Advanced Groundwater Solutions, LLC
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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 the City of College Station Simsboro Aquifer Evaluation Report

DATE: August 1, 2023

Introduction

On behalf of the Brazos Valley Groundwater Conservation District (BVGCD, District), Advanced Groundwater Solutions, LLC (AGS) has reviewed the Aquifer Evaluation Report (AER) prepared by R.W. Harden & Associates, Inc. (RWHA) in support of a permit application for the City of College Station (City, College Station) for three proposed new wells to be completed in the Simsboro Aquifer with a withdrawal amount of 5,065 acre-feet per year (ac-ft/yr). The AER dated June 6, 2023 was submitted to BVGCD on that date. The AER 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 Simsboro Aquifer of the proposed new wells in the west part of Brazos County.

The proposed well locations are shown on Figure 1 below with the wells located about 1 to 1.5 miles south-southwest of the intersection of Farm-to-Market Road 1687 and Old San Antonio Road (OSR) in west Brazos County.

AGS has evaluated the hydrogeological conditions, mapping of BVGCD permitted and registered Simsboro wells within one mile of the proposed City of College Station 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.

Proposed City of College Station Wells

The AER identifies three proposed College Station wells with simulated pumping rates that range from 949 to 1,180 gallons per minute (gpm) and an annual permit allocation of 5,065 acre-feet. Table 1 below was extracted from the RWHA AER and provides the annual permitted allocation in acre-feet and simulated pumping rate in gpm for each of the proposed College Station Simsboro Aquifer screened wells.

Proposed Well ID	GAM Row / Column (Node)	Permit Amount	
		Acre-Feet per Year	Gallons Per Minute (gpm)
Well 10	R51/C148 (168066)	1,903	1,180
Well 11	R50/C147 (167774)	1,631	1,011
Well 12	R51/C148 (167775)	1,531	949
Total Aggregate Permit Amount		**5,065**	**3,140**

Table 1. Proposed City of College Station Well Annual Permit Allocation and Simulated Pumping Rates (From RWHA AER)

The proposed locations of the three City of College Station wells are shown on Figure 1 below.

