Evaluation of LCRA's Proposal to Pump 25,000 Acre-Feet per Year from the Simsboro Aquifer

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1.0 Introduction

The Lower Colorado River Authority (LCRA) is proposing to pump 25,000 ac-ft/yr from the Simsboro Aquifer in Bastrop County, Texas. The water would be pumped from eight wells.[1] The wells would be installed approximately eight miles north east of the city of Bastrop,[2] and would be screened from approximately 1000 feet to 1500 feet below land surface[3]. The pumping would be phased in: 8000 ac-ft/yr in phase I, 15,000 ac-ft/yr in phase II, and 25,000 ac-ft/yr in phase III.[4]

The effects of LCRA's pumping were estimated using the Lost Pines Groundwater Conservation District's (LPGCD) version of the *Central Queen City and Sparta Groundwater Availability Model* (GAM)[5]. The input files used to generate the results presented in this report were provided by the LPGCD[6], or are modifications of LPGCD-provided files[7]. Figure 1 shows the geologic units represented in the GAM.

LCRA's pumping would affect groundwater levels and the discharge of groundwater to the Colorado River.

2.0 Effects on groundwater

2.1 Simsboro Aquifer

LCRA's pumping would reduce hydraulic heads in the Simsboro Aquifer. The effects would extend to both the confined and unconfined portions of the aquifer. Where the aquifer is confined, the reduction in heads will reduce water levels in wells that draw water from the aquifer. Where the aquifer is unconfined, the reduction in heads will dewater portions of the aquifer. Drawdowns in the Simsboro Aquifer due to LCRA's proposed pumping are shown in figure 2.

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[1] LCRA, 2018, page 1 of 6.
[2] Proposed well 5 to be located approximately Lat. 30.183820, Lon. -97.219671 (LCRA, 2018, attachment C).
[3] LCRA, 2018, page 2 of 6.
[4] For the purposes of modeling it is assumed that phase I begins in 2020, phase II in 2023, and phase III in 2026 (DBS, 2018, page 2).
[5] The GAM is based on the MODFLOW computer code developed by the U.S. Geological Survey (TWDB 2004, page 6-1).
[6] LPGCD, 2013.
[7] For example, the input flag in the stream flow routing file (qcsp_c_v1.02.str) was altered to instruct the model to print estimates of flow into or out of aquifers along each stream reach.

