AGS
Advanced Groundwater Solutions, LLC
www.advancedgw.com

# 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 Bryan Simsboro Aquifer Evaluation Report

**DATE:** August 2, 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 INTERA, Inc. (INTERA) in support of a permit application for the City of Bryan (City, Bryan) for four proposed new wells to be completed in the Simsboro Aquifer with a withdrawal amount of 14,204 acre-feet per year (ac-ft/yr). The AER dated June 28, 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 to the north of Sandy Point Road (Farm to Market Road 1687), south of State Highway 6 south and east of Old San Antonio Road.

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

The AER identifies four proposed Bryan wells with average annual pumping rates that range from 1,775 to 3,100 gallons per minute (gpm) that are based on an annual permit allocation of 14,204 acre-feet. Table 1 below is from the INTERA AER.

| New Well ID | Latitude | Longitude | Estimated Depth (ft bgs) | Annual Supply (AF) | Average Annual Rate (gpm) |
|---|---|---|---|---|---|
| 20 | 30.724081 | -96.441389 | 2,900 | 2,863 | 1,775 |
| 21 | 30.718428 | -96.434894 | 2,950 | 3,035 | 1,882 |
| 22 | 30.712978 | -96.462196 | 2,900 | 5,000 | 3,100 |
| 23 | 30.715839 | -96.473132 | 2,880 | 3,306 | 2,050 |

Table 1. Proposed City of Bryan Well Annual Permit Allocation and Average Annual Pumping Rate (From INTERA AER)

The proposed locations of the four City of Bryan wells are shown on Figure 1 below.

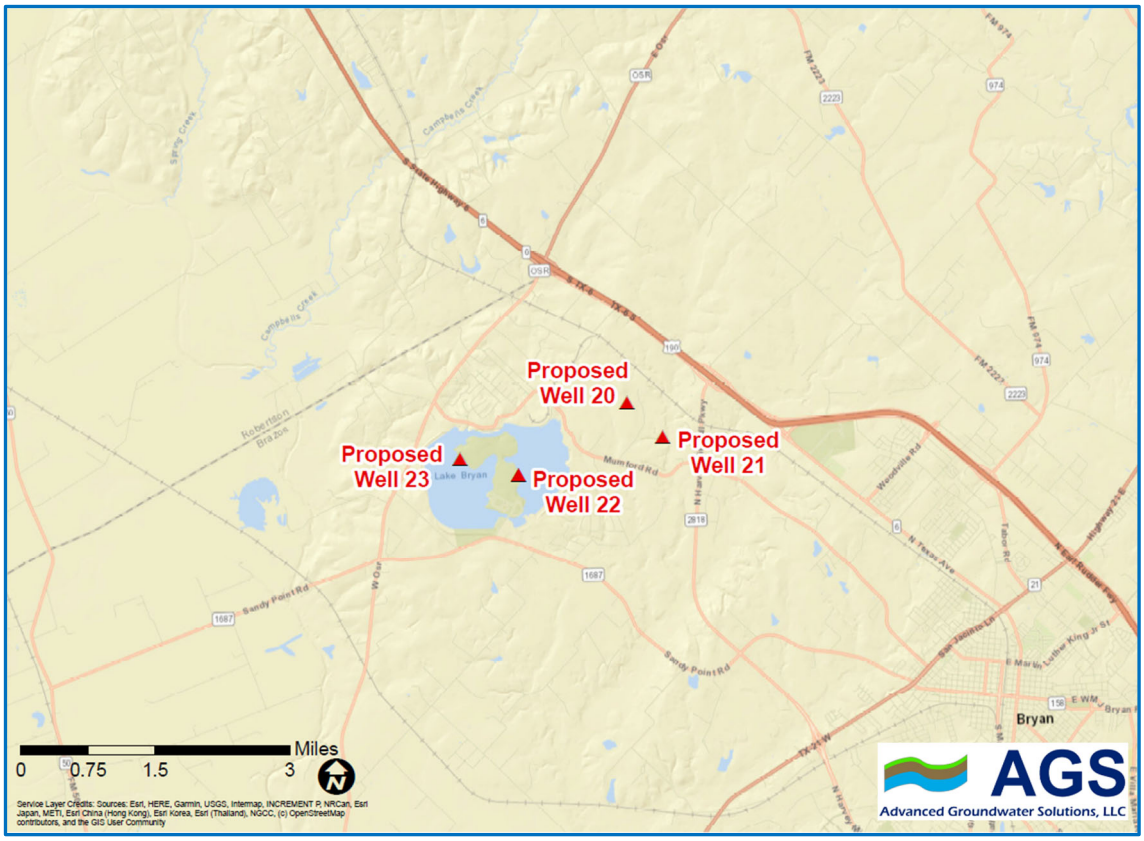



Figure 1. Proposed City of Bryan Well Location Map

## 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 top of the Simsboro Aquifer at the proposed well sites in a range of about 2,300 to 2,500 feet below land surface and estimates the thickness of the Simsboro to be