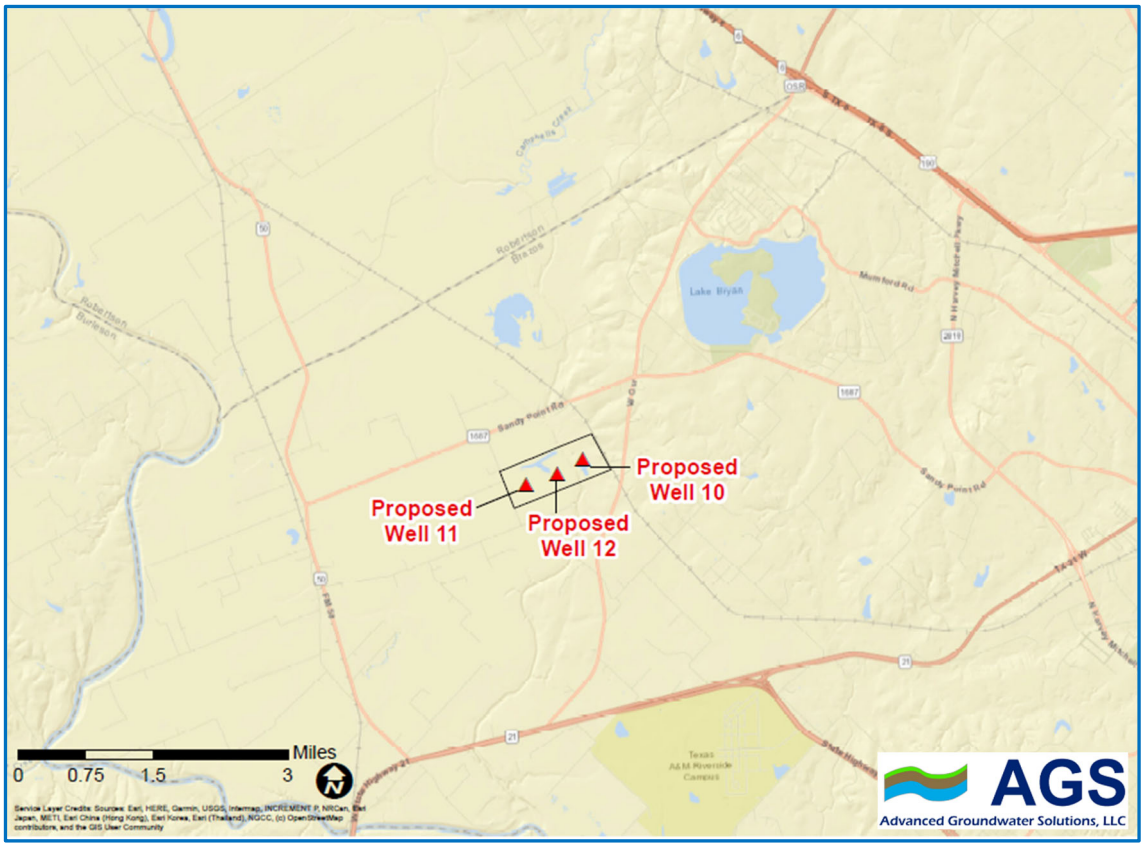


Figure 1. Proposed City of College Station Well Location Map

Hydrogeologic Conditions

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

AGS has evaluated the hydrogeological conditions presented in the AER and generally agrees with the information presented in this section.

The AER identifies the average extent (top and bottom) of the Simsboro Aquifer at the proposed well sites as about 2,200 to 2,900 feet below land surface based on Version 3.02 of the Central Portion of the Sparta, Queen City and Carrizo-Wilcox Aquifers GAM (INTERA Incorporated and

others, 2020) and geophysical logs and driller's logs within a 3-mile radius of the proposed property. The RWHA estimate of the top and bottom of the Simsboro Aquifer at the proposed well site is similar to the AGS estimate of about 2,300 to 2,950 feet.

Site specific information will be available once the test holes are drilled and logged for each of the proposed City of College Station wells.

Simsboro Aquifer Wells Within 1-mile of the Proposed Wells

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

AGS has confirmed that the BVGCD well, College Station Well 6 (BVHU-0043), identified in Table 1 in the RWHA AER is the only permitted or registered Simsboro well within one mile of the proposed College Station wells.

Interference Drawdown Estimates

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

BVGCD Rule 8.4(b)(7)(B)(3) requires an estimate of water level drawdown caused by the well(s) pumping at the permitted rate for 1 year and 10 years at a distance of up to five miles from the well(s) using Version 3.02 of the Central Portion of the Sparta, Queen City and Carrizo-Wilcox Aquifers GAM (INTERA Incorporated and others, 2020). An estimate of the drawdown at locations of existing registered and permitted wells in the BVGCD database that are located within one mile and screen the same aquifer as the well(s) is required to be developed using an analytical tool.

Appropriate analytical models are generally used to provide estimates of pumping effects at or near the well(s) over shorter time horizons. Regional numerical models like the TWDB GAMs are generally used to account for regional variability in the aquifer such as changes in transmissivity and faulting as well as recharge, leakage between aquifers, stream-aquifer interaction, other pumping, and other factors impacting water levels. Appropriate numerical models can provide more reliable estimates of pumping effects on a more regional scale and over longer time horizons.

Groundwater Availability Model Simulation

RWHA used the TWDB Central Portion of the Sparta, Queen City and Carrizo-Wilcox Aquifer GAM to estimate drawdown that results from continuously pumping the proposed City of College Station wells at a combined rate of 5,065 ac-ft/yr for 1 year and 10 years. A copy of the RWHA 1-year and 10-year GAM simulated interference drawdown illustrations from the AER (RWHA Figures 2 and 3) are attached to this memorandum.

The GAM simulation methodology described in the RWHA AER is common for isolating pumping effects. Two GAM simulations were completed with the first simulation (the baseline run) using the unmodified Groundwater Management Area (GMA) 12 "S-19" Desired Future Conditions (DFC) run and with the second simulation (the modified run) being identical to the

baseline except that the requested 5,065 ac-ft/yr of pumping was included in the MODFLOW WEL file. The simulated water levels from each simulation were compared by subtracting the simulated water level elevations of the baseline run from the modified run. GMA 12 "S-19" includes additional regional pumping, which gradually increases through time. GMA 12 "S-19" was approved in 2021 and does not include all of the pumping from the Simsboro Aquifer that has been permitted by BVGCD in the area in the past year.

AGS was able to verify the RWHA GAM simulations using methodology described in the AER to isolate the pumping effects of the proposed College Station wells.

AGS has reviewed this AER based on the hydrogeologic information available today, the information provided by the applicant, and the models and tools available at this time. New scientific or hydrogeologic information or updated models may change the findings of this review.

Analytical Model Simulation

RWHA used an analytical model based on the Theis non-equilibrium equation to estimate water level drawdown at and surrounding the proposed wells. RWHA used aquifer properties from the GAM at each proposed well location for the analytical simulations, with transmissivity values that range from 98,181 to 101,156 gallons per day per foot (gpd/ft) and storativity values that range from 1.16 x 10-4 to 8.47x10-4. Table 4 provided in the AER shows the proposed City of College Station analytical drawdown estimates developed by RWHA.

