

TECHNICAL MEMORANDUM

Aquifer Evaluation Report for Proposed New Simsboro Production – City of College Station

Date: June 6, 2023

To: Mr. Alan Day, General Manager, Brazos Valley GCD
From: Elizabeth Ferry, P.G.

Introduction

On behalf of the City of College Station (City), R. W. Harden & Associates, Inc. (RWH&A) provides this Aquifer Evaluation Report as required by the Brazos Valley Groundwater Conservation District (BVGCD) Rule 8.4.(b)(7)(B) (District Rules amended September 10, 2020) for wells capable of producing 800 or more acre-feet per year of groundwater. The City intends to develop additional groundwater production from the Simsboro aquifer for public supply use from their 321.18-acre property in Brazos County, Texas. Specifically, the City is requesting an aggregated annual production capacity of 5,065 acre-feet per year, or 3,140 gallons per minute from three potential new proposed well sites on the property. Therefore, RWH&A provides this Aquifer Evaluation Report in support of aggregated permit request.

Per the District Rule, RWH&A provides herein a description of the geologic setting, a summary of the estimated hydrogeologic parameters at the proposed well sites, and estimated water level drawdown as a result of the proposed requested permitted production. For clarity, within this report the District's Rules (2020) are italicized and subsequently followed by RWH&A's responses.

For this work, RWH&A compiled and reviewed available information pertaining to the geologic structure, lithologic composition, and aquifer hydraulics in the project area. RWH&A's evaluation included a review of available geologic and hydrologic data including published and unpublished groundwater and geologic maps and reports, well completion records, well testing records, geophysical logs, and other applicable information. Data sources included the City, the BVGCD, the Texas Water Development Board (TWDB), the Texas Department of Licensing and Regulation, the University of Texas Bureau of Economic Geology (BEG), the Texas Commission on Environmental Quality, the United States Geological Survey (USGS), and RWH&A files.

Rule 8.4 APPLICATIONS

*(b)(7)(B) in the case of wells capable of producing 800 or more acre-feet/year:
study shall be conducted by a registered professional engineer or geologist that has expertise in groundwater hydrology evaluating the projected effect of the proposed withdrawal on the aquifer or any other aquifer conditions, or effects on existing permit holders or other groundwater users in the District. Five copies of the report shall be submitted with the permit application.*