approximately 500 to 600 feet. These estimates appear to be reasonable based on the review of local geophysical logs.

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

## Simsboro Aquifer Wells Within 1-mile of the Proposed Wells

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

AGS has confirmed that the nine BVGCD permitted or registered Simsboro wells identified in Table 6 in the INTERA AER are the only permitted or registered Simsboro wells within one mile of the proposed City of Bryan wells. Seven of the nine wells belong to the City of Bryan (Wells 11, 12, 15, 16, 17, 18 and 19 (CS 4)) and two wells belong to the City of College Station (Wells 1 and 2).

## 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

INTERA 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 Bryan wells at a combined rate of 14,204 ac-ft/yr for 1 year and 10 years. A copy of the INTERA 1-year and 10-year GAM simulated drawdown illustrations from the AER (INTERA Figures 12 and 13) are attached to this memorandum.

In the AGS verification runs, two GAM simulations were completed with the first simulation (the baseline run) using the unmodified Groundwater Management Area (GMA) 12 “S-19” Desired Future Condition (DFC) run and with the second simulation (the modified run) being identical to

the baseline except that the requested 14,204 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.

The AGS GAM simulation results after 1 and 10 years of pumping 14,204 ac-ft/yr from the proposed City of Bryan wells show drawdown estimates that are generally similar to INTERA's results. AGS was able to replicate the drawdowns at distance after 1-year of pumping (about 40 to 45 feet drawdown at 5 miles and about 60 to 70 feet of drawdown at 1 mile) and 10-years of pumping (about 55 to 65 feet drawdown at 5 miles and about 75 to 85 feet of drawdown at 1 mile). AGS estimated a drawdown value that is about 5 feet more than INTERA at proposed Well 23 in the 1-year and 10-year simulations. This minor difference may be attributed to differences in contouring the simulation results.

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

INTERA used a groundwater model constructed using TTIM to estimate projected pumping impacts of the proposed City of Bryan wells. TTIM is a three-dimensional analytical model and the model used in the Bryan simulations includes five layers representing the Reklaw Formation, Carrizo Aquifer, Calvert Bluff Formation, Simsboro Aquifer and Hooper Formation. Aquifer parameter values for each layer of the TTIM model are based on values from the corresponding layer of the GAM averaged over a 5-mile area.

AGS was able to generally recreate the INTERA analytical model simulation results using the well production rate and aquifer parameter data discussed in the Hydrogeological Report.

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

As a way of evaluating potential long-term estimated water level decline at the proposed City of Bryan 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 attached Figures 2 through 5. The water level projections shown in the attached figures are from the TWDB approved DFC/MAG run known as GMA 12 "S-19", but do not include the local impacts from the proposed Bryan wells included in the AER, nor do they include all of the pumping from the Simsboro Aquifer that has been permitted 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).

The graphs on Figures 2 through 5 illustrate 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 locations of the proposed wells.

Historical static water level measurements are also shown on Figures 2 and 3 for the City of Bryan Well 12 (BVHU-0005), which is located about 0.80 miles to the northeast of proposed Bryan Well 20 and about 0.83 miles to the north-northeast of proposed Bryan Well 21. The City of Bryan Well 12 screen sands of the Simsboro Aquifer in the depth interval of about 2,385 to 2,902 feet below land surface. Historical City of Bryan Well 15 (BVHU-0008) static water levels are shown on Figures 4 and 5. The City of Bryan Well 15 screen sands of the Simsboro Aquifer in the depth interval of about 2,389 to 2,867 feet below land surface. Well 15 is located about 0.60 miles north of proposed Bryan Well 22 and about 0.76 miles to the northeast of proposed Bryan Well 23.

Available drawdown in wells in the Simsboro Aquifer will decline over time based on the DFC simulation. In other words, the line with green dots does not include the impact of the proposed Bryan 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 INTERA GAM and analytical simulations using the data provided in the AER.