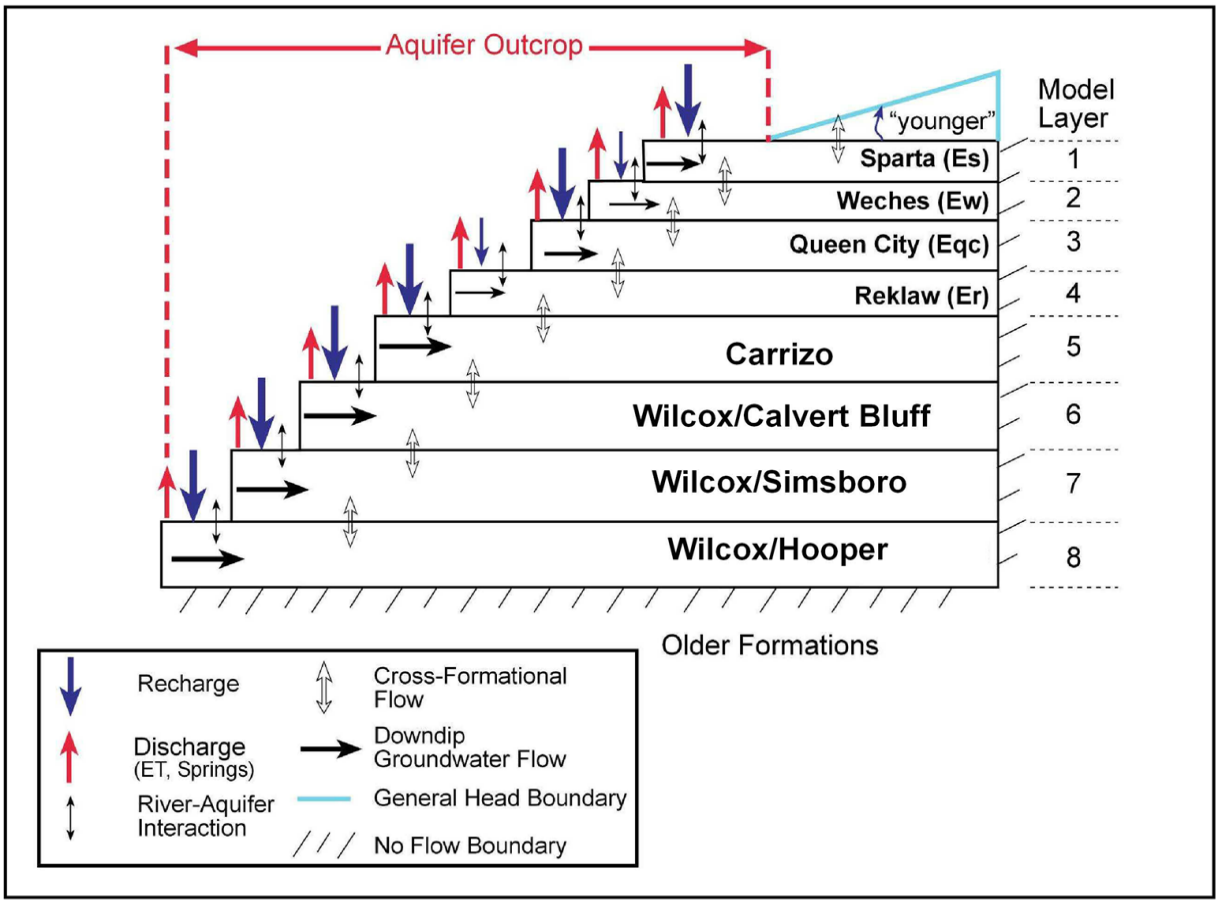

Figure 1
Geologic Units Represented in the GAM

2.2 Leakage from other aquifers

The effects of LCRA's pumping would not be limited to the Simsboro Aquifer. The pumping would induce leakage from the Calvert Bluff and Hooper aquifers. This leakage would reduce water levels in the Calvert Bluff and Hooper aquifers. In figure 1, leakage (cross-formational flow) between geologic units is indicated by double-headed arrows. In a 2009 pump-test conducted in Lee County, it was estimated that 22% of the water pumped from the Simsboro was derived from leakage from adjacent aquifers[8].

Table 1 shows the effects of LCRA's pumping on the Calvert Bluff, Simsboro, and Hooper aquifers. It should be noted that the drawdowns shown in table 1 would be in addition to the drawdowns due to baseline pumping (table 2). Drawdowns in the Calvert Bluff and Hooper aquifers due to LCRA's proposed pumping are shown in figures 3 and 4.

[8] Thornhill 2009, page 8.