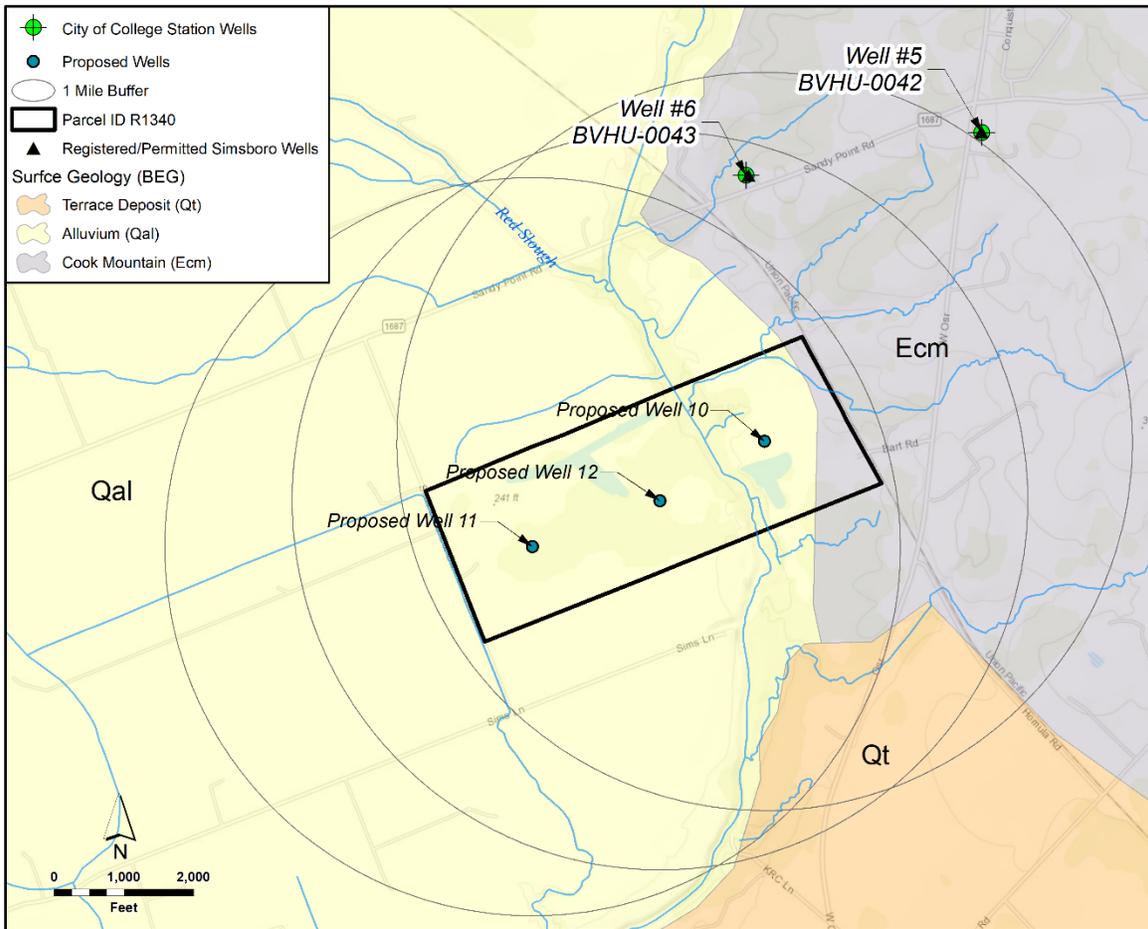
The evaluation report shall include the following:

(1) A description of the hydrogeologic conditions in proximity to the well(s) that includes:

a. the surface geology

Figure 1 illustrates the surface geology in proximity to the proposed wells. According to the BEG, alluvial sediments (Qal) and the Cook Mountain Formation (Ecm) of the Claiborne Group are mapped across the surface of the subject property.

Figure 1. Surface Geology of Site



b. the depth interval of the proposed water bearing zone

According to the Groundwater Availability Model (GAM) for the Central Portion of the Sparta, Queen City, and Carrizo-Wilcox Aquifers v.3.02 (2020) and geophysical logs and driller's reports within a 3-mile radius of the property, the depth interval of the target water bearing zones within the Simsboro aquifer beneath the subject property is on average approximately 2,200 feet to about 2,900 feet below ground level. Actual site-specific depths to the top and base of the aquifer beneath the property will be determined through drilling and logging at the well sites.

c. the anticipated thickness of the water bearing zone

According to nearby geophysical logs and driller's reports, the anticipated thickness of the water bearing zone of the Simsboro aquifer is on average 430 feet.

- d. a statement of whether the water bearing zone is anticipated to be in unconfined or confined condition

The estimated depth to the static water level is 230 feet below ground level. The estimated depth to top of the water bearing zone is 2,200 feet below ground level. This means that the water bearing zone is under confined conditions as the artesian pressure rises nearly 2,000 feet above the top of the aquifer.

- e. a description of any hydrologic features or geologic features located within one mile of the proposed well(s) site(s).

According to USGS topographic map as shown on Figure 1, Red Slough creek and its tributaries are identified within a one-mile radius of the proposed well sites, in addition two ponds are also identified on the property.

- (2) A well table giving data on each registered or permitted well located within one mile of the well(s) and screening the same aquifer. The well table shall include the name of the well owner, well registration or permit number, casing and screen diameter and depth settings, total well depth, and aquifer screened. A map shall be provided showing the location of the well(s) at a scale no greater than one-inch equals 1,000 feet.