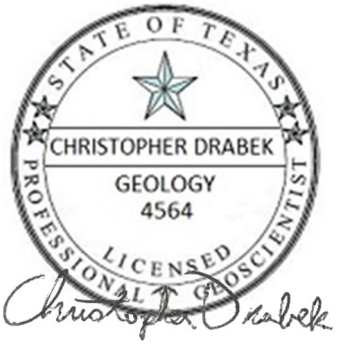
## References

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:




The seal appearing on this document was authorized by Christopher Drabek, P.G. 4564 on 8/2/2023.
Advanced Groundwater Solutions, LLC (TBPG Firm Registration No. 50639)

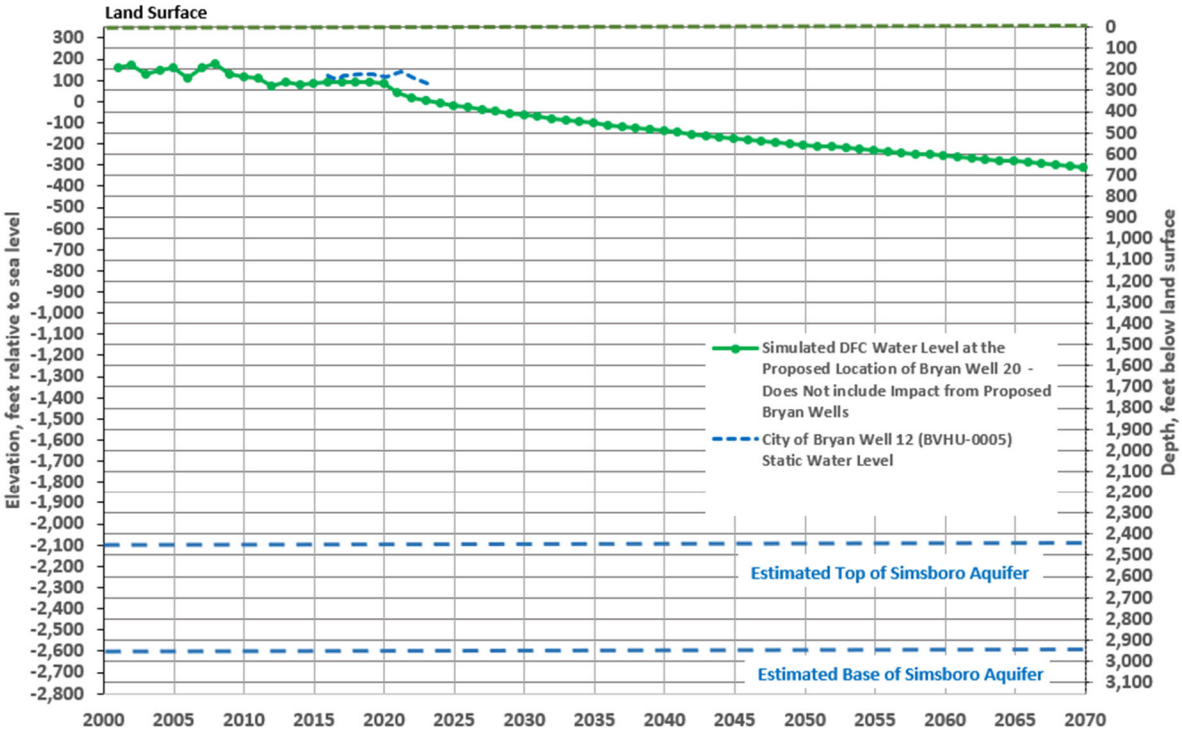



Figure 2. Projected DFC Water Level Change at Proposed City of Bryan Well 20

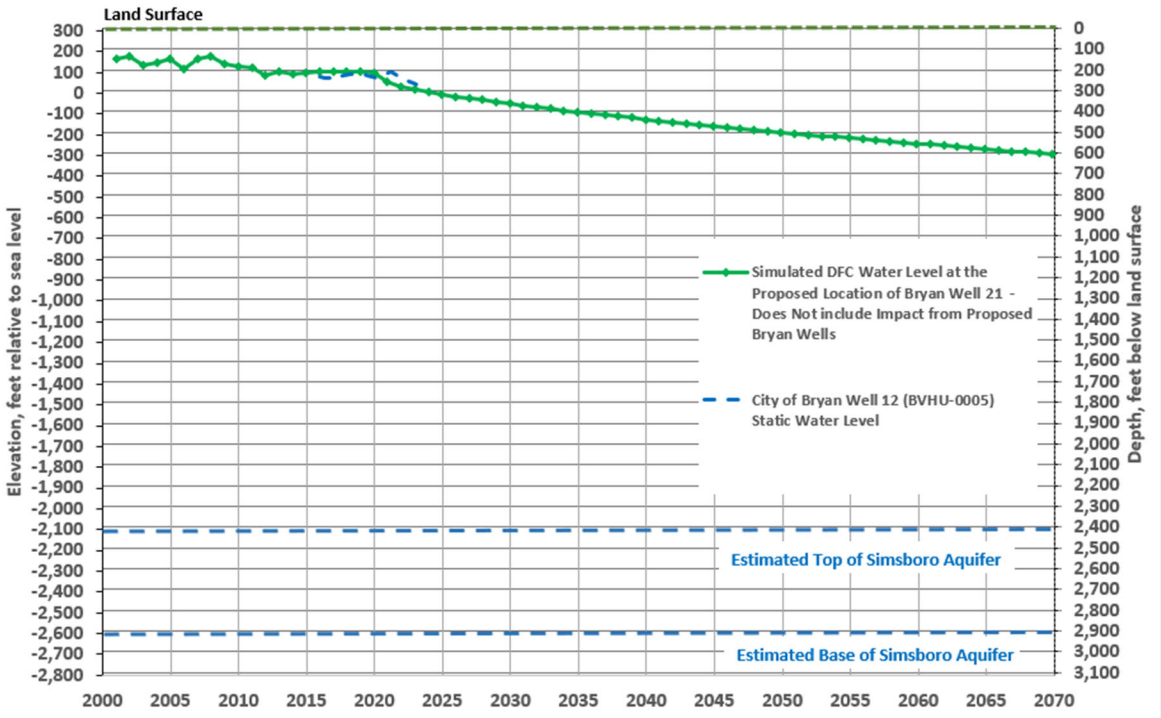



Figure 3. Projected DFC Water Level Change at Proposed City of Bryan Well 21

