

Technical Memorandum

TO: Mr. Alan Day, General Manager
Brazos Valley Groundwater Conservation District

FROM: Christopher Drabek, P.G., and James Beach, P.G.

SUBJECT: Review of James Brien Simsboro Aquifer Evaluation Report

DATE: February 6, 2023

Introduction

On behalf of the Brazos Valley Groundwater Conservation District (BVGCD, District), Advanced Groundwater Solutions, LLC (AGS) has reviewed the Aquifer Evaluation Report prepared by Thornhill Group, Inc. (TGI) in support of a permit application from Mr. James Brien for two wells with a combined withdrawal amount of 4,115 acre-feet per year (ac-ft/yr) from the Simsboro Aquifer. Ground Water Consultants, LLC (GWC) supported the review of the report. The first submitted Aquifer Evaluation Report is dated January 10, 2023. After preliminary review, AGS, GWC and BVGCD provided comments to TGI and requested some modifications to the report on January 25, 2023. A revised report was submitted to BVGCD on January 27, 2023. The Aquifer Evaluation Report was submitted to address BVGCD Rule 8.4(b)(7)(B) for wells capable of producing 800 or more acre-feet per year and discusses the potential impacts of groundwater production from the proposed two wells screening the Simsboro Aquifer in the west part of Robertson County.

The Aquifer Evaluation Report identifies Brien Well 1 with a maximum pumping rate of 1,700 gallons per minute (gpm) and an annual permit allocation of 2,186 acre-feet and Brien Well 2 with a maximum pumping rate of 1,500 gpm and an annual permit allocation of 1,929 acre-feet. The combined maximum pumping rate of Brien Wells 1 and 2 is 3,200 gpm with a total annual permit allocation of 4,115 acre-feet. The proposed locations of the wells are shown on Figure 1 with the wells located just west of FM 1644 and north of the Brazos River.

AGS and GWC have evaluated the hydrogeological conditions, mapping of BVGCD permitted and registered Simsboro wells within one mile of the proposed wells and the water level drawdown estimates developed using the Texas Water Development Board (TWDB) Groundwater Availability Model (GAM) and analytical tools presented in the submitted Aquifer Evaluation Reports. Discussion of the Aquifer Evaluation Report in this memorandum refers to the revised version of the report dated January 27, 2023.