On April 27, 2023, RWH&A obtained information from the BVGCD including location of registered and permitted wells which are plotted in Figure 1. According to the information provided, the City’s existing Well #6 (BVHU-0043) is the only reported registered and permitted well located within a one-mile radius of the proposed well sites and is completed within the Simsboro aquifer. Table 1 summarizes the data regarding the City’s permitted Well #6 located within one mile of the proposed wells and screening the Simsboro aquifer.

Table 1. Reported Wells within One-Mile Radius of Proposed Wells

Well Owner	BVGCD Permit Number	Reported Casing Diameter and Setting Depth*	Screen Diameter and Setting Depth*	Total Well Depth*	Aquifer Screened
College Station (Well #6)	BVHU-0043	<ul style="list-style-type: none"> • 20 inches to 745 ft • 16 inches from 745 to 2,141 ft • 10-3/4 inch (liner) at various intervals between 2,141 to 2,895 ft 	10-3/4 inch 2,350 to 2,506 ft 2,519 to 2,570 ft 2,575 to 2,653 ft 2,665 to 2,689 ft 2,730 to 2,800 ft	2,895 ft	Simsboro

Asterisk (*) indicates the information was obtained from the City’s records and downhole video survey sheet and is reported in feet below top of casing.

- (3) An estimate of the water-level drawdown that can be caused by pumping the well(s) at the permitted rate for one year and ten years at a distance of five miles from the well(s). Water-level drawdown contours shall be shown at ten-foot contour intervals. The estimate of pumping effects shall be developed using the most recent TWDB approved version of the Queen City Sparta GAM or TWDB Yegua-Jackson GAM, as applicable.

RWH&A utilized the GAM for the Central Portion of the Sparta, Queen City, and Carrizo-Wilcox Aquifers v.3.02 (2020) to estimate water level drawdown as a result of pumping the proposed wells at the requested permitted rates. RWH&A ran two numerical model simulations: 1) the first run utilized the TWDB Groundwater Management Area 12 (GMA-12) Desired Future Conditions (DFC) run (GMA-12 “S-19”) as the baseline pumping input file, and 2) the second run was modified from the baseline pumping input file with adding the requested permitted rates for each well. The model pumping rates included in the second GAM simulation are summarized in Table 2.

Table 2. Permitted Pumpage Input Model Rates for Each Well

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

To estimate the water level drawdown caused by the proposed wells pumping at the requested permitted rates, RWH&A subtracted the simulated Simsboro aquifer water level from the two simulation runs and contoured the results as predicted drawdown after one year and after ten years of pumping which are presented in Figure 2 and Figure 3, respectively.

