THORNHILL GROUP, INC.

Professional Hydrogeologists • Water Resources Specialists

July 25, 2023

Mr. Charles Fazzino
Fazzino Investments, LP
1001 Anderson Street
Hearne, Texas 77859

Re: Aquifer Evaluation Report –
Drilling/Production Permit Applications for Six (6) New Simsboro Wells to be Completed on Fazzino Investments, LP Properties, Robertson County, Texas

Dear Mr. Fazzino:

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 Fazzino Investments, LP herein referenced as Fazzino Family or Fazzino, completing six (6) new wells into the Simsboro Aquifer underlying three (3) separate properties in Robertson County, Texas to produce an annual allocation of groundwater of 10,348 acre-feet per year. Figure 1 illustrates the locations of the individual Fazzino properties. The Fazzino properties are located west of U.S. Highway 190/State Highway 6 (US 190/SH 6). The northernmost property (i.e., Property 1) is about 3.5 miles west-southwest of the City of Calvert, between 1.8 and 2.4 miles west of Farm Road 1644 (FM 1644) along Wildcat Bridge Road which is along the northern boundary of the property. Walnut Creek is along the western boundary of Property 1. Property 2 is approximately 4.1 miles west of the downtown portion of the City of Hearne and is 1.24 miles north of United States Highway 190 (US 190)/United States Highway 79 (US 79). The eastern boundary of Property 2 is along FM 1644 and the western boundary is the Brazos River. Fazzino Property 3 is approximately 4.1 miles due south of downtown Hearne. The property is situated along FM 50 about 2.6 miles south-southeast of US 190/US 79 and approximately 2.5 miles west of US 190/State Highway 6 (SH 6). The total acreage for the properties is approximately 1,318 acres based on geographic information system (GIS) mapping. Requested production is equivalent to that allowed by the BVGCD Rules for well spacing and allocation on a property-by-property basis.

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 Fazzino properties. Proposed well identifications, coordinates in decimal degrees, 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	30.945554	-96.727687	281 feet AMSL
No. 2	30.941356	-96.725083	287 feet AMSL
No. 3	30.851775	-96.662976	272 feet AMSL
No. 4	30.848652	-96.669293	273 feet AMSL
No. 5	30.816412	-96.591883	261 feet AMSL
No. 6	30.816641	-96.585293	255 feet AMSL

*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:

Property Identification And Acreage	Well Identification	Maximum Pumping Rate	Annual Allocation
1 (363 acres)	No. 1	1,000 gpm	1,290 acre-feet
	No. 2	1,000 gpm	1,290 acre-feet
2 (761 acres*)	No. 3	2,100 gpm	2,710 acre-feet
	No. 4	2,100 gpm	2,710 acre-feet
3 (195 acres)	No. 5	920 gpm	1,187 acre-feet
	No. 6	900 gpm	1,161 acre-feet
		Total Annual Allocation	**10,348 acre-feet**

The asterisk (*) indicates that the GIS value (shown) varies from the CAD acreage of 695.301 acres.

The radii attributed to the pumping rates for each of the wells lie within each of the Fazzino property boundaries. The nearest known existing wells completed into the Simsboro Aquifer are approximately 3,900, 6,900, and 12,000 feet from the nearest proposed Simsboro well on Property 1, Property 2, and Property 3, respectively. The proposed overlap of well radii for Well No. 3 and Well No. 4 (Property 2) complies with the requirements of the District and is similar to overlaps in previous permit applications. As will be discussed later in this report, the overlap is reasonable based on local hydrogeological conditions, will result in minimal effects on interference drawdown between the proposed Fazzino wells, and will not significantly change impacts on surrounding wells. 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 the locations of each of the Fazzino properties and wells with respect to the Major Aquifers as delineated by the TWDB. Figure 3 shows the extents of the Minor Aquifers delineated by TWDB in relation to the Fazzino properties and wells. Figure 4 provides a Surface Geology Map. The following provides aquifer and geologic summaries for each of the Fazzino properties:

- Northern Property (Property 1) – lies atop the Brazos River Alluvium Aquifer which is the only Minor Aquifer at the site. The Calvert Bluff Formation subcrops beneath the alluvial and terrace deposits; therefore, the Carrizo-Wilcox is the only Major Aquifer present. Part of the Calvert Bluff Formation lies immediately beneath the base of the alluvium. The entire local thickness of the Simsboro and the Hooper occur beneath the property.