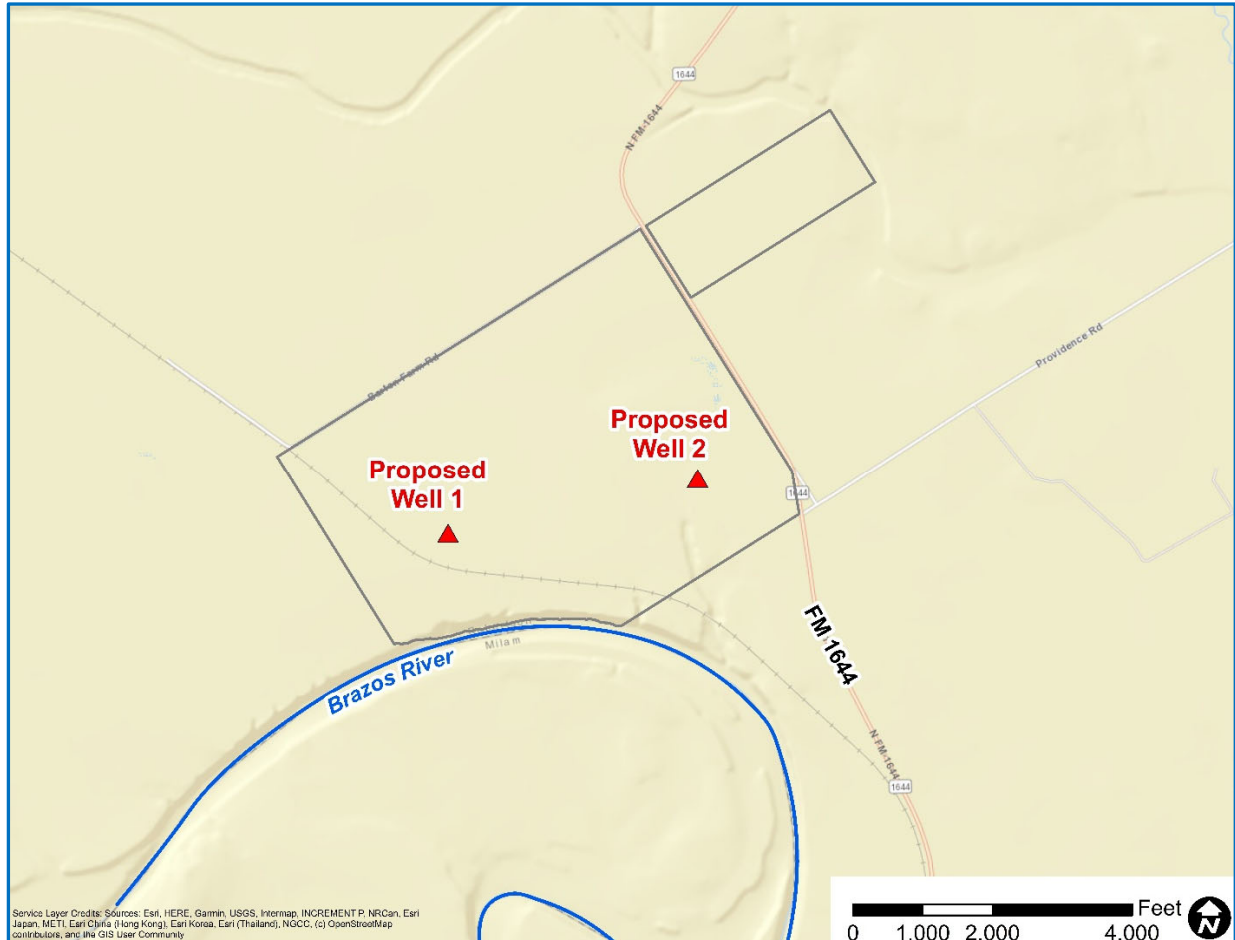


Figure 1. Proposed Well Location Map

Hydrogeologic Conditions

Rule 8.4(b)(7)(B)(1)

AGS has evaluated the hydrogeological conditions presented in the Aquifer Evaluation Report and generally agrees with the information presented in this section. Our comments regarding the hydrogeologic conditions at the subject property are included below.

Paragraph one of the Surface Geologic Setting on Page 3 of the TGI report states ‘Geologically updip and present to the southeast of the property is the Queen City Aquifer...’ and while the Queen City Aquifer can be found to the southeast of the Brien property, the Queen City is located downdip, not updip, of the formations present below the Brien property.

The Aquifer Evaluation Report identifies the top of the Simsboro Aquifer in the range of about -375 to -500 feet relative to sea level (rsl) or about 650 to 780 feet below land surface at the subject property. Review of local electric logs and the Brien irrigation well drillers log (State of Texas Well Report Tracking Number 313037) indicates that the top of the Simsboro in the vicinity of the Brien property could about -275 to -350 feet rsl or about 555 to 630 feet below land surface. The

Aquifer Evaluation Report did not discuss the base of the Simsboro Aquifer. We estimate the base of the of the Simsboro in the vicinity of the Brien property is about -675 to -760 feet rsl or about 955 to 1,040 feet below land surface. TGI estimated the sand thickness of the Simsboro Aquifer to be in the range of 450 to 500 feet. Site specific information will be available once the test hole is drilled and logged for the first of the two proposed wells. The proposed well screen interval was not discussed for either of the proposed wells in the Aquifer Evaluation Report.

There is about a 100- to 150-foot difference in opinion of the estimated depth to the top of the Simsboro Aquifer across the Brien property. TGI estimates that the Simsboro water levels would rise between 475 and 650 feet above the top of the Simsboro. The difference in the estimated top of the Simsboro Aquifer could result in a difference of about 100 feet in the estimate of the amount of artesian head available above the top of the Simsboro Aquifer. AGS considers these differences to be worth mentioning but not overly consequential for the purposes of this report.

