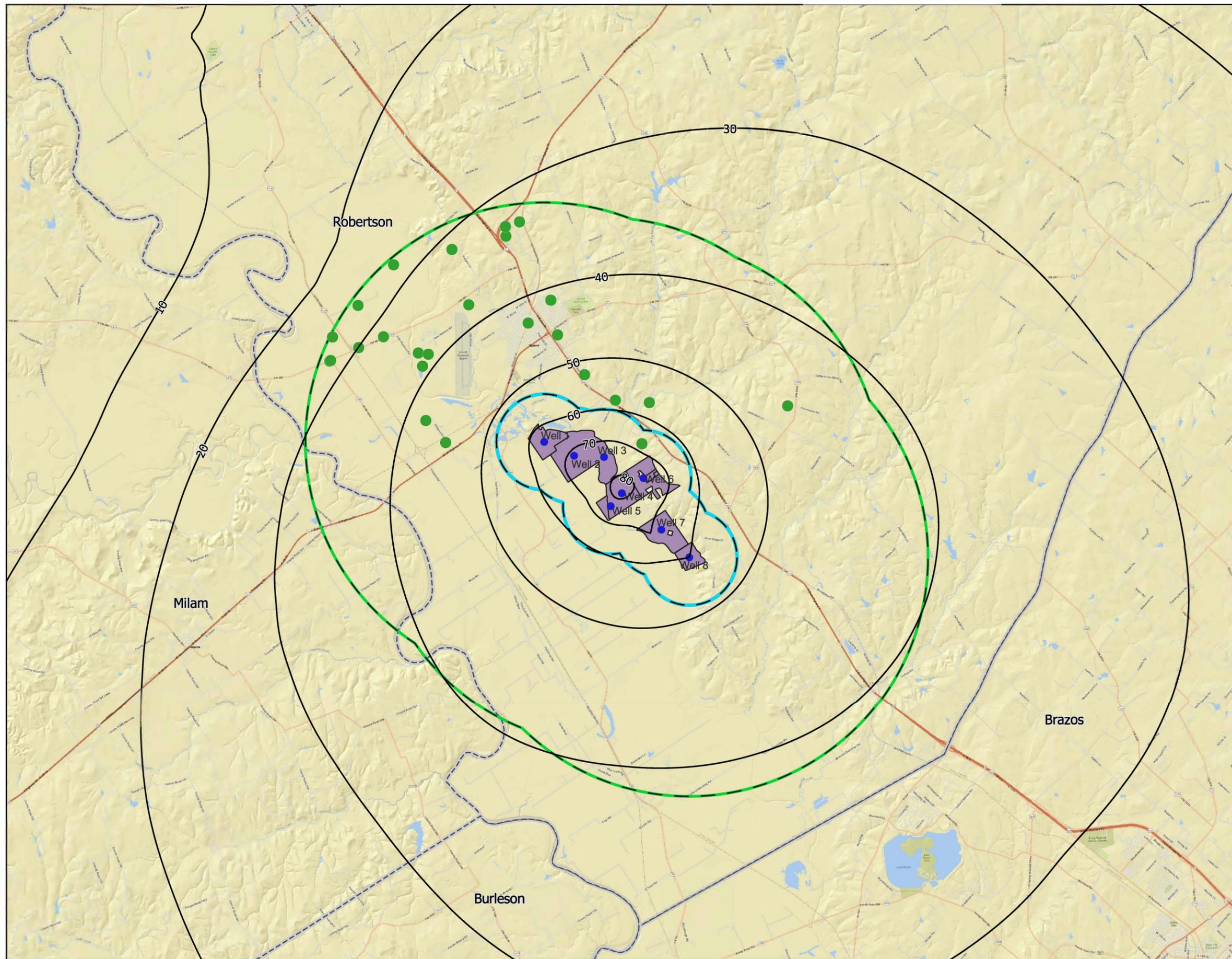
BVGCD Reported Wells w/in 5 Miles

- Simsboro



Ely Family Partnership, LP

**Figure 8: 1-Year GAM
Drawdown Contours**

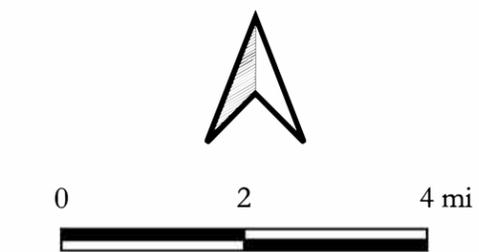


Explanation

- Proposed Wells
- 1 Mile Radius from Well Locations
- 5 Mile Radius from Well Locations
- 10-Year Modeled Drawdown - GAM
Contour Interval = 10 feet
- Ely Property
- Counties

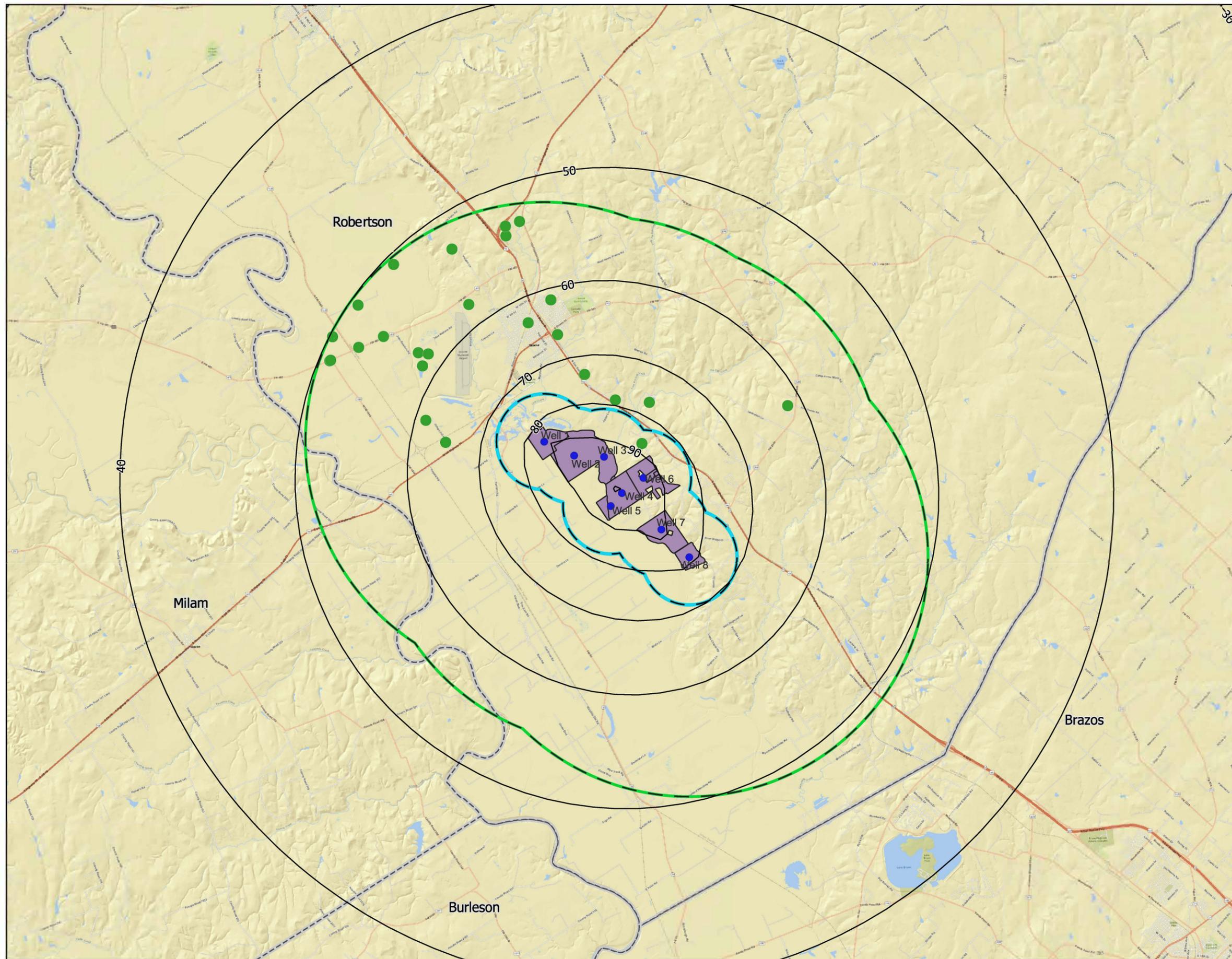
BVGCD Reported Wells w/in 5 Miles

- Simsboro



Ely Family Partnership, LP

**Figure 9: 10-Year GAM
Drawdown Contours**

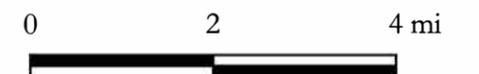


Explanation

- Proposed Wells
- 1 Mile Radius from Well Locations
- 5 Mile Radius from Well Locations
- 1-Yr Modeled Drawdown - Analytical Contour Interval = 10 feet
- Ely Property
- Counties