The BEG maps faults at the base of the Wilcox near Property 1 (see Attachment 3). The TWDB/BEG map inferred faults between 5 and 7 miles north of Property 1 that could, if present, trend closer to the property. Land surface elevation generally ranges from 280 to 290 feet above mean sea level (MSL) across the northern tract. Geologic dip is generally to the south-southeast and it gets steeper with depth in the stratigraphic section and in a downdip direction. The local dip on the base of the Wilcox may be as steep as 165 to 200 feet per mile beneath and near Property 1 (see Attachment 3). Elevations, depths, and thicknesses of key formations are provided in the table below:

Layer	Elevation	Depth	Thickness
Land Surface	280 to 290 feet AMSL	Not Applicable	Not Applicable
Base of Alluvium	235 to 245 feet AMSL	45 to 55 feet BGL	45 to 55 feet
Base of Calvert Bluff	80 to 100 feet BMSL	360 to 390 feet BGL	305 to 335 feet
Base of Simsboro	540 to 550 feet BMSL	820 to 840 feet BGL	430 to 480 feet
Base of Hooper	1,050 to 1,100 feet BMSL	1,330 to 1,390 feet BGL	490 to 570 feet

- Middle Property (Property 2) – the middle Fazzino property sits atop downdip portions of all of the units within the Carrizo-Wilcox Aquifer, the only Major Aquifer present within the property boundaries. Also, the property lies atop the Brazos River Alluvium Aquifer and there are no other Minor Aquifers present beneath the property. The Reklaw subcrops beneath the alluvial and terrace deposits and the full local thickness of the Carrizo, Calvert Bluff, Simsboro, and Hooper formations occur in the subsurface beneath the middle property.

  No faults are mapped near the Fazzino's Property 2. The local dip of the base of the Wilcox Group is approximately 95 feet per mile (see Attachment 3). Land surface elevations generally range from 270 to 275 feet above MSL. Estimates of elevations, depths, and thicknesses of the pertinent formations are provided below:

Layer	Elevation	Depth	Thickness
Land Surface	270 to 280 feet AMSL	Not Applicable	Not Applicable
Base of Alluvium	200 to 210 feet AMSL	60 to 80 feet BGL	60 to 80 feet
Base of Reklaw	135 to 145 feet AMSL	125 to 145 feet BGL	0 to 85 feet
Base of Carrizo	90 to 100 feet AMSL	170 to 190 feet BGL	35 to 65 feet
Base of Calvert Bluff	700 to 715 feet BMSL	970 to 995 feet BGL	780 to 825 feet
Base of Simsboro	1,160 to 1,200 feet BMSL	1,430 to 1,480 feet BGL	435 to 510 feet
Base of Hooper	1,735 to 1,775 feet BMSL	2,005 to 2,055 feet BGL	525 to 625 feet

- Southern Property (Property 3) – the Fazzino Property 3 lies atop downdip portions of the Carrizo-Wilcox Aquifer and is completely within the boundaries of the Brazos River Alluvium Aquifer. The Queen City subcrops locally beneath the alluvium and Property 3 is underlain by the complete local thickness of Reklaw, Carrizo, and Wilcox Group units.

Land surface elevation generally ranges from 255 to 265 feet AMSL across Property 3. There are no faults mapped locally on surface geology maps. The local dip of the base of the Wilcox ranges from 160 to 170 feet per mile. The table below provides estimates for elevations, depths, and thicknesses of formations beneath the two properties located atop the alluvial deposits:

Layer	Elevation	Depth	Thickness
Land Surface	255 to 265 feet AMSL	Not Applicable	Not Applicable
Base of Alluvium	195 to 205 feet AMSL	50 to 70 feet BGL	50 to 70 feet
Base of Queen City	100 to 110 feet AMSL	145 to 165 feet BGL	75 to 115 feet
Base of Reklaw	20 to 40 feet BMSL	275 to 305 feet BGL	110 to 160 feet
Base of Carrizo	185 to 210 feet BMSL	440 to 475 feet BGL	135 to 200 feet
Base of Calvert Bluff	1,100 to 1,140 feet BMSL	1,355 to 1,405 feet BGL	880 to 965 feet
Base of Simsboro	1,650 to 1,700 feet BMSL	1,905 to 1,965 feet BGL	500 to 610 feet
Base of Hooper	2,330 to 2,360 feet BMSL	2,585 to 2,625 feet BGL	620 to 720 feet

Aquifer Conditions and Hydraulic Parameters

This report focuses on proposed permitted production from the Simsboro Aquifer. The top of the Simsboro Formation and well depths are estimated to be in the following depth ranges:

Property Identification	Depth – Top of Simsboro	Depth – Simsboro Wells
Property 1	360 to 390 feet BGL	820 to 840 feet BGL
Property 2	970 to 995 feet BGL	1,430 to 1,480 feet BGL
Property 3	1,355 to 1,405 feet BGL	1,905 to 1,965 feet BGL

Figure 5 illustrates locations for registered and permitted Simsboro wells within five (5) miles of the proposed Fazzino 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 Fazzino wells locations. Figure 6a, Figure 6b, Figure 6c, and Figure 6d 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.