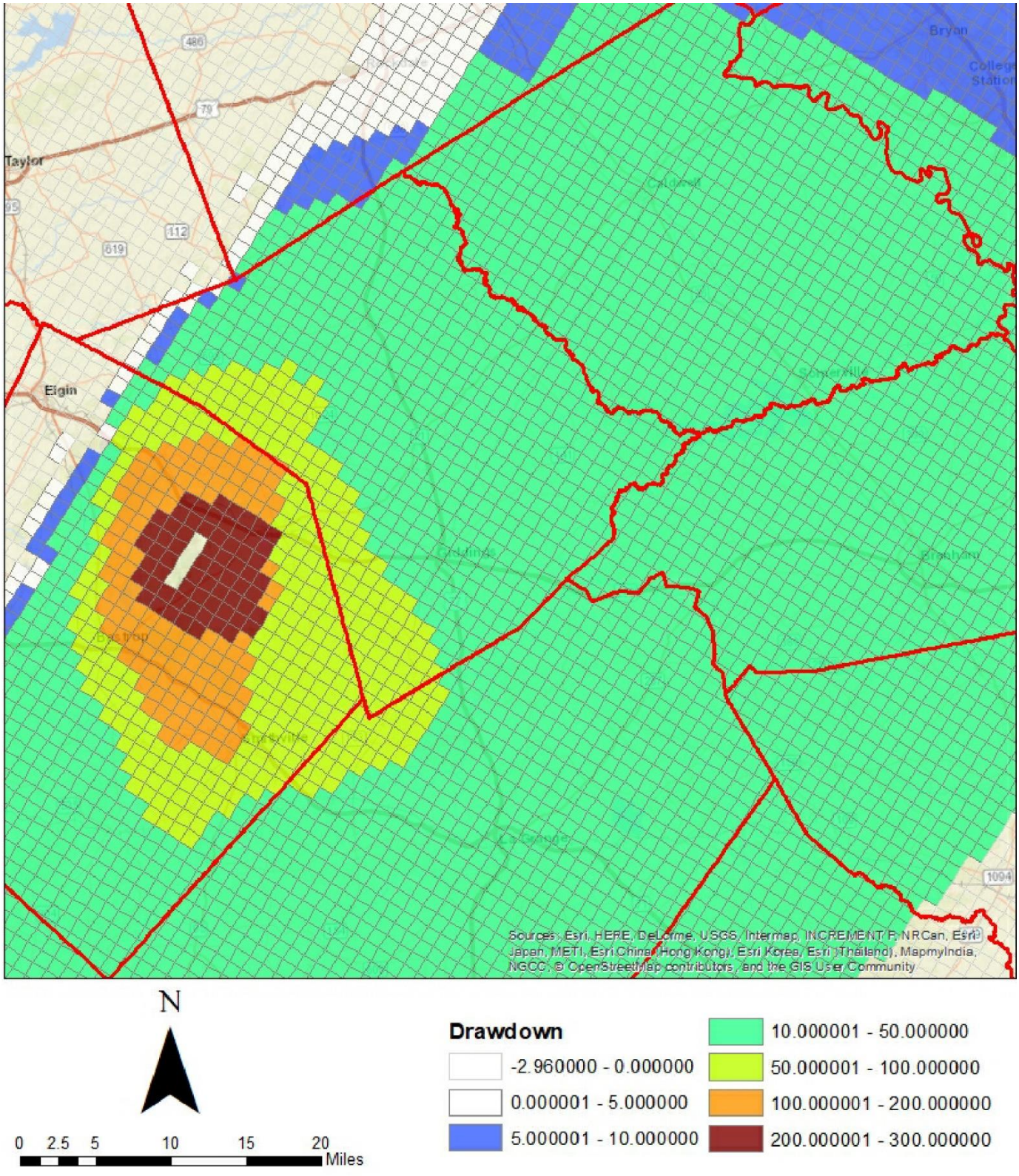

Figure 2
Drawdown in Simsboro Aquifer Due to LCRA Proposed Pumping (2060)

Table 1
GAM Predicted Drawdowns in 2060 due to
LCRA Pumping of 25,000 acre-feet per year
From the Simsboro Aquifer[9]

Aquifer (model Layer)	Maximum drawdown at LCRA wellfield (ft)	Average drawdown throughout LPGCD (ft)	Average Drawdown in Bastrop County (ft)	Average Drawdown in Lee County (ft)
Calvert Bluff (6)	22	13	13	13
Simsboro (7)	339	60	80	37
Hooper (8)	22	17	16	18

Table 2
GAM Predicted Drawdowns between 2010 and 2060 due to Baseline Pumping[10]

Aquifer (model Layer)	Average drawdown throughout LPGCD (ft)	Average Drawdown in Bastrop County (ft)	Average Drawdown in Lee County (ft)
Carrizo (5)	28	20	34
Calvert Bluff (6)	84	53	118
Simsboro (7)	234	147	333
Hooper (8)	132	93	176

[9] Drawdowns calculated by comparing GAM runs for baseline pumping, and baseline pumping plus proposed LCRA pumping of 25,000 acre-feet per year. The well file for the proposed pumping (Run151.wel) was created by DBS and provided by Jim Totten of LPGCD in May 2018. The baseline run used a modified version of Run151.well - the LCRA pumping of 25,000 ac-ft/yr was removed. The values were replaced with the values in the old baseline pumping file (Run50.wel).