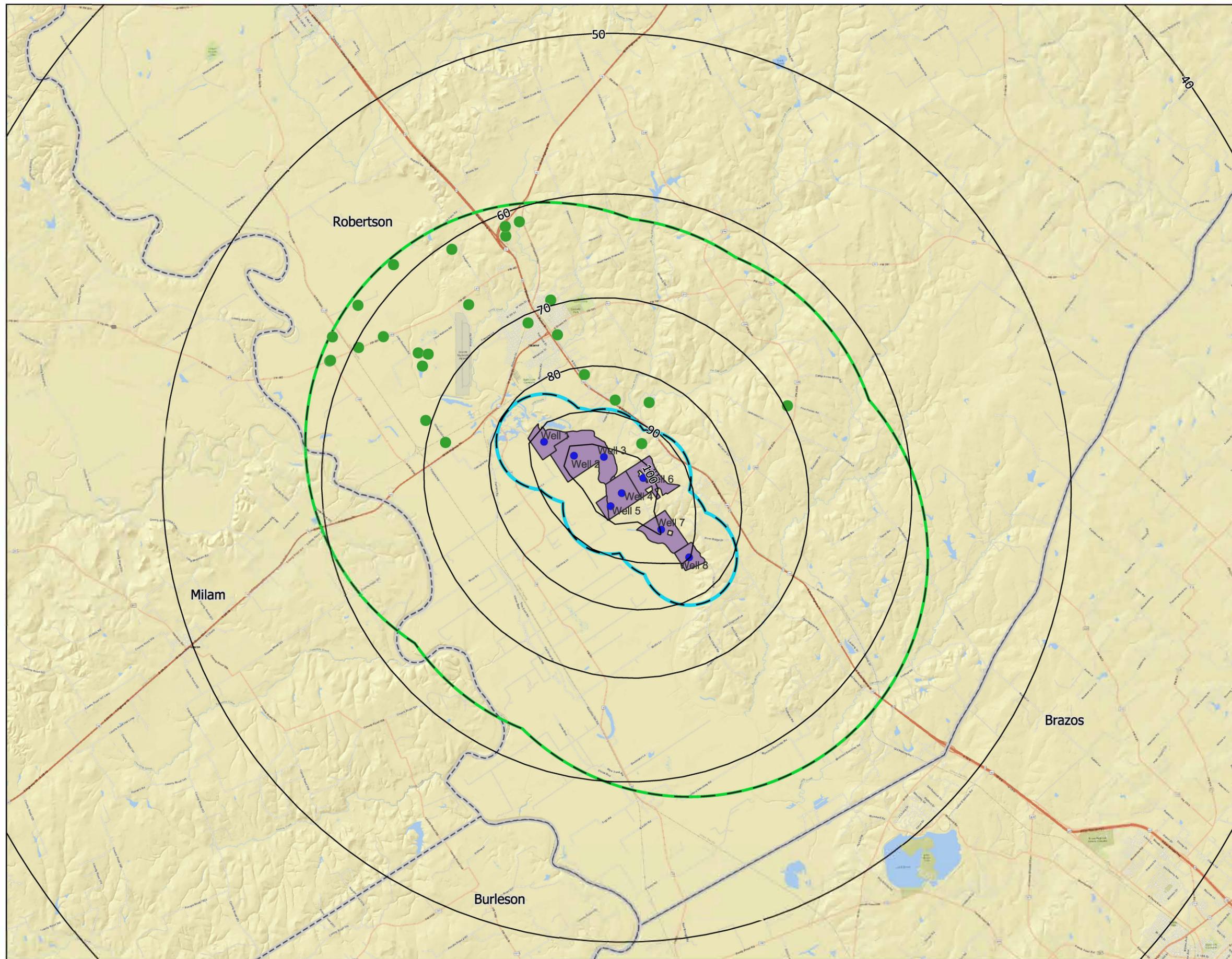
BVGCD Reported Wells w/in 5 Miles

- Simsboro



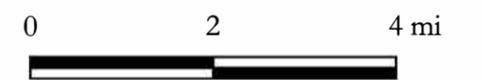
Ely Family Partnership, LP

Figure 10: 1-Year Analytical Drawdown Contours



Explanation

- Proposed Wells
- 1 Mile Radius from Well Locations
- 5 Mile Radius from Well Locations
- 10-Yr Modeled Drawdown - Analytical
Contour Interval = 10 feet
- Ely Property
- Counties
- BVGCD Reported Wells w/in 5 Miles**
- Simsboro



Ely Family Partnership, LP

Figure 11: 10-Year Analytical Drawdown Contours



ATTACHMENT 2 –
TABLES

Table 1. Simulated Drawdown at Registered and Permitted Simsboro Wells Within a 1-Mile Radius

Owner	Registration or Permit Number	Latitude	Longitude	Well Depth	Aquifer	Casing Diameter (in)	1 Year Analytical Drawdown, ft.	10 Year Analytical Drawdown, ft.	1 Year GAM Drawdown, ft.	10 Year GAM Drawdown, ft.
Boswell, Irene Couch	BVR-0390	30.841364	-96.560428	800	Simsboro	3	87	95	56	67

Table 2. Simulated Drawdown at Registered and Permitted Simsboro Wells Within a 5-Mile Radius