Net sand thicknesses for the Simsboro, as mapped by the BEG, range as follows:

- Property 1 – 350 to 450 feet
- Property 2 – 250 to 350 feet
- Property 3 – 450 to 550 feet

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). Note that the hydraulic

units are: gallons per day per square foot (gpd/ft^2) for hydraulic conductivity; gallons per day per foot (gpd/ft) for transmissivity; and, dimensionless for storage coefficient. 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 Fazzino properties:

Property I.D.	Parameter	GAM Estimate Range	TGI Estimate Range
Property 1	Thickness	430 to 450 feet	350 to 450 feet
	Hydraulic Conductivity	80 to 85 gpd/ft^2	125 to 175 gpd/ft^2
	Transmissivity	36,300 to 37,200 gpd/ft	43,750 to 78,750 gpd/ft
	Storage Coefficient*	0.00023	0.0001 (0.001)
Property 2	Thickness	470 to 480 feet	250 to 350 feet
	Hydraulic Conductivity	115 to 130 gpd/ft^2	150 to 200 gpd/ft^2
	Transmissivity	55,000 to 62,000 gpd/ft	37,500 to 70,000 gpd/ft
	Storage Coefficient*	0.00015	0.0001 (0.0005)
Property 3	Thickness	550 to 575 feet	450 to 550 feet
	Hydraulic Conductivity	170 to 180 gpd/ft^2	150 to 200 gpd/ft^2
	Transmissivity	95,000 to 103,500 gpd/ft	67,500 to 110,000 gpd/ft
	Storage Coefficient*	0.000147	0.0001 (0.0005)

The asterisk (*) indicates that TGI used a slightly higher storage coefficient for the 10-year analytical model to represent leakage and recharge conditions.

Figure 7 provides two hydrographs illustrating water-level measurements collected for nearby Texas Water Development Board (TWDB) and/or BVGCD Simsboro monitoring wells; the first chart illustrates data for TWDB Well No. 59-03-437 (BVR-1283) which is the Lee Fazzino House Well located about 3,100 feet (0.59 mile) west of Fazzino Property 1. Water levels declined by approximately 40 feet from 1979 to 1999. Advanced Groundwater Solutions (AGS) reported 44 feet of water-level decline in the Lee Fazzino House Well from 1999 into 2023 and mapped for the 1999 to 2023 period a decline in the Property 1 area of between 45 to 55 feet (see AGS, May 11, 2023). Current Simsboro artesian pressure beneath Property 1 is likely between 280 and 320 feet. Fazzino has sited two smaller capacity wells to account for the shallower Simsboro setting.

Figure 7 also shows the hydrograph for TWDB Well No. 59-04-701 (BVHU-0013) which is the City of Hearne Well #4, also known as the POW well. The POW well is approximately 3.1 miles east-northeast from Fazzino Property 2 and is about 4.8 miles north-northwest from Fazzino Property 3. Water levels in Hearne Well #4 declined by about 70 feet from 1979 through 1999. AGS reported water-level declines in the POW well of 81 feet from 1999 through 2023 (see AGS, May 11, 2023). AGS reported water-level declines from 1999 to 2023 of between 75 and 80 feet at Fazzino Property 2 and between 80 and 90 feet in the area including Fazzino Property 3. Therefore, current water levels would rise between 750 and 850 feet above the

top of the Simsboro in wells completed on Property 2. Current artesian pressures on Property 3 are likely between 1,130 and 1,230 feet.

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 Fazzino Family has requested a permit allocation for the Simsboro Aquifer of 10,348 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 annual 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 Simsboro artesian pressure declines as follows:

Distance from Property	Property 1	Property 2	Property 3
*GAM Drawdown – 1 Year of Pumping**			
Adjacent	22 feet	45 feet	25 feet
One (1) Mile	10 to 17 feet	28 to 31 feet	16 to 18 feet
Five (5) Miles	Less than 10 feet	Up to 13 feet	Up to 13 feet
*GAM Drawdown – 10 Years of Pumping**			
Adjacent	25 feet	50 feet	30 feet
One (1) Mile	12 to 18 feet	32 to 38 feet	22 to 25 feet
Five (5) Miles	Up to 15 feet	8 to 18 feet	15 to 25 feet

The asterisk (*) indicates that direct interference between properties was not accounted for the five (5) mile radii.

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 areas and within the five-mile radii. Note that due to the depth of the local Simsboro and the prolific transmissivity of the aquifer, the overlap of well radii on the Fazzino Property 2 will not cause adverse interference drawdown effects on the Fazzino wells or on local wells.

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 after one (1) and 10 years, respectively. Table 1 and Table 2 provide drawdown values at specific well locations. The analytical calculations predict Simsboro artesian pressure declines as follows:

Distance from Property	Property 1	Property 2	Property 3
*Analytical Drawdown – 1 Year of Pumping**			
Adjacent	55 feet	72 feet	52 feet
One (1) Mile	46 to 49 feet	62 to 66 feet	48 to 53 feet
Five (5) Miles	33 to 45 feet	42 to 48 feet	35 to 45 feet
*Analytical Drawdown – 10 Years of Pumping**			
Adjacent	60 feet	81 feet	65 feet
One (1) Mile	52 to 55 feet	70 to 72 feet	55 to 60 feet
Five (5) Miles	39 to 52 feet	48 to 53 feet	42 to 53 feet

The asterisk (*) indicates that direct interference between properties was not accounted for the five (5) mile radii.

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 Fazzino properties 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 again assist you in our specialty. If you have any questions, please call.

The seal appearing on this document was authorized by Michael R. Thornhill, P.G. on July 25, 2023.

Attachments

Sincerely,
THORNHILL GROUP, INC.

Michael R. Thornhill, P.G.
President