AGS estimated the drawdown at the pumping wells using the Theis analytical model and calculating the drawdown at one foot from the well. AGS was able to verify the RWHA analytical model simulations using data provided in the AER.

Estimated Long-term impacts at the Proposed City of College Station Wells based on the GMA 12 2021 DFC Run

As a way of evaluating potential long-term estimated water level decline at the proposed College Station wells, AGS plotted the simulated water level decline at each well location based on the 2021 GMA 12 DFC/Modeled Available Groundwater (MAG) projections for the Simsboro Aquifer as shown on Figure 2 below. The water level projections shown in the figure below are from the TWDB approved DFC/MAG run known as GMA 12 "S-19", but do not include the local impacts from the proposed College Station wells included in the AER, 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 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).

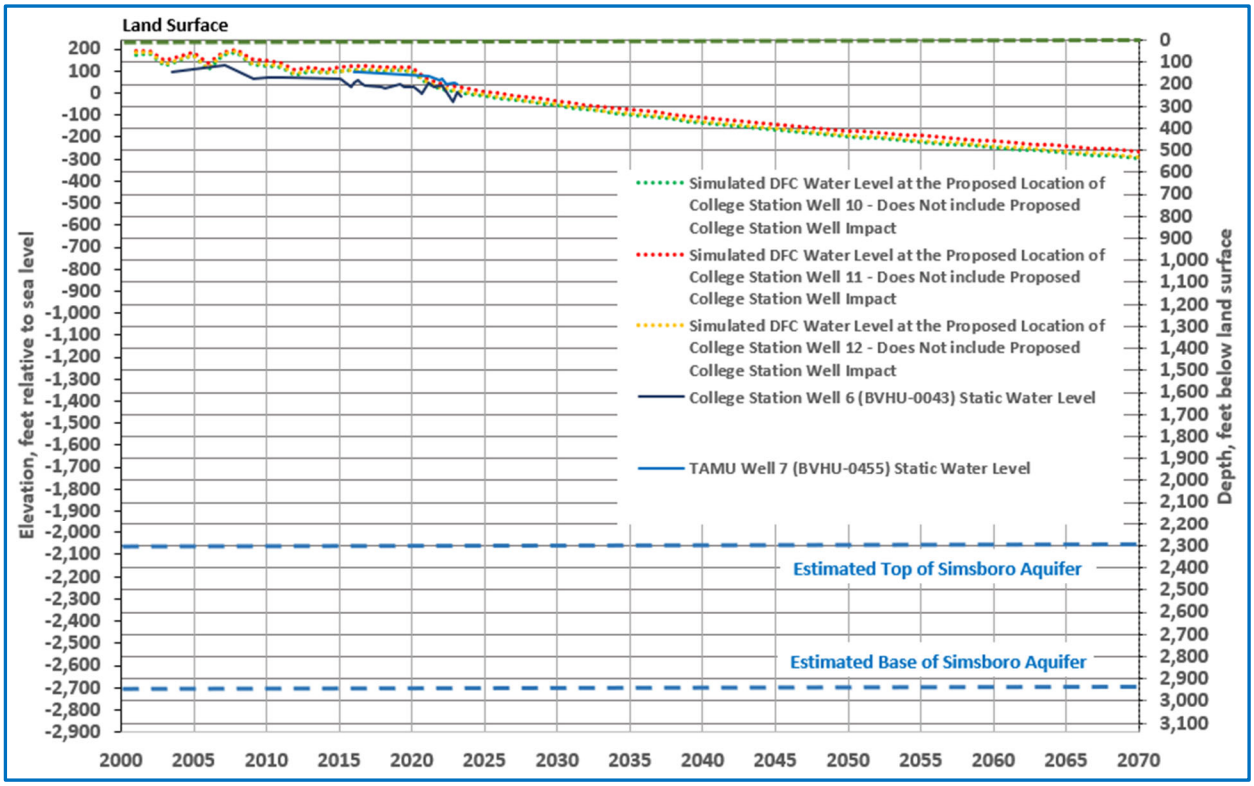


Figure 2. Projected GMA 12 2021 Planning Cycle DFC Water Level Decline at Proposed College Station Wells 10, 11 and 12.

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 based on review of available electric logs near the proposed well locations.