Owner	Registration or Permit Number	Latitude	Longitude	Well Depth	Aquifer	Casing Diameter (in)	1 Year Analytical Drawdown, ft.	10 Year Analytical Drawdown, ft.	1 Year GAM Drawdown, ft.	10 Year GAM Drawdown, ft.
Wellborn SUD	BVDO-0014	30.851710	-96.508264	2,020	Simsboro	30 , 16	62	70	34	45
Skiles, Clifford III	BVDO-0108	30.851042	-96.635889	1,242	Simsboro	30 , 16	61	69	33	42
CA Skiles Family Partnership, Ltd.	BVDO-0254	30.886626	-96.658433	0	Simsboro	30 , 18	51	59	19	26
City of Hearne	BVHU-0011	30.875673	-96.588479	1,433	Simsboro	14 , 8 5/8	66	74	36	46
City of Hearne	BVHU-0012	30.886263	-96.590453	1,430	Simsboro	12 , 6	61	69	32	41
City of Hearne	BVHU-0013	30.885707	-96.619201	1,441	Simsboro	10 , 8 , 6	58	66	29	38
City of Hearne	BVHU-0014	30.879554	-96.598692	1,275	Simsboro	12 , 10 , 8 , 7	63	71	33	43
CA Skiles Family Partnership, Ltd.	BVHU-1058C	30.870200	-96.668713	1,100	Simsboro	30 , 16	51	59	20	28
CA Skiles Family Partnership, Ltd.	BVHU-1058D	30.873824	-96.658706	1,131	Simsboro	30 , 16	52	60	22	30
CA Skiles Family Partnership, Ltd.	BVHU-1058E	30.876867	-96.649833	1,175	Simsboro	30 , 16	54	62	24	32
CA Skiles Family Partnership, Ltd.	BVHU-1058F	30.877300	-96.667783	1,065	Simsboro	30 , 16	50	58	19	26
CA Skiles Family Partnership, Ltd.	BVHU-1058G	30.898588	-96.645434	964	Simsboro	30 , 16	51	59	20	27
Bishop, Doris & Others	BVR-0060	30.902652	-96.624694	1,193	Simsboro	4 , 2	53	61	23	32
Ryan, Melvin & Sandra	BVR-0380	30.867554	-96.636420	1,100	Simsboro	4 , 2	58	66	30	39
Boswell, Irene Couch	BVR-0390	30.841364	-96.560428	800	Simsboro	3	87	95	56	67
Nigliazzo, John	BVR-0571	30.913686	-96.705731	400	Simsboro	4	77	85	46	57
Zeig, Joey	BVR-1479	30.871121	-96.634251	1,080	Simsboro	8 , 4 , 2	58	66	30	39
Mears, Frank	BVR-1506	30.870019	-96.669033	1,250	Simsboro	2	51	59	20	28
Wallace, Zane & Virginia	BVR-1845	30.871595	-96.637759	1,100	Simsboro	4 , 2	57	65	29	37
Zeig, Larry J.	BVR-3187	30.909000	-96.605579	1,270	Simsboro	4 , 2	53	61	24	33
Swaner, Ronald & Elizabeth	BVR-3190	30.906118	-96.605514	1,225	Simsboro	4 , 2	54	62	25	34



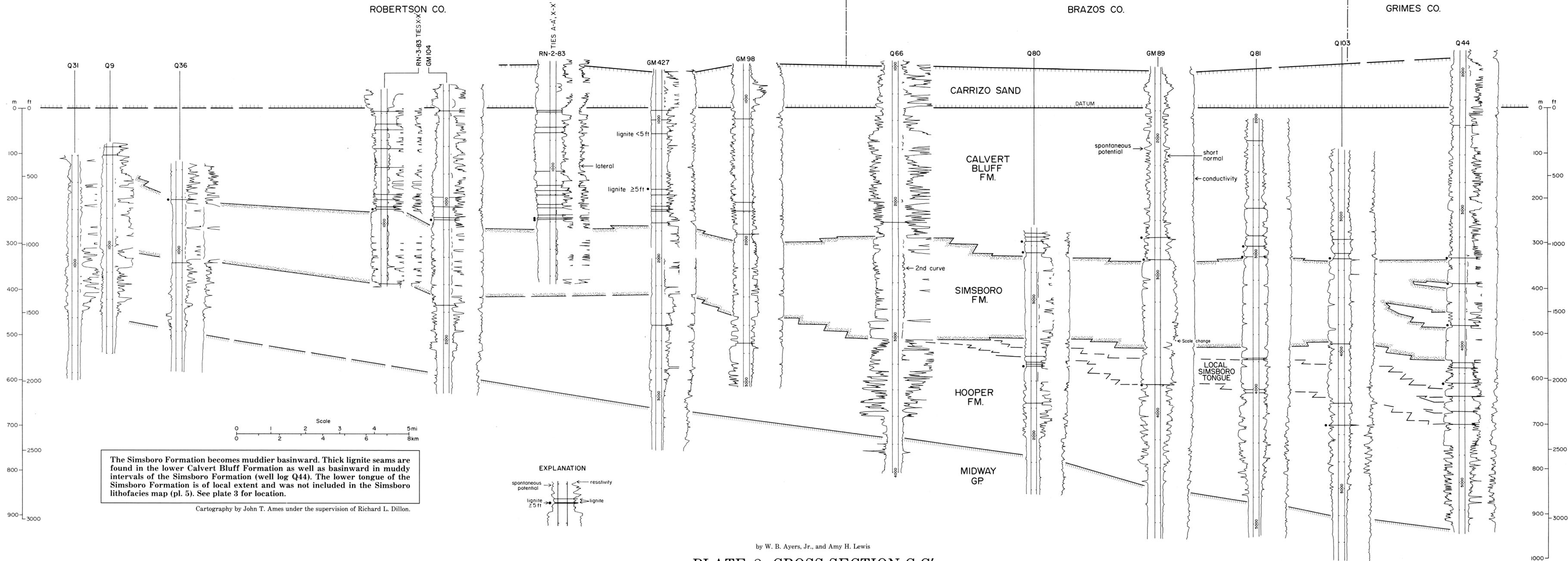
ATTACHMENT 3 –
REFERENCE MATERIALS

C

NORTHWEST

C'

SOUTHEAST

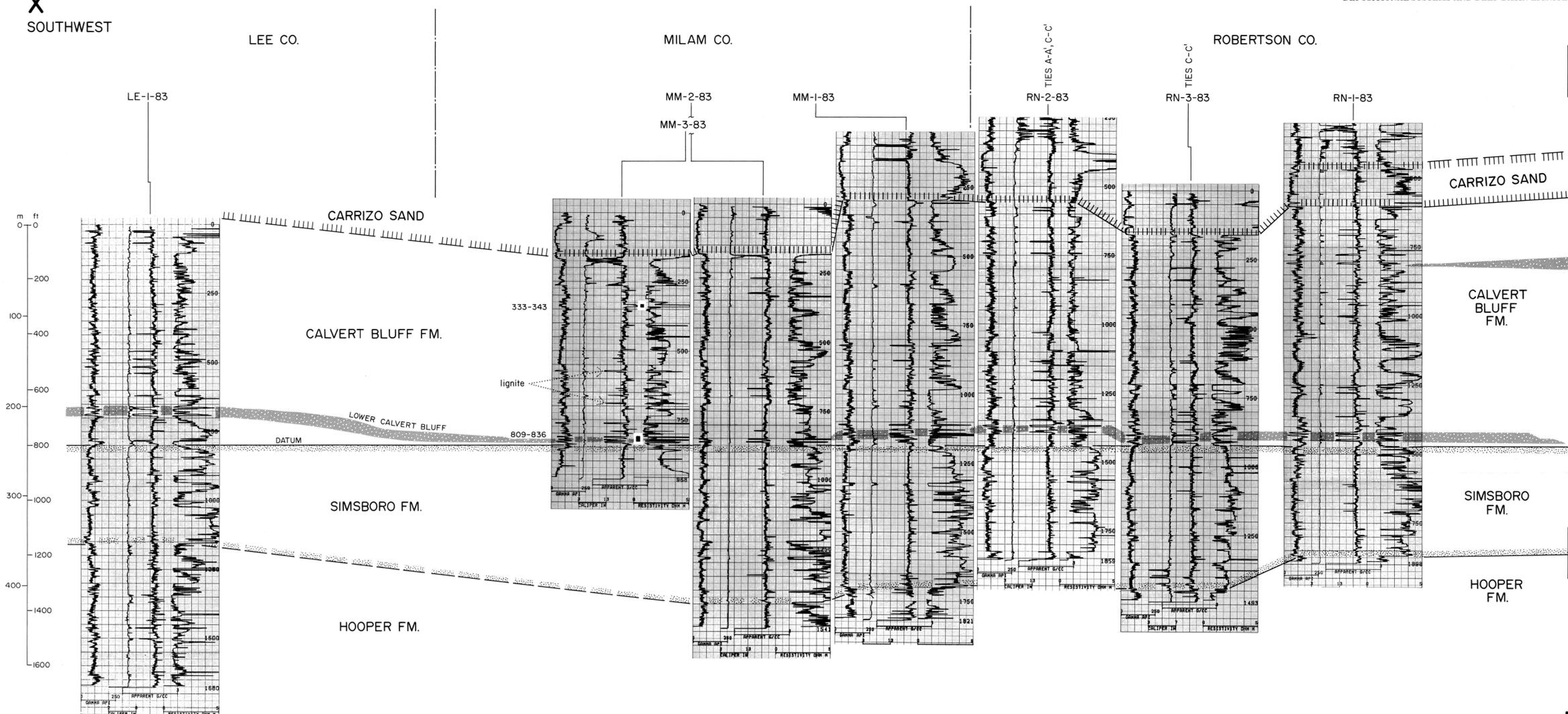


by W. B. Ayers, Jr., and Amy H. Lewis

PLATE 8. CROSS SECTION C-C'