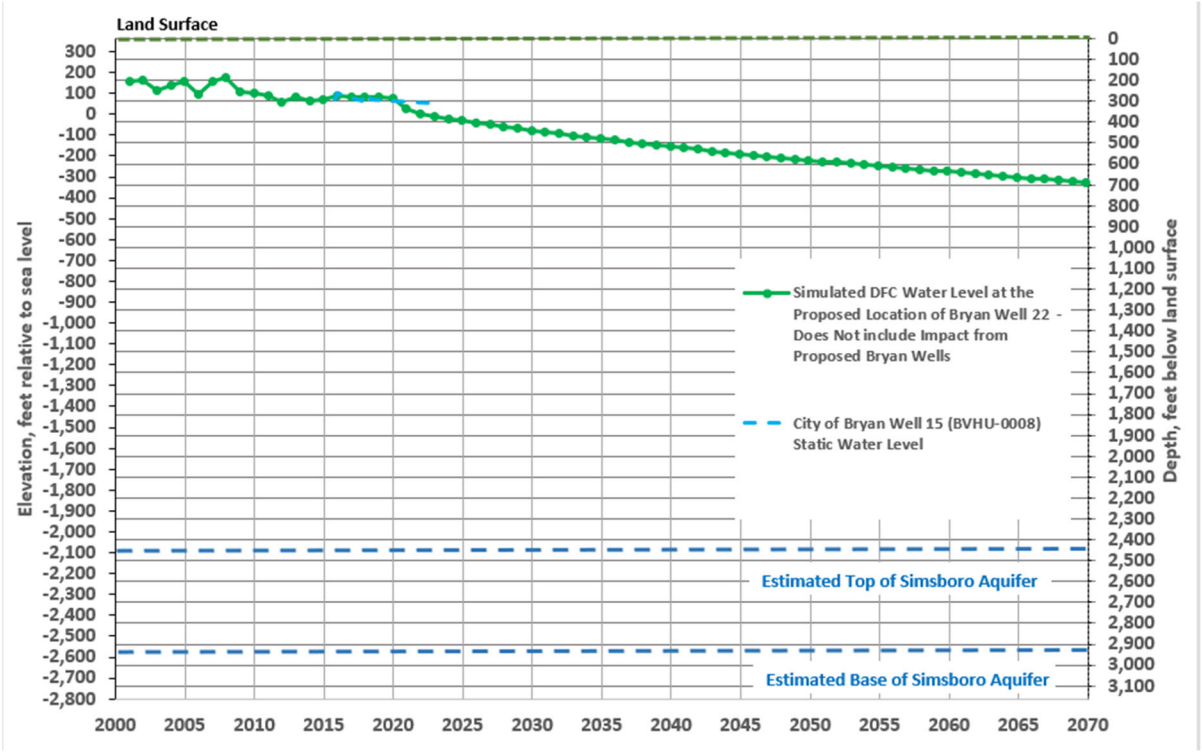



Figure 4. Projected DFC Water Level Change at Proposed City of Bryan Well 22

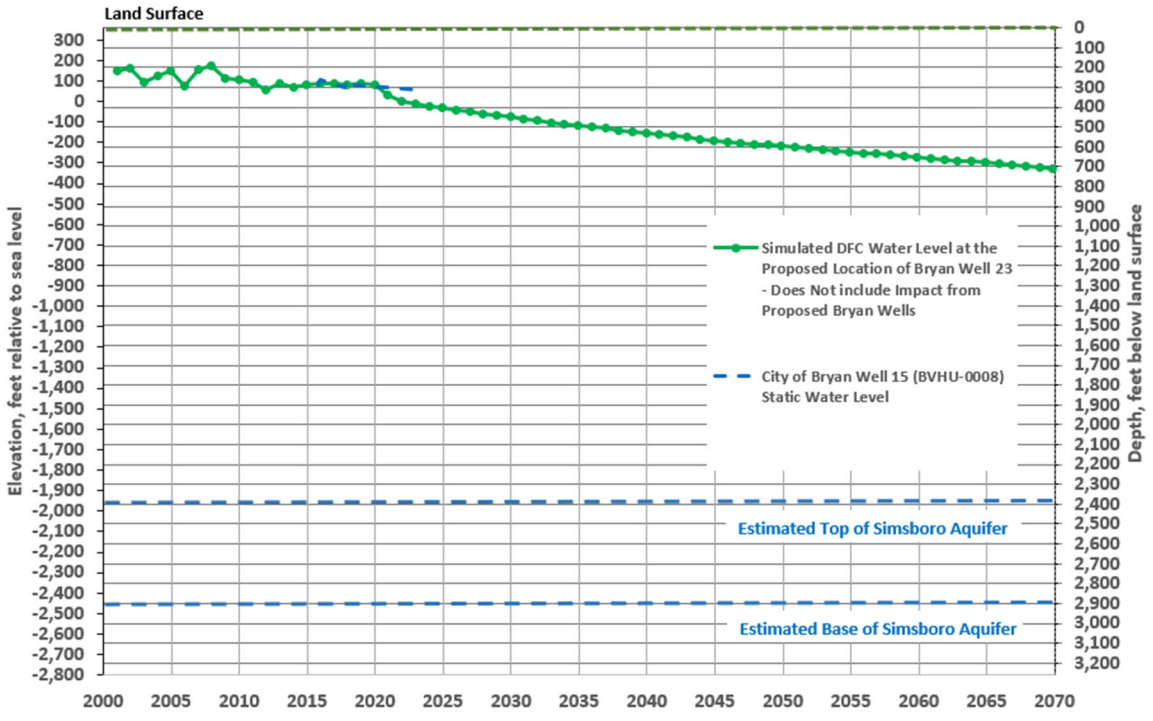



Figure 5. Projected DFC Water Level Change at Proposed City of Bryan Well 23