Simsboro Aquifer Wells Within 1-mile of the Proposed Wells

Rule 8.4(b)(7)(B)(2)

Six (6) BVGCD permitted or registered wells were identified in Table 2 of the Aquifer Evaluation Report. Table 2 includes data on each registered or permitted well screening the Simsboro Aquifer located within one mile of the proposed wells and generally includes most of the required information for the wells. Ideally, the top and bottom of the screen interval would be shown in the Screen Depth column, if available. Based on the information provided in Table 2, the well listed with a NULL registration or permit number could potentially be BVR-1503. BVR-1503 is discussed later in this section.

A map showing the location of the proposed wells and the BVGCD registered or permitted wells within one mile of the proposed wells is included as Figure 2 in the Aquifer Evaluation Report. We would recommend labeling each well with the permit or registration number. AGS has included a map with the wells labeled as Figure 2 below.

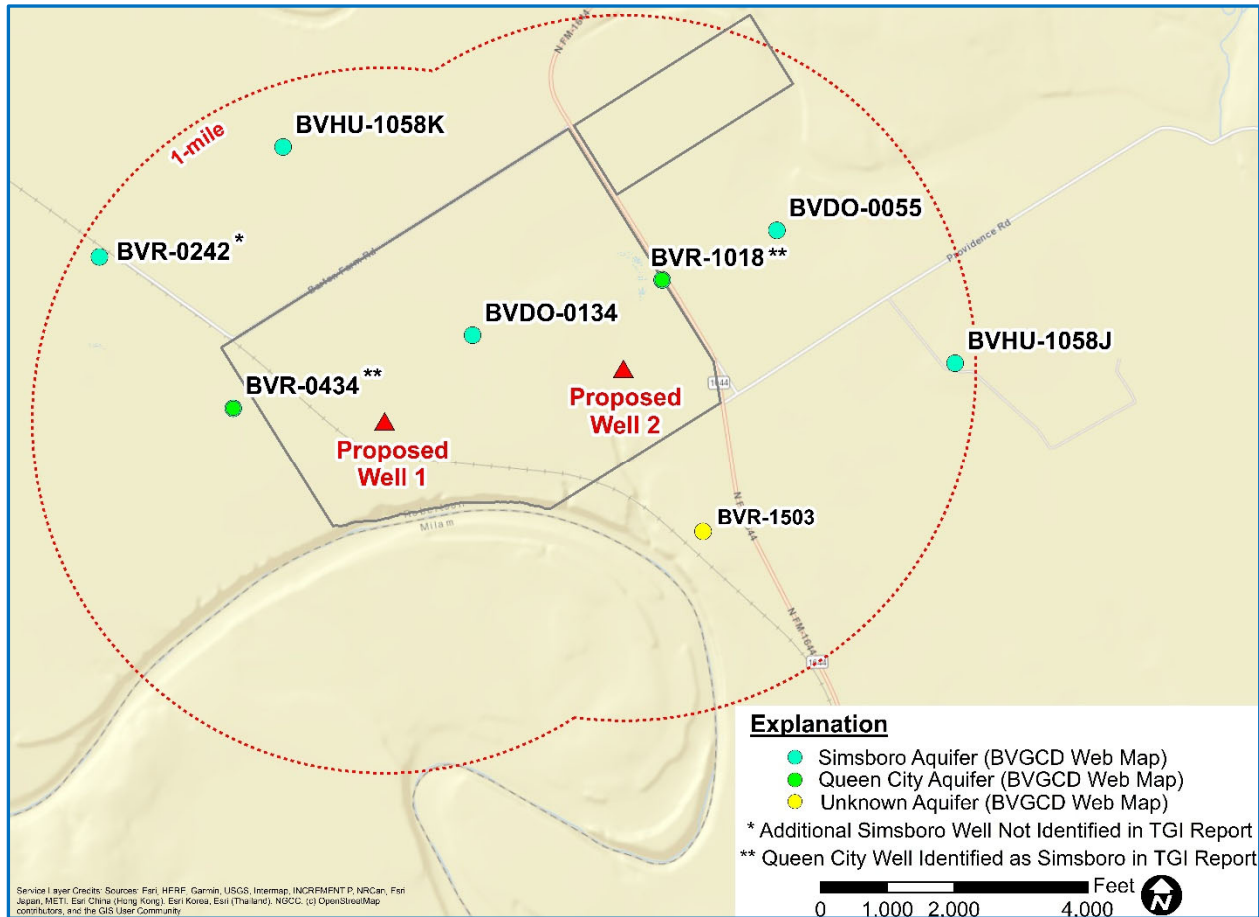


Figure 2. Map of Wells Near the Proposed Wells

The six (6) permitted or registered wells identified within one mile of the proposed wells were compared to wells shown on the BVGCD Groundwater Management Application Public Web Map (<https://brazosvalleygcd.half.com/default.aspx>). Table 2 from the TGI report includes two wells listed as Simsboro that are identified as Calvert Bluff on the BVGCD Web Map (BVR-0434, and BVR-1018).

BVR-0242 is identified as a Simsboro well on the BVGCD Web Map and is located within one mile of the proposed Brien 1 well location. BVR-0242 is not included in Table 2 of the TGI report or shown on Figure 2 in the Aquifer Evaluation Report. The BVR-0242 State of Texas Well Report (Tracking Number 495742) shows the well screened interval as 587 to 607 feet below ground level (-302 to -322 feet rsl), which would indicate that the well is completed in the Simsboro. BVR-0242 is subsequently not included in the model simulation discussion or results.

BVR-1503 is shown as a well with an unknown aquifer on the BVGCD Web Map. The depth of the well would fit with the Simsboro Aquifer in the area; however, water level data collected this past summer does not correlate with other Simsboro wells in the area.

Interference Drawdown Estimates

Rule 8.4(b)(7)(B)(3)