[10] Drawdowns for baseline pumping in 2060 minus drawdowns for baseline pumping in 2010.

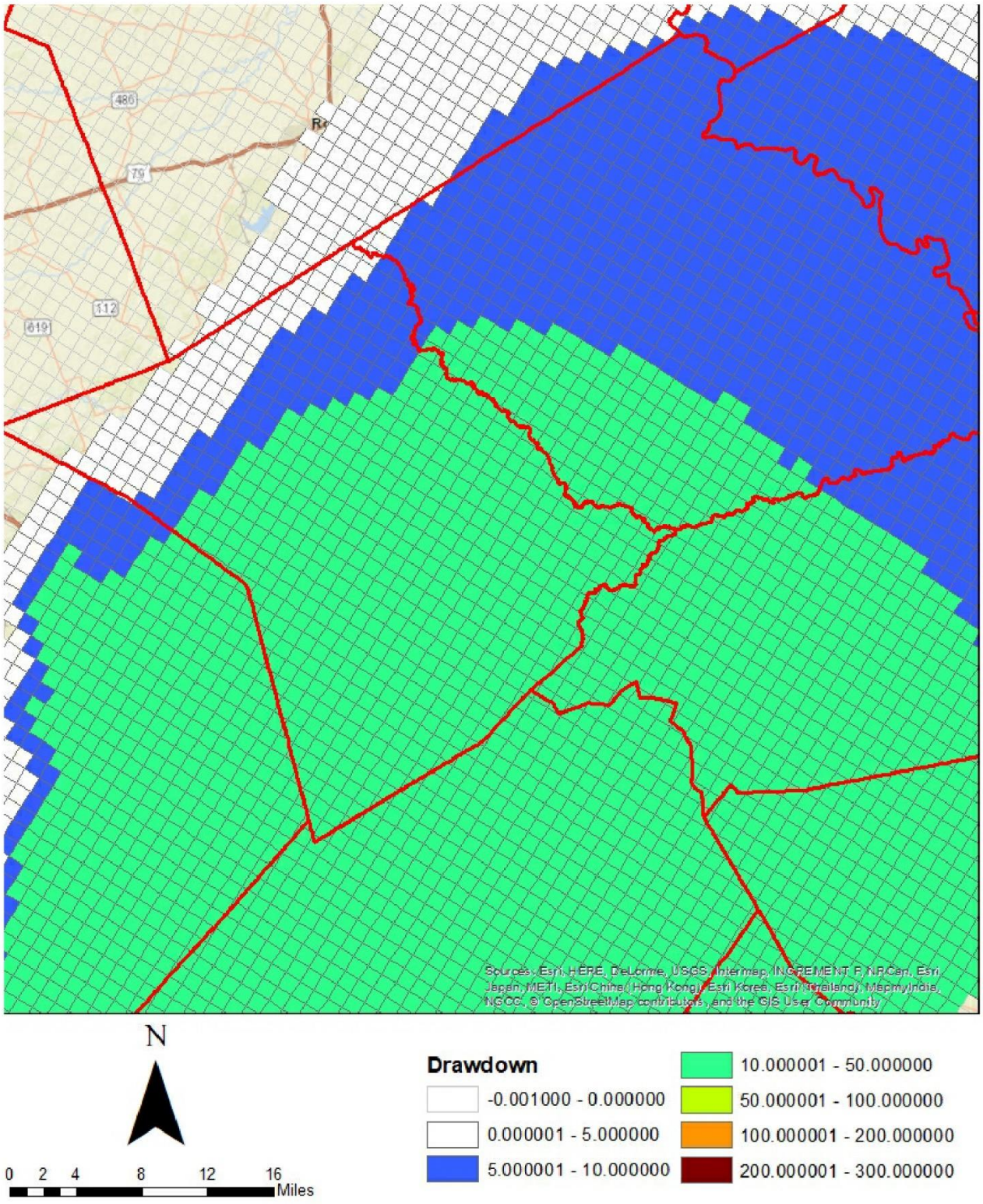

Figure 3
Drawdown in Calvert Bluff Aquifer Due to LCRA Proposed Pumping (2060)