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

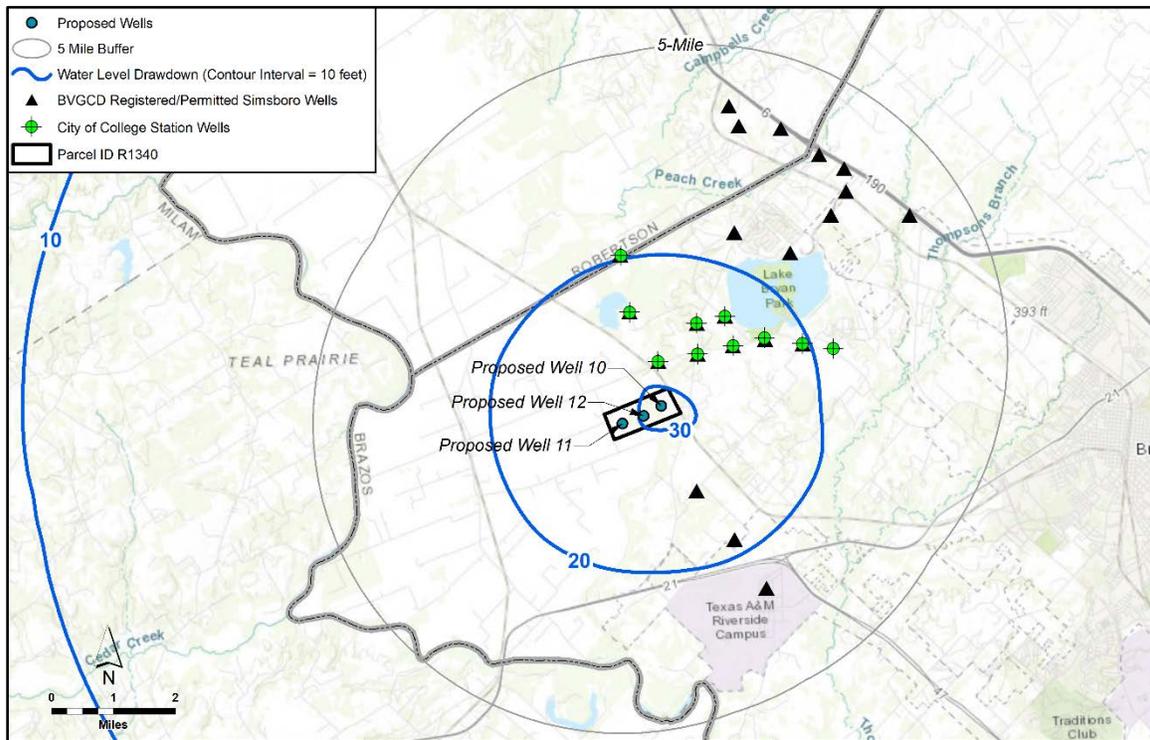
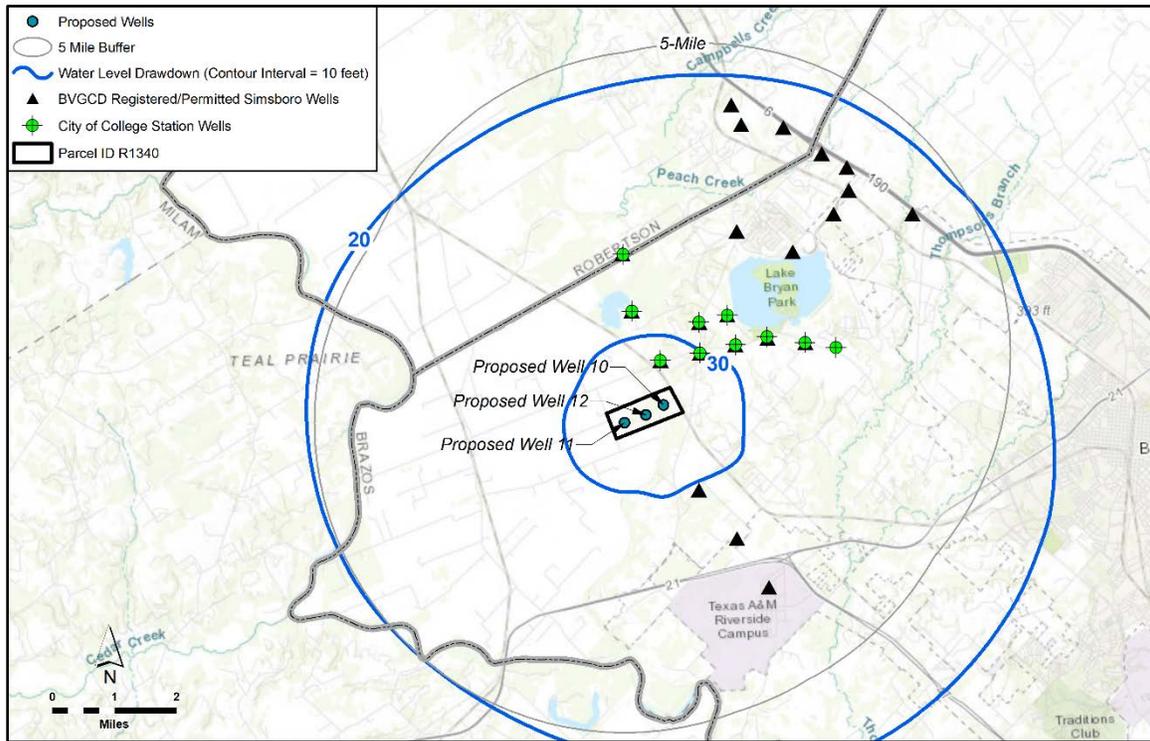


Figure 3. GAM Simulated Drawdown as a result of Aggregated Pumping 5,065 ac-ft/yr for 10 Years



The results indicate that the estimated water level drawdown at the well sites after one year and ten years of pumping is on average about 27 feet and 32 feet, respectively. At a distance of five miles from the proposed well sites, the estimated water level drawdown after one year and ten years of pumping is approximately 15 feet and 20 feet, respectively.