Groundwater Availability Model Simulation

TGI used the Central Portion of the Sparta, Queen City and Carrizo-Wilcox Aquifer GAM to estimate drawdown that results from pumping the two proposed wells continuously at a combined rate of 4,115 ac-ft/yr for one year and 10 years. The GAM simulations focus on isolating the effects of the proposed permitted pumping and do not include the impacts from other Simsboro pumping in BVGCD or regional impacts from pumping in areas surrounding BVGCD.

Figures 6 and 7 of the Aquifer Evaluation Report show simulated effects after one year and 10-years of pumping, respectively. The TGI 10-year GAM simulated interference drawdown is estimated to be about 20 to 50+ feet within one mile from the proposed wells and about less than five feet to 13 feet at a distance of five miles from the proposed wells, depending on the direction from the proposed wells. A copy of the TGI 10-year GAM simulated interference drawdown illustration from the Aquifer Evaluation Report (Figure 7) is attached to this memorandum. The GAM estimated drawdown contours to the northwest appear to be influenced by a fault included in the GAM, which is in the same general area as a fault that has been mapped recently by GWC and AGS.

Table 1 from the Aquifer Evaluation Report shows GAM simulated one year and 10-year drawdown estimates at BVGCD permitted and registered Simsboro wells within a five-mile radius of the proposed wells. The GAM simulated drawdown values shown in TGI Table 1 were spot checked against the drawdown contours shown on TGI Figures 6 and 7 of the Aquifer Evaluation Report.

The TGI report did not discuss the GAM simulation methodology, including how much pumping was placed at each model node. To check the results, AGS performed a GAM simulation using Version 3.02 of the Central Portion of the Sparta, Queen City and Carrizo-Wilcox Aquifers GAM (INTERA Incorporated and others, 2020) with each of the proposed wells pumping the requested annual permit allocation (Brien Well 1: 2,186 ac-ft/yr at Node 159438; Brien Well 2: 1,929 ac-ft/yr at Node 159940). The AGS GAM simulation results after one year and 10 years of pumping 4,115 ac-ft/yr show that drawdown estimates are about 5 to 10 feet less than what is reported in the TGI simulation. AGS reserves the right to perform additional model simulations in the future and review the results.