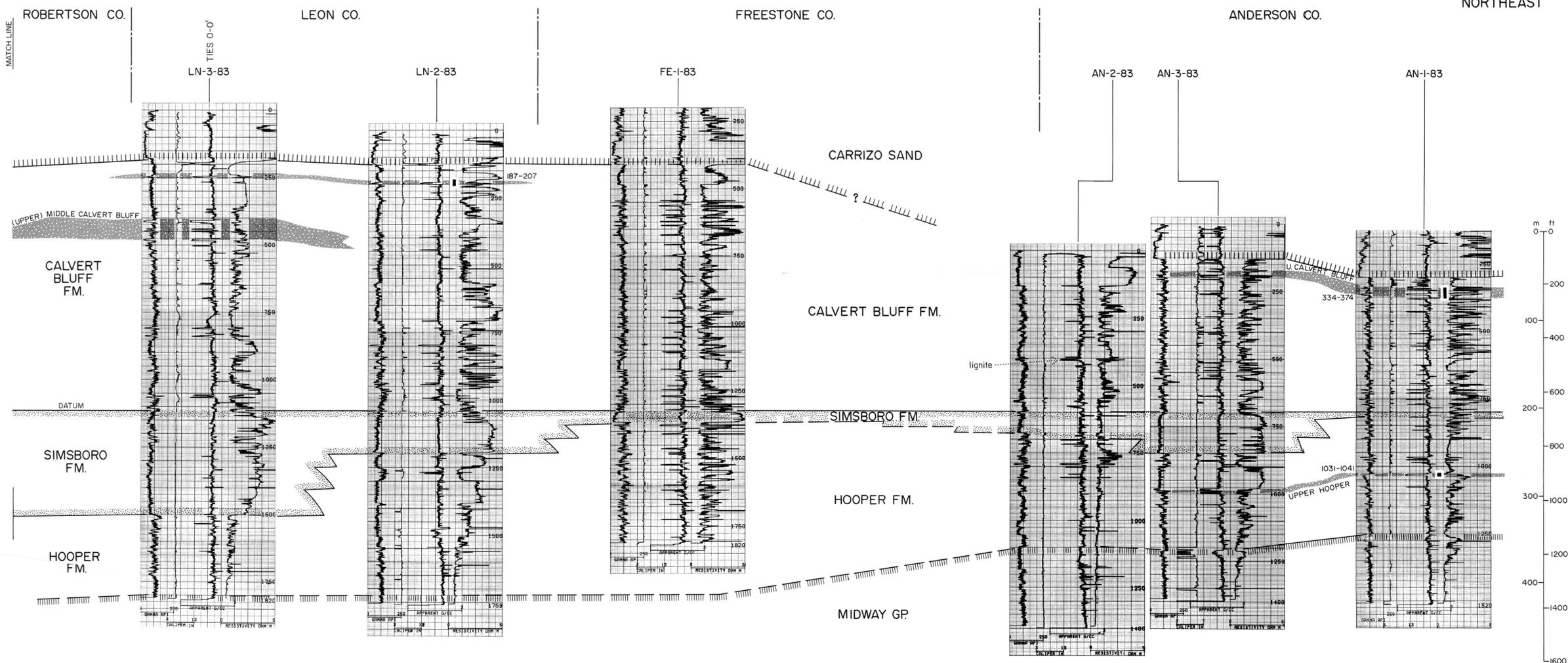
1985

X
SOUTHWEST



MATCH LINE

X'
NORTHEAST

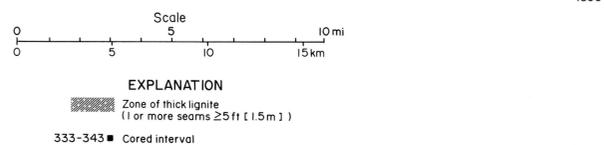


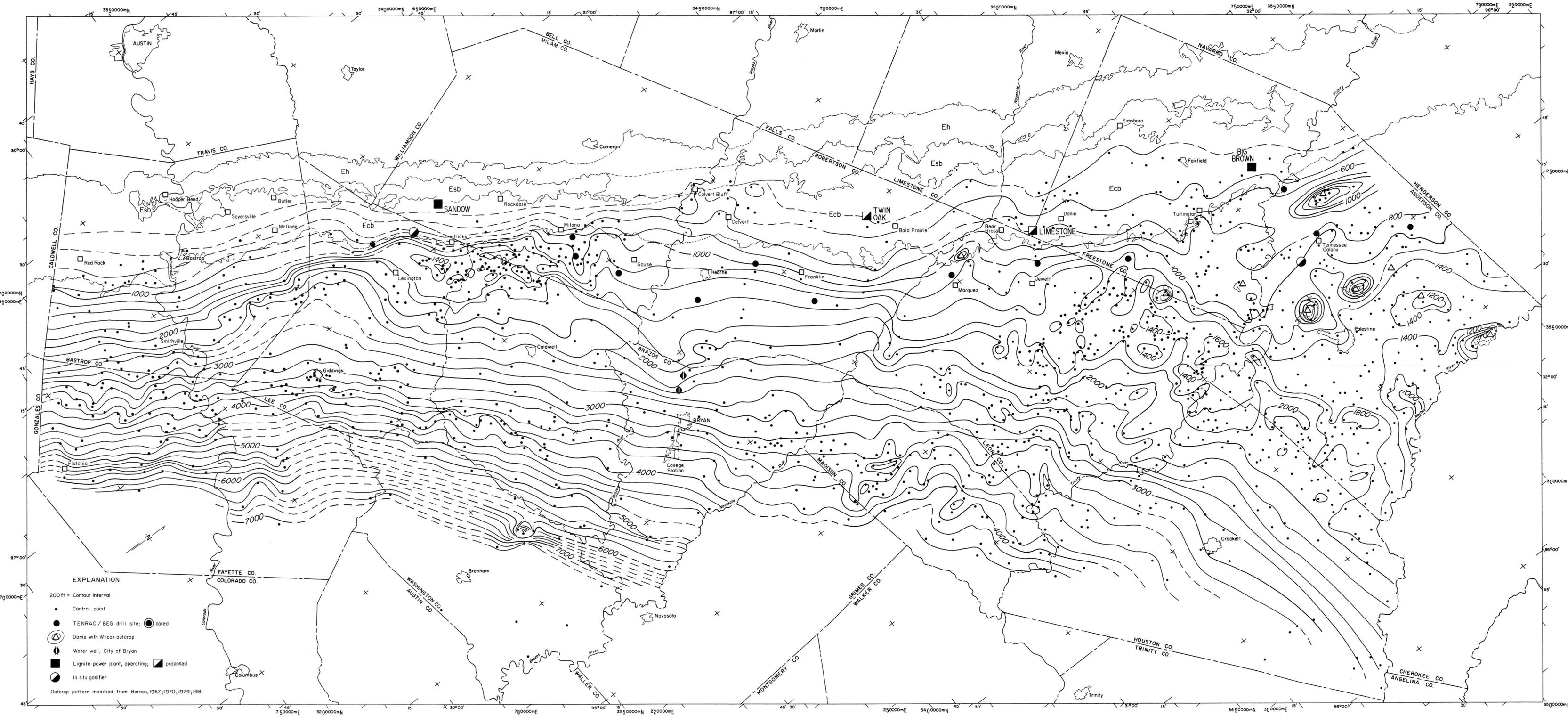
Geophysical logs from Texas Energy and Natural Resources Advisory Council/Bureau of Economic Geology wells show the stratigraphic occurrence of deep lignite (200 to 2,000 ft [61 to 610 m]) in east-central Texas. Thick lignite seams (seams 5 ft [1.5 m] or thicker) are found in the (a) upper Hooper Formation on the northeast, (b) lower Calvert Bluff Formation on the southwest, and (c) upper Calvert Bluff Formation on the northeast. Lateral continuity of individual lignite seams within the zones is neither implied nor true; wells were drilled in low-sand (floodbasin) areas between major-sand axes, which limit seam continuity. See plate 3 for location. Full-scale geophysical well logs are available from the Bureau of Economic Geology.