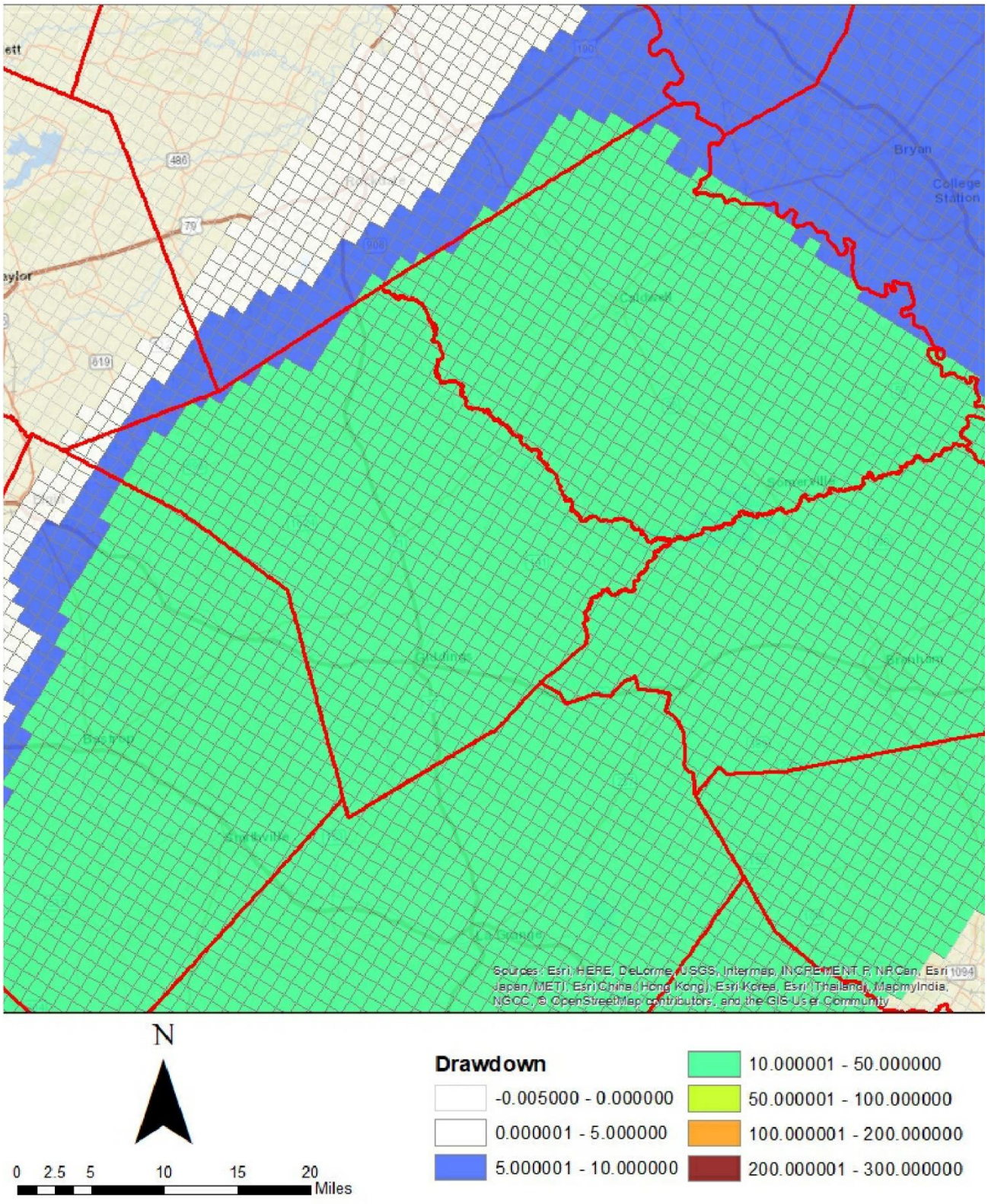

Figure 4
Drawdown in Hooper Aquifer Due to LCRA Proposed Pumping (2060)

3.0 Effects on groundwater discharges to Colorado River

As shown elsewhere, the GAM does not accurately predict the effects of pumping on the amount of groundwater discharged to the Colorado River. It does, however, reliably predict the trends in groundwater discharge resulting from pumping.[11] A new version of the GAM is being developed[12]. One objective of the new GAM is *to help improve the capability to simulate surface water-groundwater interaction … .*[13]

Figure 5 shows that LCRA's pumping would decrease groundwater discharge to the Colorado River.