Analytical Model Simulation

TGI used an analytical model based on the Theis non-equilibrium equation to estimate theoretical potentiometric head declines at and surrounding the proposed wells. A transmissivity value of 65,000 gallons per day per foot (gpd/ft) and storativity value of 0.0001 were used at both well locations to simulate drawdown after one year and 10 years of pumping. Table 1 provided in the Aquifer Evaluation Report shows simulated one year and 10-year drawdown estimates at BVGCD

permitted and registered Simsboro wells within a five mile radius of the proposed wells based on the analytical modeling. AGS verified TGI calculations using a Theis based tool.

Estimated Long-term impacts at wells based on GMA 12 2021 DFC Run

As a way of evaluating potential long-term estimated water level decline at the two proposed wells, AGS plotted the simulated water level decline at the proposed well locations based on results from the 2021 Groundwater Management Area (GMA) 12 Desired Future Conditions (DFC) water level projections for the Simsboro Aquifer. The water level projections shown on the graphs in Figure 3 below are from the TWDB approved DFC run (GMA 12 “S-19”) but do not include the local impacts from the proposed wells included in the Aquifer Evaluation Report nor do they include all of the pumping from the Simsboro Aquifer that has been permitted in the area in the past year. The DFC run includes pumping estimates from the Groundwater Conservation Districts in GMA 12 as of about December 2021 that yield DFCs so that the TWDB can estimate the Modeled Available Groundwater (MAG). The detailed assumptions for the DFC simulation can be found in the GMA 12 Explanatory Report (Daniel B. Stephens & Associates and others, 2022) and documentation of the TWDB MAG run can be found in GAM Run 21-017 MAG: Modeled Available Groundwater for the Aquifers in Groundwater Management Area 12 (Shi and Harding, 2022).