Cartography by John T. Ames under the supervision of Richard L. Dillon.

by W. B. Ayers, Jr., and Amy H. Lewis

PLATE 22. LIGNITE CROSS SECTION X-X'
1985





- EXPLANATION**
- 200 ft = Contour interval
 - Control point
 - TENRAC / BEG drill site; ● cored
 - ⊙ Dome with Wilcox outcrop
 - ⊕ Water well, City of Bryan
 - Lignite power plant, operating; ▨ proposed
 - ⊙ In situ gasifier
- Outcrop pattern modified from Barnes, 1967; 1970; 1979; 1981

- Ecb Calvert Bluff Formation
- Esb Simsboro Formation
- Eh Hooper Formation

Base map adapted from Army Map Service base maps, 10,000-meter Universal Transverse Mercator grid, zones 14 and 15. Cartography by John T. Ames under the supervision of Richard L. Dillon.

by W. B. Ayers, Jr., and Amy H. Lewis



PLATE 28. SIMSBORO OVERBURDEN MAP

1985

The depth to the top of the Simsboro (Simsboro overburden) provides an estimate of the depth required to test the entire lignite-bearing Calvert Bluff Formation.

04E1984-28

Water Quality:	Strata Depth (ft.)	Water Type
	2328-2750	Desirable

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Weisinger Water Well, Inc.**
2200 East Davis
Conroe, TX 77301

Driller Name: **James Edward Murphy** License Number: **3153**

Comments: **45.39 specific capacity @ 3503 gpm after 1 hour**
30" underreamed 2322-2770
12-20 Unimin Gravel

Amended 12/15/05 ref#2702
TWDB assigned SWN 5921108.

Report Amended on by Request #2702

Report Amended on 4/6/2017 by Request #21125

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:
BLANK PIPE & WELL SCREEN DATA

Top (ft.)	Bottom (ft.)	Description
0	8	dirt
8	60	clay
60	100	shale
100	150	clay
150	245	Sand
245	274	dark clay
274	305	clay,sandy clay
305	336	sandy clay
336	356	sand
356	428	dark clay
428	460	shale,sand
460	490	sand,shale,sand

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
24	N	Surface Casing	0-800
16	N	Surface Casing	800-2322
10	N	Blank Liner	2122-2328
10	N	Pipe Base Screen	2328-2520 .025
10	N	Blank Liner	2520-2530
10	N	Pipe BaseScreen	2530-2588 .025
10	N	Blank Liner	2588-2598
10	N	Pipe Base Screen	2598-2606 .025
10	N	Blank Liner	2606-2612
10	N	Pipe Base Screen	2612-2647 .025
10	N	Blank Liner	2647-2654
10	N	Pipe Base Screen	2654-2690 .025
10	N	Blank Liner	2690-2704

490	525	dark clay
525	560	clay,sandy shale
560	585	shale,sand
585	615	sand,clay sandy
615	650	sandy,shale
650	680	sandy shale,sand
680	710	sand,shale
710	740	sand
740	771	sand,shale streak
771	802	shale
802	833	sand
833	864	shale & sand streak
864	900	shale
900	1060	shale,sand streaks
1060	1090	shale
1090	1120	shale,sandy shale
1120	1155	shale,sand
1155	1200	sand
1200	1240	shale,sand streaks
1240	1300	sandy shale
1300	1492	sticky shale
1492	1556	shale & sand streaks
1556	1587	shale & lignite
1587	1619	shale
1619	1635	sand
1635	1650	shale & sand streaks
1650	1680	shale
1680	1713	shale & sand streaks
1713	1745	shale & sand
1745	1810	sand
1810	1840	sand & shale
1840	1871	shale & sandy shale
1871	1960	sand
1960	1980	shale
1980	2000	sand
2000	2030	hard shale
2030	2090	shale

10 N Pipe Base Screen 2704-2750 .025
10 N Blank Liner & BPV 2750-2770

2090	2155	shale,sand streaks
2155	2182	shale,hard shale
2182	2215	shale
2215	2250	shale & sand streaks
2250	2320	shale
2320	2400	sand
2400	2412	shale
2412	2435	course sand
2435	2440	sand
2440	2465	sand & shale
2465	2495	shale
2495	2515	sand
2515	2527	shale
2527	2558	shale,sand
2558	2619	sand
2619	2651	shale,sand
2651	2685	shale
2685	2746	sand
2746	2809	shale
2809	2880	sand
2880	2900	hard shale

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

**Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540**

STATE OF TEXAS WELL REPORT for Tracking #172420

Owner:	City of College Station Well No.7	Owner Well #:	7
Address:	P.O. Box 9960 College Station, TX 77843	Grid #:	59-21-4
Well Location:	OSR/NW of Sandy Point Rd College Station, TX	Latitude:	30° 42' 21" N
Well County:	Brazos	Longitude:	096° 29' 19" W
		Elevation:	No Data
Type of Work: New Well		Proposed Use: Public Supply	

Drilling Start Date: **11/26/2007** Drilling End Date: **3/26/2009** Plans Approved by TCEQ - **YES**

	Diameter (in.)	Top Depth (ft.)	Bottom Depth (ft.)
Borehole:	48	0	92
	26	0	800
	22	800	2389

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed; Under-reamed**

	Top Depth (ft.)	Bottom Depth (ft.)	Filter Material	Size
Filter Pack Intervals:	2389	2965	Gravel	12-20 #1

	Top Depth (ft.)	Bottom Depth (ft.)	Description (number of sacks & material)
Annular Seal Data:	0	2389	2388-Cement

Seal Method: **Positive Displacement**

Distance to Property Line (ft.): **No Data**

Sealed By: **Driller**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed**

Water Level: **199 ft.** below land surface on **2008-03-18** Measurement Method: **Unknown**

Packers: **No Data**

Type of Pump: **Turbine** Pump Depth (ft.): **470**

Well Tests: **Pump** Yield: **3008 GPM with 65 ft. drawdown after 36 hours**

Water Quality:	<i>Strata Depth (ft.)</i>	<i>Water Type</i>
	2395-2945	Desirable

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Weisinger Water Well, Inc.**

**2200 East Davis
Conroe, TX 77301**

Driller Name: **Clint Gaskins**

License Number: **54561**

Apprentice Name: **Bobby Terry**

Apprentice Number: **57233**

Comments: **PWS ID#0210002
UNIMIN #1 12-20
SCREEN GAUGE .025
26" UNDERREAMED
Assigned SWN 59-21-415 by TWDB on 6/9/2010.**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:
BLANK PIPE & WELL SCREEN DATA

<i>Top (ft.)</i>	<i>Bottom (ft.)</i>	<i>Description</i>
0	60	Clay
60	173	Clay,Some Gravel
173	204	Clay,Gravel
204	235	Clay
235	298	Clay,Sand
298	330	Gravel,Sand
330	361	Clay,Gravel
361	423	Clay
423	486	Clay,Sand
486	517	Clay
517	547	Clay,some Gravel
547	578	Sand,little gravel
578	609	Clay,little sand
609	641	Clay,sand
641	672	Clay