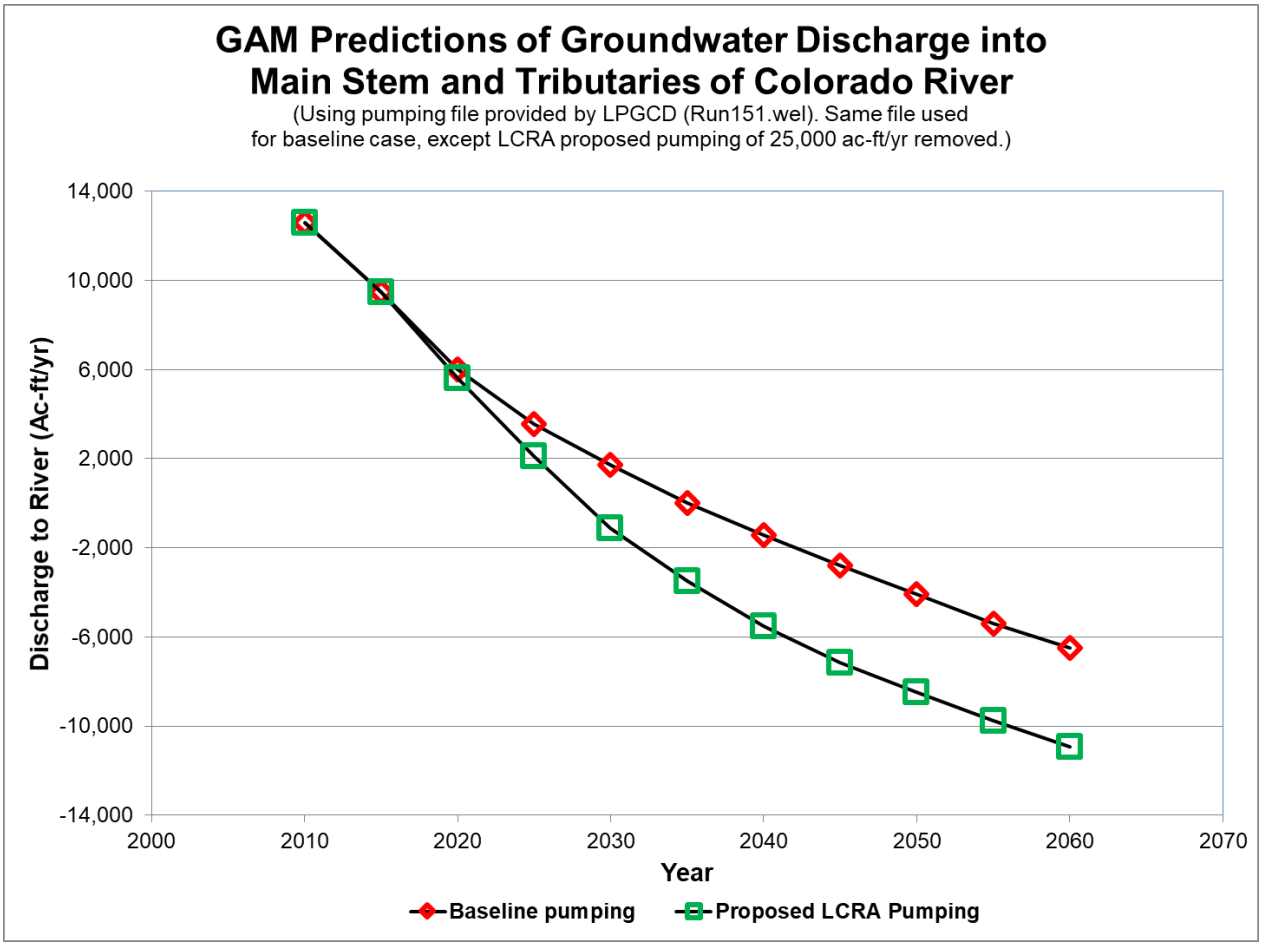

Figure 5
GAM Prediction of Groundwater Discharge to Colorado River and its Tributaries

[11] Rice, G., 2015, appendix 1.
[12] TWDB, 2017.
[13] TWDB, 2017, page xiii.

4.0 Conclusions

LCRA's proposed pumping would:

- Reduce hydraulic heads in the Calvert Bluff, Simsboro, and Hooper aquifers.
- The reduced heads in the confined portions of these aquifers would cause water levels in wells to decline.
- Reduced heads in the unconfined portion of the aquifers (recharge area) would cause dewatering of portions of the aquifers.
- Reduce groundwater discharge to the Colorado River, thereby reducing the amount of water flowing in the river.[14]

References

DBS (Daniel B. Stephens & Associates, Inc.), 2018, *Memorandum to Jim Totten, General Manager, Lost Pines Groundwater Conservation District*, April 6, 2018.

LCRA (Lower Colorado River Authority), 2018, *Lower Colorado River Authority's Application for Groundwater Operating and Transport Permits for Griffith League Ranch*, submitted to the Lost Pines Groundwater Conservation District, February 21, 2018. Note: LCRA submitted eight applications on this date, one for each well.

LPGCD (Lost Pines Groundwater Conservation District), 2013, input, output, and summary files related to LPGCD's GAM runs.