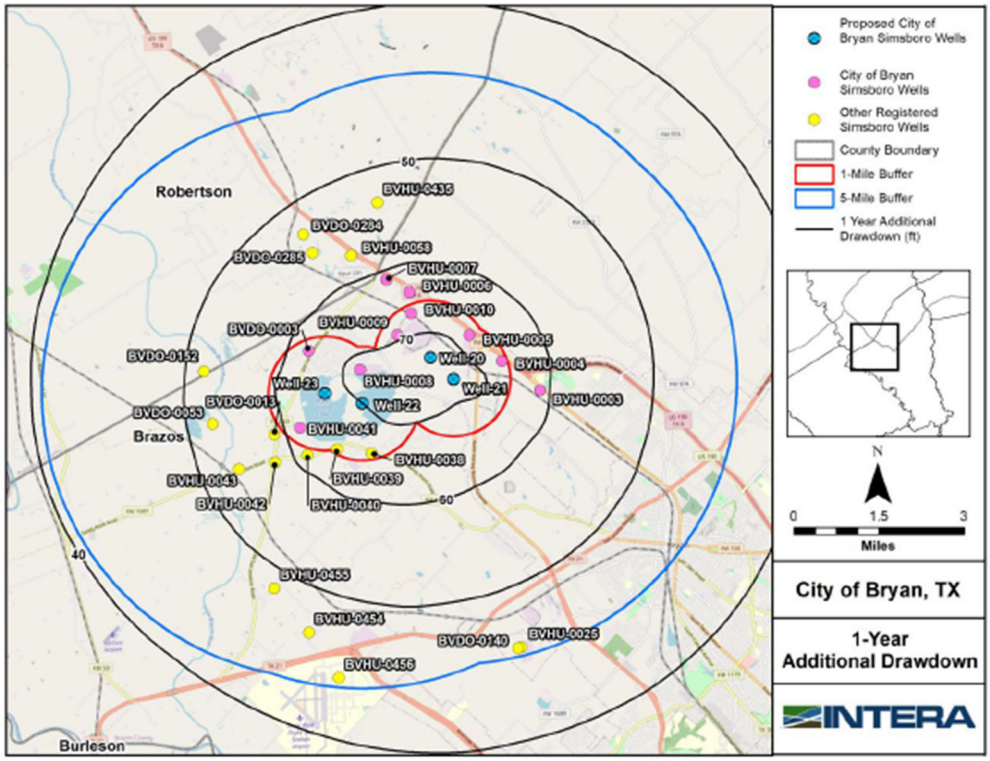



Figure 12. Drawdown after one year of pumping using the TWDB GAM.

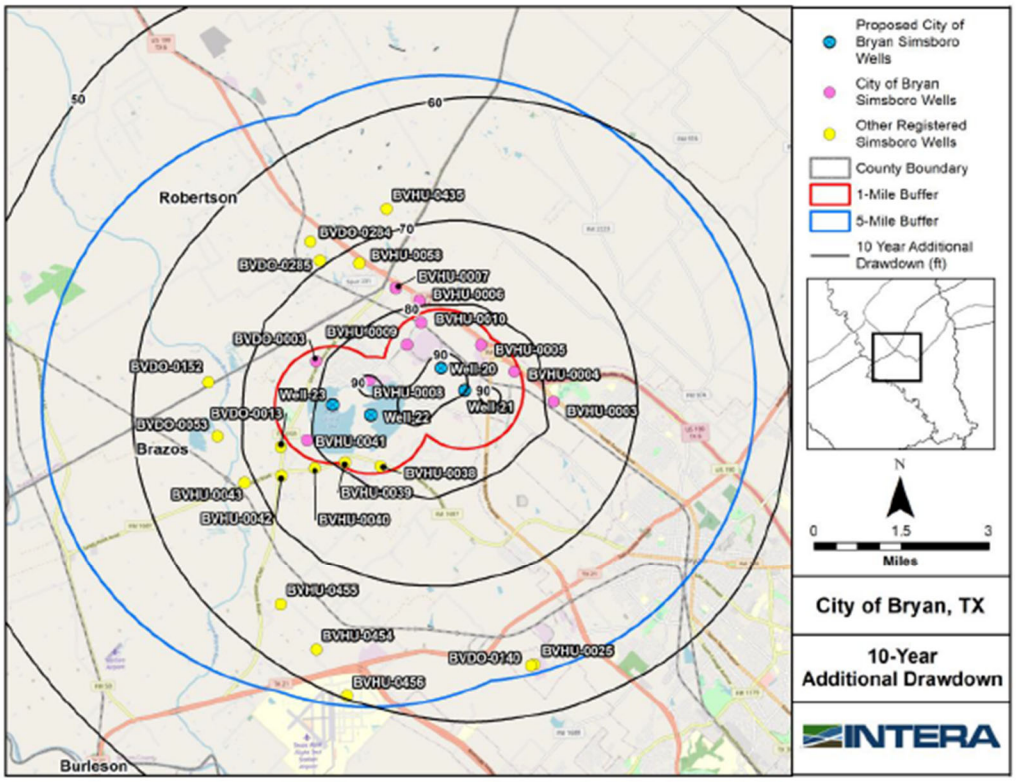



Figure 13. Drawdown after 10 years of pumping using the TWDB GAM.