Historical static water level measurements are also shown on Figure 2 for the City of College Station Well 6 (BVHU-0043), which is located about 0.75 miles to the north of proposed College Station Well 10 and screen sands of the Simsboro Aquifer in the depth interval of about 2,352 to 2,876 feet below land surface. Historical Texas A&M University Well 7 (BVGCD Permit BVHU-0455) static water levels are shown on Figure 2 and the well screen sands of the Simsboro Aquifer in the depth interval of about 2,395 to 2,945 feet below land surface. BVHU-0455 is located about 1.5 miles south of proposed College Station Well 10.

Available drawdown in wells in the Simsboro Aquifer will decline over time based on the DFC simulation. In other words, the red, orange and green dashed lines do not include the impact of the proposed College Station wells. Although not evaluated or 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. Pumping by the proposed wells will have some of the same type effects on the aquifer.

Conclusions

The submitted AER addresses the requirements defined by BVGCD Rule 8.4(b)(7)(B) for wells capable of producing 800 or more acre-feet per year. AGS was able to verify the RWHA GAM and analytical simulations using the data provided in the AER.

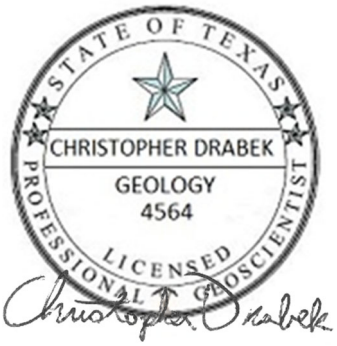
References

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.

Geoscientist's Seal:



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Advanced Groundwater Solutions, LLC (TBPG Firm Registration No. 50639)

Figure 2. GAM Simulated Drawdown as a result of Aggregated Pumping 5,065 ac-ft/yr for 1 Year

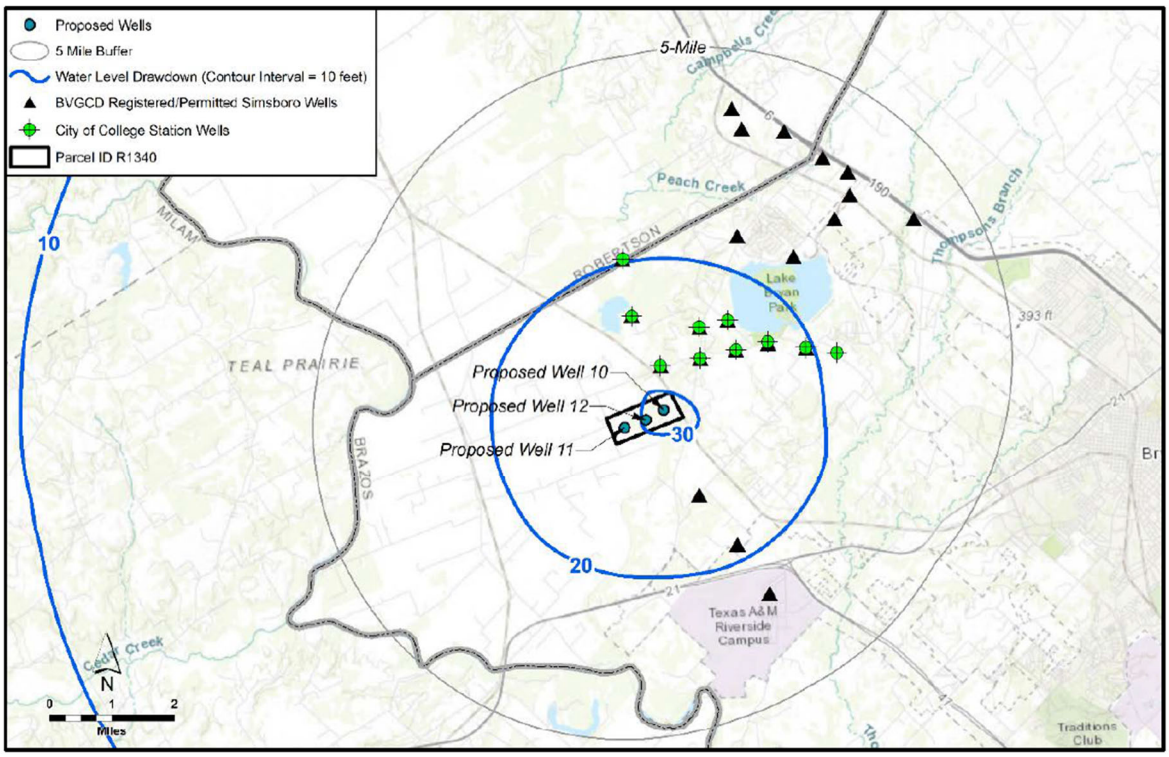

Figure 3. GAM Simulated Drawdown as a result of Aggregated Pumping 5,065 ac-ft/yr for 10 Years