Rice, G., 2015, *Effects of Vista Ridge Pumping on Groundwater and Surface Water in the Lost Pines and Post Oak Savannah Groundwater Conservation Districts*, Appendix 1
Reliability of GAM Groundwater Discharge Predictions, Amount and Trend of Discharge to Streams, September 22, 2015.

Thornhill (Thornhill Group, Inc.), 2009, *A Report of Results of Drilling and Testing Programs to Verify Ground-Water Supplies in the Simsboro Aquifer – Proposed End Op, LP Well Fields in Bastrop and Lee Counties, Texas*, April 15, 2009.

TWDB, 2004, *Groundwater Availability Models for the Queen City and Sparta Aquifers*, October, 2004.

TWDB, 2017, *Final Report: Field Studies and Updates to the Central Carrizo-Wilcox, Queen City, and Sparta GAM to Improve the Quantification of Surface Water-Groundwater Interaction in the Colorado River Basin*, August 2017.

[14] It is possible that the reduction in flow caused by LCRA pumping would contribute to a reversal of the hydraulic relationship between the Colorado River and the Carrizo Wilcox aquifers. That is, LCRA's pumping, together with baseline pumping and other proposed pumping projects (e.g., End Op, Forestar), could result in the Colorado changing from a stream that gains water from the aquifers, to a stream that loses water to the aquifers.