Aquifer hydraulic data available from other sources for wells located in proximity to the well(s) may be considered in estimating the water-level drawdown effects of pumping. Include in the evaluation an estimate of the drawdown at the locations of existing registered and permitted wells contained in the BVGCD database that screen the same aquifer as the well(s) and are located within one mile of the well(s). This estimate shall be developed using an analytical tool approved by the District and the best available science concerning local aquifer properties such as transmissivity and storativity.

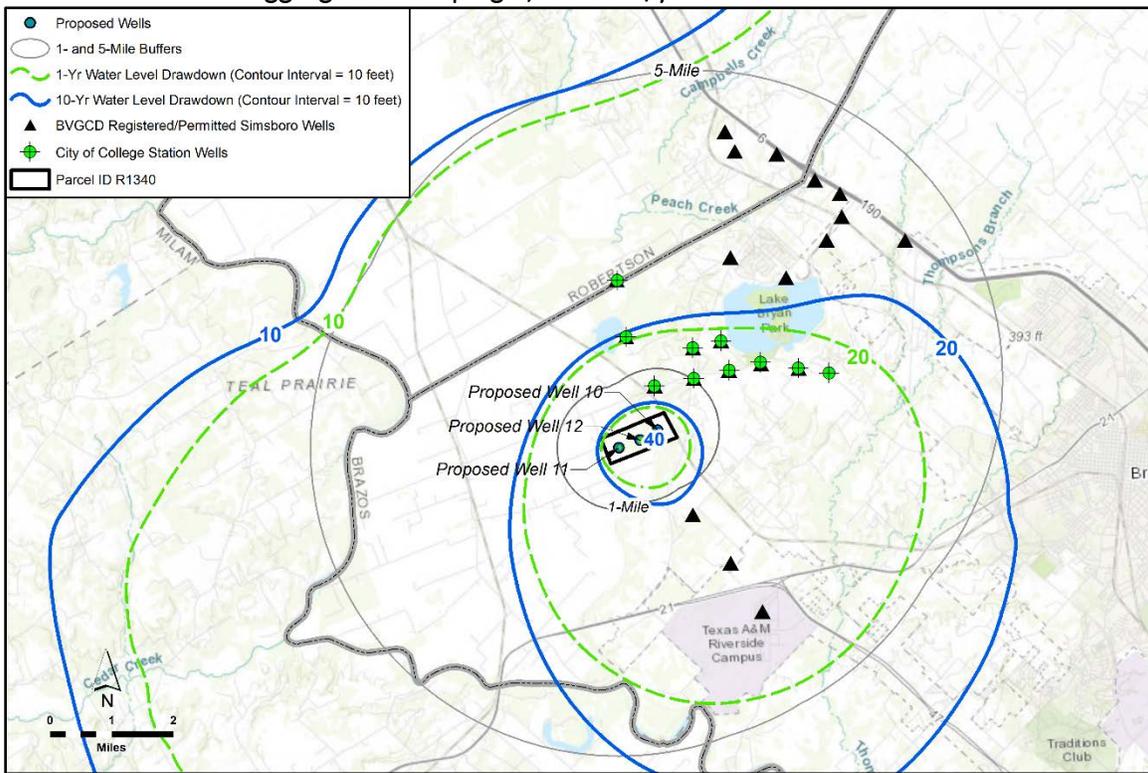
RWH&A performed analytical groundwater flow modeling utilizing the Theis non-equilibrium equation to estimate water level drawdown at locations of existing BVGCD registered and permitted wells screened within the Simsboro aquifer and located within one mile of the proposed well sites. The input hydraulic parameters for the analytical model run interpolated surfaces of transmissivity and storage derived from the GAM for Layer 9 across the project area. Table 3 lists the interpolated aquifer transmissivity in gallons per day per foot (gpd/ft) and aquifer storage at each well site used for analytical modeling.