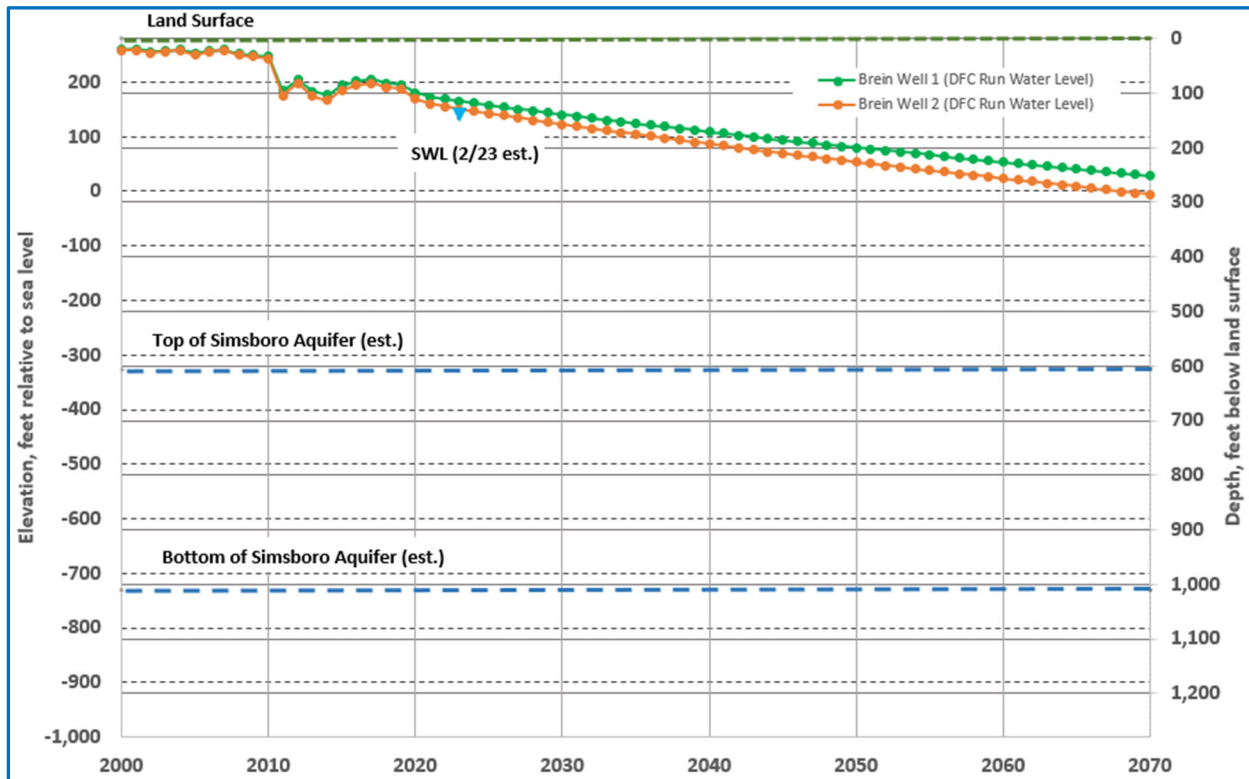


Figure 3. Projected DFC Water Level Decline at the two proposed wells.

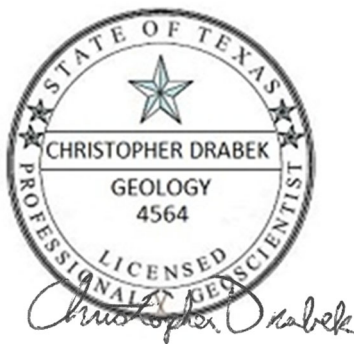
The graph illustrates the relationship between the land surface, estimated static water level through time, and the estimated top and bottom of the Simsboro Aquifer at the location of the two proposed wells. Available drawdown in wells in the Simsboro will decline over time based on the DFC simulation. Pumping water levels in wells in areas of concentrated pumping could be one hundred or more feet deeper than the estimated static water levels shown on Figure 3. Although not discussed in detail herein, these levels of water level decline in wells and artesian head decline in the aquifer will have some impact on vertical leakage, intercepted discharge, reduction in confined and unconfined storage, and potential flow directions in the aquifer.

TGI's report makes note of the testing observed by BVGCD representatives on March 18, 2009. For clarification, BVGCD representatives (LBG-Guyton Associates John Seifert) observed short term pumping (15-20 minutes) of the irrigation wells with flow meter readings of about 3,000 gpm on March 18, 2009.

Conclusions

The submitted Aquifer Evaluation Report generally addresses the requirements defined by BVGCD Rule 8.4(b)(7)(B) for wells capable of producing 800 or more acre-feet per year. As required by the rules, the evaluation focuses on the proposed Brien wells pumping of 4,115 ac-ft/yr from the Simsboro Aquifer and does not include what could be the overall effects of all the pumping that could occur in the area.

Geoscientist's Seal:



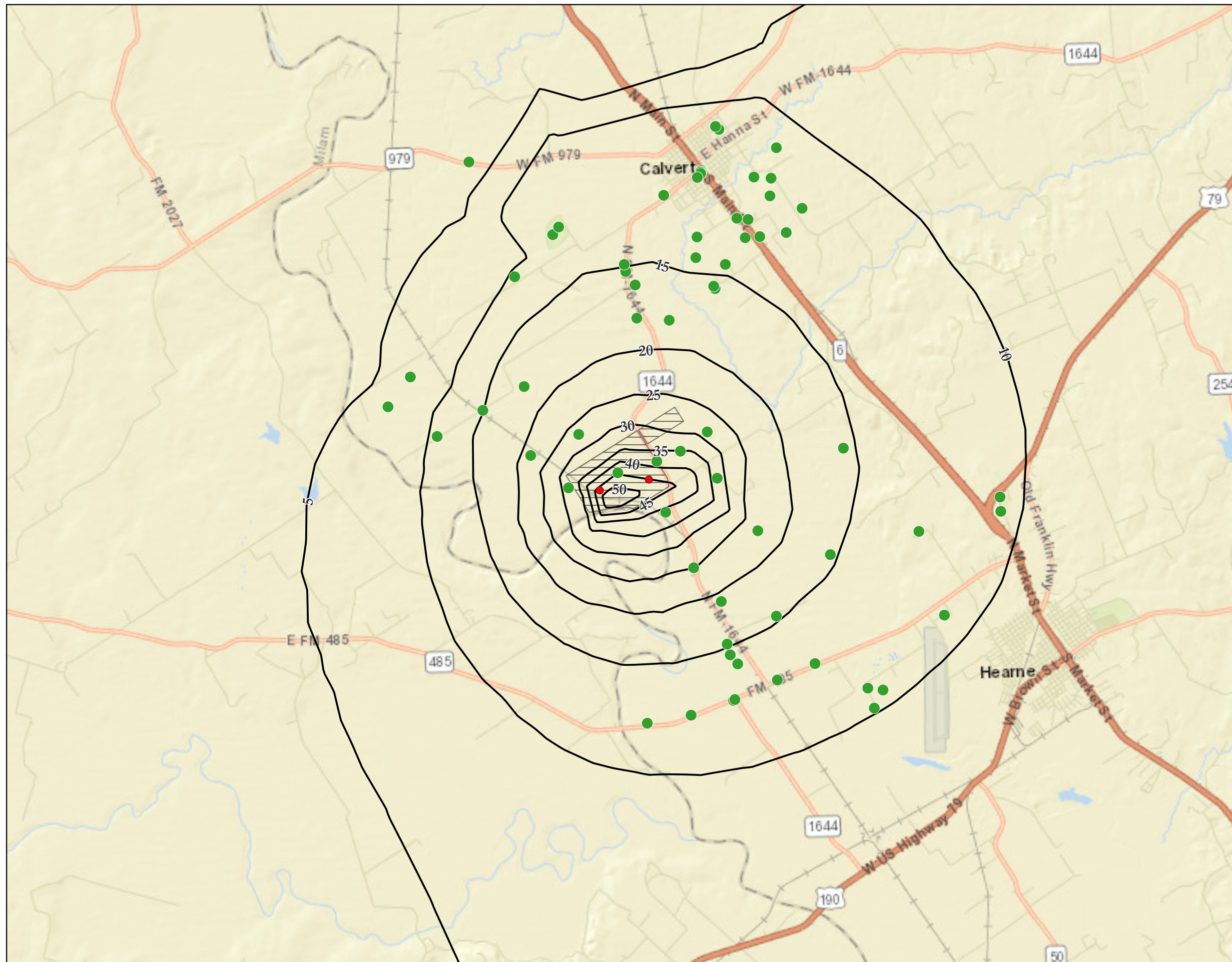
The seal appearing on this document was authorized by Christopher Drabek, P.G. 4564 on 2/6/2023.
Advanced Groundwater Solutions, LLC
TBPG Firm Registration No. 50639

References

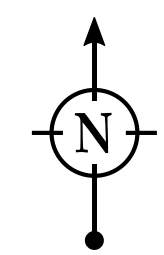
Daniel B. Stephens & Associates, INTERA Incorporated, and Ground Water Consultants, LLC, 2022, Desired Future Condition Explanatory Report for Groundwater Management Area 12, 859 p.

INTERA Incorporated, D.B. Stephens & Associates, and Ground Water Consultants, LLC, 2020, GMA 12 Update to the Groundwater Availability Model for the Central Portion of the Sparta, Queen City, Carrizo-Wilcox Aquifers: Update to Improve Representation of the Transmissive Properties of the Simsboro Aquifer in the Vicinity of the Vista Ridge Well Field, 30 p.

Shi, J. and Harding, J., 2022, GAM RUN 21-017 MAG: Modeled Available Groundwater for the Aquifers in Groundwater Management Area 12, 36 p.



- Brien Proposed Wells
- BVGCD Registered Simsboro Well
- 10-Year Drawdown (feet)
- Brien Property Boundary



Scale 1:84,000

Figure 7:
10-Year QCSP GAM
Drawdown Contours