<i>Dia. (in.)</i>	<i>New/Used</i>	<i>Type</i>	<i>Setting From/To (ft.)</i>
20 N		Surface Casing	2-800
16 N		Surface Casing	800-2389
10 N		Blank Liner	2239-2395
10 N		SS Screen	2395-2468
10 N		Blank Liner	2468-2485
10 N		SS Screen	2485-2666
10 N		Blank Liner	2666-2685
10 N		SS Screen	2685-2724
10 N		Blank Liner	2724-2740
10 N		SS Screen	2740-2746
10 N		Blank Liner	2746-2761
10 N		SS Screen	2761-2767
10 N		Blank Liner	2767-2783
10 N		SS Screen	2783-2827
10 N		Blank Liner	2827-2844
10 N		SS Screen	2844-2850

672	733	Sand,Clay
733	764	Sand
764	796	Clay
796	827	Sand,Clay
827	980	Sand,Gravel
980	1011	Sand,Clay
1011	1042	Clay
1042	1074	Sand,little clay
1074	1105	sand
1105	1136	Sand,Shale
1136	1167	Shale
1167	1197	Shale,Sand
1197	1228	Clay,Sand
1228	1290	Clay
1290	1322	Clay,Gravel
1322	1385	Gravel,Clay
1385	1417	Clay,Gravel
1417	1510	Clay
1510	1541	Lignite,Clay
1541	1572	Clay,Gravel
1572	1603	Gravel
1603	1634	Gravel,little Sand
1634	1665	Gravel,Sand
1665	1674	Clay
1674	1759	Sand,some Gravel
1759	1791	Gravel,Sand
1791	1822	Clay
1822	1853	Gravel
1853	1914	Sand
1914	1945	Sand,Gravel
1945	1977	Clay,Sand
1977	2007	Clay,some Sand
2007	2037	Clay
2037	2069	Shale,Clay
2069	2101	Shale,little Clay
2101	2163	Gravel,Clay
2163	2194	Clay,Sand

10 N Blank Liner 2850-2868
10 N SS Screen 2868-2945
10 N Blank Liner & BPV 2945-2965
Cement Plug 2970-3000

2194	2225	Clay,Sand
2225	2256	Lignite,Clay
2256	2287	Clay,little Gravel
2287	2319	Clay
2319	2382	Clay,Sand
2382	2413	Sand
2413	2475	Sand,little Clay
2475	2506	Clay,Sand
2506	2537	Sand,some Clay
2537	2569	Sand
2569	2630	Sand,Gravel
2630	2660	Gravel,little Sand
2660	2691	Clay,Gravel
2691	2723	Clay,Gravel,Shale
2723	2754	Gravel,Clay
2754	2785	Clay,Shale
2785	2817	Clay,Sand
2817	2848	Sand,Clay
2848	2879	Sand,little Clay
2879	2910	Sand
2910	2941	Sand,Gravel
2941	3000	Clay,Shale

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Please include the report's Tracking Number on your written request.

**Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540**

STATE OF TEXAS WELL REPORT for Tracking #195663

Owner: City of College Station	Owner Well #: Sparta No. 1
Address: 1101 Texas Avenue College Station, TX 77842	Grid #: 59-21-5
Well Location: From OSR & FM 1687 - 2.5 mi on FM 1687 to water plant College Station, TX 77842	Latitude: 30° 41' 56" N
	Longitude: 096° 27' 06" W
Well County: Brazos	Elevation: No Data
<hr/>	
Type of Work: New Well	Proposed Use: Public Supply

Drilling Start Date: **2/15/2006**

Drilling End Date: **5/26/2006**

Plans Approved by TCEQ - **YES**

	Diameter (in.)	Top Depth (ft.)	Bottom Depth (ft.)
Borehole:	36	0	40
	24	40	441
	18	441	540

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed; 24" Underream**

	Top Depth (ft.)	Bottom Depth (ft.)	Filter Material	Size
Filter Pack Intervals:	361	540	Gravel	

	Top Depth (ft.)	Bottom Depth (ft.)	Description (number of sacks & material)
Annular Seal Data:	0	441	546

Seal Method: **Positive Displacement**

Distance to Property Line (ft.): **No Data**

Sealed By: **Advanced Oilwell Service**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed**

Water Level: **132.4 ft. below land surface on 2006-06-08** Measurement Method: **Unknown**

Packers: **n/a**

Type of Pump: **Turbine** Pump Depth (ft.): **350**

Well Tests: **Pump** Yield: **1218 GPM with 81.6 ft. drawdown after 36 hours**

Water Quality:	<i>Strata Depth (ft.)</i>	<i>Water Type</i>
	No Data	No Data

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **J & S Water Wells**
P.O. Box 675
Bellville, TX 77418

Driller Name: **Monte D. Richardson** License Number: **54385**

Comments: **Type pump: Goulds Model # 11CMC-7 / 125 HP USEM**
\$mew
TWDB SW #59-21-510
7/8/2010 Doc Jones

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:
BLANK PIPE & WELL SCREEN DATA

<i>Top (ft.)</i>	<i>Bottom (ft.)</i>	<i>Description</i>
0	40	30-inch Conductor
40	44	Red Clay
44	65	Gray Sand & Rocks
65	92	Gray Clay & Sand Streaks
92	127	Gray Clay
127	185	Gray Shale
185	233	Rocks & Shale
233	243	Gray Sand & Shale Streaks
243	285	Gray Shale & Clay
285	333	Gray Semi-Coarse Sand
333	360	Gray Clay
360	365	Sand
365	420	Gray Clay
420	500	Light Gray Coarse Sand
500	520	Hard Rocks & Coarse Sand
520	577	Hard Gray Clay

<i>Dia. (in.)</i>	<i>New/Used</i>	<i>Type</i>	<i>Setting From/To (ft.)</i>
Installed Material Record & Figure attached to original form.			

577	600	Gray Sand & Rocks
600	630	Gray Sand
630	640	Rocks & Sand
640	688	Clay & Sand Streaks
688	780	Gray Sand Mixed with Some Rocks
780	790	Gray Clay
790	864	Gray Sand & Rocks

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Please include the report's Tracking Number on your written request.

**Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540**

STATE OF TEXAS WELL REPORT for Tracking #212279

Owner:	CITY OF COLLEGE STATION WELL # 8	Owner Well #:	3
Address:	300 KRENEK RD, 2ND FLOOR COLLEGE STATION, TX 77840	Grid #:	59-20-3
Well Location:	4036 WEST OSR BRYAN, TX 77807	Latitude:	30° 42' 32" N
Well County:	Brazos	Longitude:	096° 30' 24" W
		Elevation:	No Data
Type of Work: New Well		Proposed Use: Public Supply	

Drilling Start Date: **10/19/2009**

Drilling End Date: **3/6/2010**

Plans Approved by TCEQ - **YES**

	Diameter (in.)	Top Depth (ft.)	Bottom Depth (ft.)
Borehole:	42	0	86
	30	86	1200
	22	1200	2146

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed; Under-reamed**

	Top Depth (ft.)	Bottom Depth (ft.)	Filter Material	Size
Filter Pack Intervals:	1986	2749	Gravel	12/20

	Top Depth (ft.)	Bottom Depth (ft.)	Description (number of sacks & material)
Annular Seal Data:	0	86	92
	0	2146	2083

Seal Method: **Positive Displacement**

Distance to Property Line (ft.): **50**

Sealed By: **SCHLUMBERGER**

Distance to Septic Field or other concentrated contamination (ft.): **150**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **ENGINEERING FIRM**

Surface Completion: **Surface Slab Installed**

Water Level: **103.33 ft. below land surface on 2010-03-06** Measurement Method: **Unknown**

Packers: **N/A**

Type of Pump: **Turbine** Pump Depth (ft.): **585**

Well Tests: **Pump** Yield: **3002 GPM with 70 ft. drawdown after 36 hours**

Plug Information:	Description (number of sacks & material)	Top Depth (ft.)	Bottom Depth (ft.)
	2790 TO 2750 40 SACKS		