Table 3. Hydraulic Parameters at each Well Site for Analytical Modeling

Proposed Well ID	GAM (Layer 9) Transmissivity	GAM (Layer 9) Storage
Well 10	98,181 gpd/ft	1.19×10^{-4}
Well 11	101,156 gpd/ft	1.16×10^{-4}
Well 12	98,964 gpd/ft	8.47×10^{-4}

The proposed production amounts listed within Table 2 were incorporated into the analytical model to estimate water level drawdown after continuous pumping for one year and ten years. The contoured results of pumping for one and ten years are provided in Figure 4.

Figure 4. Analytical Model Predicted Drawdown as a result of Aggregated Pumping 5,065 ac-ft/yr for 1 and 10 Years



As mentioned, RWH&A obtained a copy of the BVGCD’s well information with locations of existing registered and permitted Simsboro wells and identified the City’s existing Well #6 (BVHU-0043) is the only reported registered and permitted well located within a one-mile radius of the proposed well sites. Table 4 lists the simulated drawdown at the well sites (distance of one foot from the center of the well bore) and at the City’s Well #6 as a result of pumping the requested aggregated permit amount after one and ten years.

Table 4. Analytical Drawdown as a Result of Proposed Permitted Pumping

Proposed Well ID	Simulated Drawdown (feet)	
	One Year	Ten Years
Well 10	53.8	55.0
Well 11	49.3	50.4
Well 12	51.0	52.1
Well #6 (BVHU-0043)	26.0	26.9

Discussion of Results

In summary, the City is requesting an aggregated permitted production of 5,065 acre-feet per year, or 3,140 gpm from the City’s property in Brazos County, Texas. RWH&A evaluated the hydrogeologic conditions and performed numerical and analytical modeling to estimate water level drawdown as a result of the requested aggregated permitted production amount. The estimated average depth interval of the Simsboro beneath the project area is approximately 2,200 feet to 2,900 feet below ground level with an estimated net sand thickness of approximately 430 feet. However, it is important to note that the depths and thickness are estimates; site-specific depths and thickness of the Simsboro aquifer will vary as a result of geologic structure and can only be determined through a drilling and logging program.

Based on available hydraulic information and numerical modeling, it is estimated that the water level drawdown as a result of pumping the requested aggregated production continuously for one year and ten years is 27 feet and 32 feet, respectively. At a distance of five miles from the proposed well sites, the simulated water level drawdown after one year and ten years of pumping is approximately 15 feet and 20 feet, respectively. Analytical modeling predicts water level drawdowns of approximately 50 to nearly 55 feet of drawdown at the well bore sites after one and ten years of continuous pumpage of the requested aggregated permitted amount and approximately 26 feet one mile from the proposed well sites.

We appreciate the opportunity to provide you with this Aquifer Evaluation Report on behalf of the City of College Station. If you have any questions, please contact us.



The seal appearing on this document was authorized by Elizabeth Ferry, P.G. No. 11011 on June 6, 2023. R.W. Harden & Associates, Inc. TBPG Firm No. 50033.

Sincerely,

Elizabeth Ferry, P. G.
Senior Hydrogeologist | Principal
R. W. Harden & Associates, Inc.

Cc: Stephen A. Maldonado, Jr., P.E., City of College Station
Gary Mechler, City of College Station
Richard Weatherly, P.E., Freese and Nichols, Inc.

Selected References

Brazos Valley Groundwater Conservation District, 2020, September 10, Rules of the Brazos Valley Groundwater Conservation District.

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

Shi, J. and Hardin, J., 2022, November 1, Modeled Available Groundwater for the Aquifers in Groundwater Management Area 12: GAM Run 21-017 MAG.