Water Quality:	Strata Depth (ft.)	Water Type
	SEE ABOVE	FRESH

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **ALSAY INCORPORATED**
6615 GANT
HOUSTON, TX 77066

Driller Name: **BRITT ROLLIE** License Number: **4992**

Apprentice Name: **DAVID SIGMAN** Apprentice Number: **58292**

Comments: **Hammons, Travis P.**
58346
TWDB swm 5920317 added 3/19/2013

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:
BLANK PIPE & WELL SCREEN DATA

From (ft)	To (ft)	Description
0	6	Sub-structure
6	27	Dark Brown Clay
27	68	Gravel
68	132	Gray Sandy Clay
132	204	Dark Gray Coarse Sand w/ Lignite
204	244	Dark Gray Clay
244	256	Sand (Dark Gray)
256	266	Clay (Dark Gray)
266	332	Sand (w/ Clay Streaks)
332	362	Clay (Dark Gray)
362	400	Sand (Dark Gray)
400	424	Clay (Dark Gray)
424	610	Sand (Gray)
610	634	Clay (Dark Gray)

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
36	N	STEEL 0-86	.312
24	N	STEEL (ABOVE NAT. GRND LVL)	12-1200 .500
16	N	STEEL W/SWEDGE	1200-2146 .500
10-3/4	N	STEEL W/SS SCREEN	1976-2160 .500
10-3/4	N	STEEL W/SS SCREEN	2160-2284 .500
10-3/4	N	STEEL W/SS SCREEN	2284-2292 .500
10-3/4	N	STEEL W/SS SCREEN	2292-2466 .500
10-3/4	N	STEEL W/SS SCREEN	2466-2472 .500
10-3/4	N	STEEL W/SS SCREEN	2472-2484 .500
10-3/4	N	STEEL W/SS SCREEN	2484-2489 .500
10-3/4	N	STEEL W/SS SCREEN	2489-2550 .500
10-3/4	N	STEEL W/SS SCREEN	2550-2556 .500
10-3/4	N	STEEL W/SS SCREEN	2556-2577 .500
10-3/4	N	STEEL W/SS SCREEN	2577-2582 .500
10-3/4	N	STEEL W/SS SCREEN	2582-2592 .500

634 û 700 Sand (Gray)
700 û 870 Clay (Gray)
870 û 930 Gray Sandy Clay
930 û 1122 Sand (Few Clay Streaks)
1122 û 1228 Clay (Gray)
1228 û 1268 Sandy Clay (Gray)
1268 û 1282 Clay (Gray)
1282 û 1370 Sandy Gray Clay
1370 û 1702 Clay (Gray)
1702 û 1774 Sandy Gray Clay
1774 û 1804 Clay (Gray)
1804 û 1814 Sand (Gray)
1814 û 1842 Sandy Clay (Gray)
1842 û 1926 Sand (Gray)
1926 û 1960 Sandy Gray Clay
1960 û 1996 Sand (Gray)
1996 û 2010 Clay (Gray)
2010 û 2036 Sand (Gray)
2036 û 2050 Clay (Gray)
2050 û 2054 Sand
2054 û 2066 Clay (Gray)
2066 û 2132 Sand (Gray)
2132 û 2160 Sandy Clay (Gray)
2160 û 2284 Sand
2284 û 2292 Clay (Whitish Gray)
2292 û 2594 Sand (Some Lignite Streaks)
2594 û 2630 Clay (Gray)
2630 û 2816 Sand
2816 û 2860 Sandy Clay (Gray)
2860 û 2874 Sand
2874 û 2904 Clay (Gray)
2904 û 3007 Sandy Gray Clay

10-3/4 N STEEL W/SS SCREEN 2592-2631 .500
10-3/4 N STEEL W/SS SCREEN 2631-2724 .500
10-3/4 N STEEL W/SS SCREEN 2724-2749 .500

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(512) 334-5540**

STATE OF TEXAS WELL REPORT for Tracking #332785

Owner: City of College Station	Owner Well #: No Data
Address: 1101 Texas Avenue College Station, TX 77842	Grid #: 59-21-4
Well Location: 6 mi. N Hwy21 on OSR College Station, TX 77842	Latitude: 30° 41' 54" N
Well County: Brazos	Longitude: 096° 29' 19" W
	Elevation: No Data
Type of Work: New Well	
Proposed Use: Public Supply	

Drilling Start Date: **1/25/2006** Drilling End Date: **2/9/2006** Plans Approved by TCEQ - **YES**

	Diameter (in.)	Top Depth (ft.)	Bottom Depth (ft.)
Borehole:	24	0	40
	22	40	1110
	18	1110	1360

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed; Under-reamed**

	Top Depth (ft.)	Bottom Depth (ft.)	Filter Material	Size
Filter Pack Intervals:	1020	1360	Gravel	

	Top Depth (ft.)	Bottom Depth (ft.)	Description (number of sacks & material)
Annular Seal Data:	0	1110	1006

Seal Method: **Positive Displacement**

Distance to Property Line (ft.): **No Data**

Sealed By: **Advanced Oilwell Services**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed**

Water Level: **83.7 ft. below land surface on 2006-05-15** Measurement Method: **Unknown**

Packers: **No Data**

Type of Pump: **Turbine** Pump Depth (ft.): **460**

Well Tests: **Pump** Yield: **863 GPM with 210 ft. drawdown after 36 hours**

Water Quality:

<i>Strata Depth (ft.)</i>	<i>Water Type</i>
No Data	No Data

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information:

Driller Name: **Monte Richardson** License Number: **54385**

Comments: **Carrizo Well #1**
24 conductor 36' Hole
24' Underream

^CLH

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:
BLANK PIPE & WELL SCREEN DATA

<i>Top (ft.)</i>	<i>Bottom (ft.)</i>	<i>Description</i>
0	40	24 inch conductor
40	126	gray clay
126	140	gray sand
140	170	clay
170	185	gray sand
185	240	rocks & clay
240	350	rocks & gray sand
350	380	hard gray shale
380	400	gray sand & rocks
400	413	gray clay
413	423	hard gray sand with coal streaks
423	454	gray clay & coal
454	510	gray clay & rocks
510	540	sand & coal

<i>Dia. (in.)</i>	<i>New/Used</i>	<i>Type</i>	<i>Setting From/To (ft.)</i>
See Attached Installed Material record			

540	570	sand & rocks with coal streaks
570	618	gray clay & coal
618	628	gray sand
628	640	gray clay
640	685	gray sand
685	705	gray clay
705	826	gray sand
826	1030	hard gray clay
1030	1115	gray clay & rocks
1115	1260	white sand & rocks
1260	1290	white sand with clay streaks
1290	1330	gray clay
1330	1340	white sand & rocks
1340	1390	gray clay
1390	1400	white sand
1400	1415	coal
1415	1446	hard gray clay

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Plug Information:

Description (number of sacks & material)	Top Depth (ft.)	Bottom Depth (ft.)
Cement	2634	2800

Water Quality:

Strata Depth (ft.)	Water Type
2088 - 2610	Fresh

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Weisinger, Inc**
2200 E DAVIS ST
Conroe, TX 77301

Driller Name: **Larry Jernigin** License Number: **50285**

Apprentice Name: **Seth Flynt** Apprentice Number: **59915**

Comments: **Datum Point (FT): 12ft above ground level for lithology, Casing, Screen, Liner and well completion depths.**

Lithology:
 DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:
 BLANK PIPE & WELL SCREEN DATA

Top (ft.)	Bottom (ft.)	Description
0	160	sand
160	220	sand with clay seams
220	305	sand
305	310	sandy clay
310	550	sand
550	580	sandy clay
580	635	sand
635	740	sandy clay
740	770	clay with sand seams
770	785	clay
785	795	clay/sand
795	1000	sand with clay seams
1000	1020	clay
1020	1070	sand
1070	1085	sandy clay

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
24	Surface Casing	New Steel	.500	2	1200
20	Surface Casing	New Steel	.500	1200	2078
14	Blank	New Steel	.500	1928	2088
14	Screen	New Pipe Base Stainless Steel	.500 0.025	2088	2358
14	Blank	New Steel	.500	2358	2368
14	Screen	New Pipe Base Stainless Steel	.500 0.025	2368	2430
14	Blank	New Steel	.500	2430	2444
14	Screen	New Pipe Base Stainless Steel	.500 0.025	2444	2610
14	Blank	New Steel	.500 0.5	2610	2630

1085	1290	sand/lignite
1290	1300	clay/lignite
1300	1335	sand lignite
1335	1350	clay/lignite
1350	1775	sand/lignite
1775	1800	sand
1800	1880	sandy clay/ lignite
1880	1970	sandy clay/lignite
1970	1985	clay
1985	2090	sand/clayseams/lignite
2090	2680	sand/lignite seams
2680	2800	sand seams/shale/lignite

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STATE OF TEXAS WELL REPORT for Tracking #219794

Owner: Nigliuzzio, John	Owner Well #: No Data
Address: PO Box 332 Hearne, TX 77859	Grid #: 59-12-2
Well Location: 3.28 mi. SE of Hearne Hearne, TX 77859	Latitude: 30° 51' 13" N
Well County: Robertson	Longitude: 096° 33' 21" W
	Elevation: No Data

Type of Work: New Well	Proposed Use: Domestic
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Drilling Start Date: **9/8/2009** Drilling End Date: **10/27/2009**

	Diameter (in.)	Top Depth (ft.)	Bottom Depth (ft.)
Borehole:	7.5	0	840
	3.875	840	1040

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Telescope**

	Top Depth (ft.)	Bottom Depth (ft.)	Description (number of sacks & material)
Annular Seal Data:	0	840	63

Seal Method: **Pressure**

Sealed By: **Siegert Water Wells Inc.**

Distance to Property Line (ft.): **Landowner**

Distance to Septic Field or other concentrated contamination (ft.): **150**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed**

Water Level: **45 ft. below land surface on 2009-10-27** Measurement Method: **Unknown**

Packers: **1 K Packer**

Type of Pump: **Submersible** Pump Depth (ft.): **140**

Well Tests: **Jetted** Yield: **32 GPM with 120 ft. drawdown after 2 hours**

Water Quality:

Strata Depth (ft.)	Water Type
443-556	Good

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Siegert Water Well Inc.**

**4411 Burt Rd.
Bryan, TX 77807**

Driller Name: **Jason Siegert**

License Number: **4252**

Comments: **^EO**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:
BLANK PIPE & WELL SCREEN DATA

Top (ft.)	Bottom (ft.)	Description
0	7	sand
7	12	sandy clay
12	32	sandy clay and gravel
32	90	shale
90	100	sandy clay
100	180	shale
180	460	very sandy shale
460	489	sand
489	585	sandy shale
585	736	streaky sand
736	885	sandy shale
885	889	very hard rock
889	917	sandy shale
917	919	very hard rock
919	930	streaky sand
930	980	sand
980	1032	streaky sand
1032	1037	very sandy shale

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
4"	N	PVC Blank	0'-840' B
2.5"	N	Galv Blank	830'-914' .012
2.5"	N	Galv Screen	914'-1040' B

1037	1040	hard shale
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STATE OF TEXAS WELL REPORT for Tracking #378269

Owner: BOSWELL, ANSELL	Owner Well #: No Data
Address: RT1 BOX 719 Hearne, TX 77859	Grid #: 59-12-2
Well Location: Old Hearne Road Hearne, TX 77859	Latitude: 30° 50' 33" N
Well County: Robertson	Longitude: 096° 33' 38" W
	Elevation: 306 ft. above sea level
Type of Work: Replacement Proposed Use: Domestic	

Drilling Start Date: **8/28/2014** Drilling End Date: **9/3/2014**

	Diameter (in.)	Top Depth (ft.)	Bottom Depth (ft.)
Borehole:	12.25	0	12
	6.75	12	650
	3.875	650	700

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **telescope**

	Top Depth (ft.)	Bottom Depth (ft.)	Description (number of sacks & material)
Annular Seal Data:	0	12	10 Sakrete
	0	10	8 Sakrete
	435	640	23 Portland

Seal Method: **Grout and Pressure**

Distance to Property Line (ft.): **50 +**

Sealed By: **Driller**

Distance to Septic Field or other concentrated contamination (ft.): **100 +**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **Measured**

Surface Completion: **Surface Sleeve Installed**

Water Level: **55 ft. below land surface on 2014-09-02** Measurement Method: **Unknown**

Packers: **k-packer 604'**

Type of Pump: **Submersible** Pump Depth (ft.): **200**

Well Tests: **Jetted** Yield: **60+ GPM with 55 ft. drawdown after 4 hours**

Water Quality:	<i>Strata Depth (ft.)</i>	<i>Water Type</i>
	637 - 700	Potable

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Brien Water Wells**
5214 South Highway 6
Hearne, TX 77859

Driller Name: **Pete Brien** License Number: **1750**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Casing:
BLANK PIPE & WELL SCREEN DATA

<i>Top (ft.)</i>	<i>Bottom (ft.)</i>	<i>Description</i>
0	5	Sand
5	80	Sand and Sandy Clay
80	260	Sandy Shale and Sand
260	380	Sandy Shale and Shale
380	610	Sand
610	637	Sandy Shale
637	700	Sand

<i>Dia. (in.)</i>	<i>New/Used</i>	<i>Type</i>	<i>Setting From/To (ft.)</i>
8"	New	PVC Casing	0 - 12
4"	New	PVC Casing	+1 - 640
2"	New	Galvanized Liner	604 - 667
2.5"	New	PVC Screen	667 - 697 .016
2"	New	PVC pipe	697 - 700

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ATTACHMENT 4 –
SELECTED REFERENCES

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Ayers, W. B. Jr, Lewis, Amy H., *The Wilcox Group and Carrizo Sand (Paleogene) in East Central Texas : Depositional Systems and Deep-Basin Lignite*, Bureau of Economic Geology, 1985.

Dutton, Alan R., Harden, Bob, Nicot, Jean-Philippe, O'Rourke, David O., Tinker, Scott W., Jackson, John, Jackson, Katherine G., *Groundwater Availability Model for the Central Part of the Carrizo-Wilcox Aquifer in Texas*, Prepared for the Texas Water Development Board, February 2003.

Intera, Inc., 2015, Update on Monitoring Program, Presented at the Post Oak Savannah Groundwater Conservation District Offices, PowerPoint Presentation, November 10, 2015.

Intera, Inc. *Groundwater Availability Models for the Queen City and Sparta Aquifers*. GAM, Austin. Texas, Water Development Board, 2004.

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

Theis, C.V., 1935, *The Relation Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Groundwater Storage: Transactions of the American Geophysical Union*, v. 16, p. 519-524.

Thornhill Group, Inc., 2018, Calvert Mine, Permit No. 27H – 2017 Annual Simsboro Depressurization/Drawdown Report, Prepared for Walnut Creek Mining Company for Submittal to the Surface Mining Division of the Texas Railroad Commission, October 19, 2018.

Thornhill Group, Inc. 2006, A Report of Hydrogeologic Evaluation of Projected Effects of Proposed Pumping of 8,300 Acre-Feet Per Year from Four Wells Completed in the Simsboro Aquifer – Dr. Cliff Skiles Farms, Robertson County, Texas, Prepared for Submittal to the Brazos Valley Groundwater Conservation District, December 27, 2006.

Young, Steven, PhD, PE, Jigmond, Marius, Jones, Toya, and Ewing, Tom, PhD, PE, Final Report: Groundwater Availability Model for the Central Portion of the Sparta, Queen City, and Carrizo-Wilcox Aquifers, Texas Water Development Board Report ###, September 2018.