Rolling Plains Groundwater Conservation District

Part 2 – Data Required for Management Plan GAM Run 25-004

TEXAS WATER DEVELOPMENT BOARD

Gare Ambrose-Igho and Shirley Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Modeling Department
February 4, 2026



Shirley C. Wade
2/4/2026

INTRODUCTION

Texas Water Code § 36.1071(h), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the Executive Administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the Executive Administrator.

The TWDB provides data and information to the Rolling Plains Groundwater Conservation District in two parts. This report constitutes part 2, the required groundwater availability modeling information, which includes:

1. the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;
2. the annual volume of water that discharges from the aquifer to springs and any surface-water bodies, including lakes, streams, and rivers, for each aquifer within the district; and
3. the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

This report replaces the results of GAM Run 19-020 (Jones, 2019). We used three groundwater availability models for the Rolling Plains Groundwater Conservation District. Information for the Seymour and Blaine aquifers is from version 1.01 of the groundwater availability model for the Seymour and Blaine aquifers (Ewing and others, 2004) and from the groundwater availability model for the Seymour Aquifer in Haskell, Knox, and Baylor counties (Jigmond and others, 2014). Information for the Cross Timbers Aquifer is from version 1.01 of the groundwater availability model for the Cross Timbers Aquifer (Harmon and others, 2025).

The groundwater management plan for the Rolling Plains Groundwater Conservation District should be adopted by the district on or before March 8, 2030, and submitted to the Executive Administrator of the TWDB on or before April 7, 2030. The current management plan for the Rolling Plains Water Conservation District expires on June 6, 2030.

METHODS

In accordance with the provisions of the Texas Water Code § 36.1071 (h), the groundwater availability models mentioned above were used to estimate information for the Rolling Plains Groundwater Conservation District management plan. The average annual water budget values for recharge, surface-water outflow, inflow to the district, outflow from the district, and the flow between aquifers within the district are summarized in this report.

Values may differ from the previous report as a result of routine updates to the spatial grid files used to define county, groundwater conservation district, and aquifer boundaries, which can impact the calculated water budget values. Additionally, the approach used for analyzing model results is reviewed during each update and may have been refined to better delineate groundwater flows. Finally, results may differ due to the use of more recent models or techniques.

It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

If the Rolling Plains Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions after reviewing the figures, please notify the TWDB Groundwater Modeling Department at your earliest convenience.

The flow components presented in this report do not represent the full groundwater budget. If additional inflow and outflow information would be helpful for planning purposes, the district may submit a request in writing to the TWDB Groundwater Modeling Department for the full groundwater budget.

Models and Aquifers

Groundwater availability model for the Seymour and Blaine aquifers

- Version 1.01 (Ewing and others, 2004)
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).
- Water budgets were extracted for the historical calibration period (1980 through 1999) using ZONEBUDGET for MODFLOW 2000 Version 3.01 (Harbaugh, 2009).
- This model was used to analyze the following aquifers:
    - Seymour Aquifer
    - Blaine Aquifer

Groundwater availability model for the Seymour Aquifer in Haskell, Knox, and Baylor counties

- Version 1.01 (Jigmond and others, 2014)
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).
- Water budgets were extracted for the historical calibration period (1980 through 2005) using ZONEBUDGET Version 3.01 (Harbaugh, 2009).
- This model was used to analyze the following aquifer:
    - Seymour Aquifer

Groundwater availability model for the Cross Timbers Aquifer

- Version 1.01 (Harmon and others, 2025)
- The model was run with MODFLOW 6 (Langevin and others, 2017).
- Water budgets were extracted for the historical calibration period (1980 through 2022) using ZONEBUDGET for MODFLOW 6 (Langevin and others, 2021).
- This model was used to analyze the following aquifer:
    - Cross Timbers Aquifer

For more information on model parameters, packages used to simulate groundwater flow, other model layers, or model assumptions, please see the associated model reports linked in the References section.

RESULTS

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the groundwater availability model results for the Seymour, Blaine, and Cross Timbers aquifers located within Rolling Plains Groundwater Conservation District:

1. Precipitation recharge - the areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.
2. Surface-water outflow - the total water discharging from the aquifer (outflow) to surface-water features such as streams, reservoirs, and springs.
3. Flow into and out of district - the lateral flow within the aquifer between the district and adjacent counties.
4. Flow between aquifers - the net vertical flow between the aquifer and adjacent aquifers or confining units. This flow is controlled by the relative water levels in each aquifer and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs.

The information needed for the district's management plan is summarized in Tables 1 through 3. Figures 1, 3, and 5 show the area of the models from which the values in Tables 1 through 3 were extracted. Figures 2, 4, and 6 provide a generalized diagram of the groundwater flow components provided in Tables 1 through 3.

Table 1: Summarized information for the Seymour Aquifer. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Seymour Aquifer	111,944
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Seymour Aquifer	61,515
Estimated annual volume of flow into the district within each aquifer in the district	Seymour Aquifer	408
Estimated annual volume of flow out of the district within each aquifer in the district	Seymour Aquifer	3,503
Estimated net annual volume of flow between each aquifer in the district	From Seymour Aquifer to underlying units	6,950
	From Seymour Aquifer to Cross Timbers Aquifer	1*

*Value calculated using the groundwater availability model for the Cross Timbers Aquifer (Harmon and others, 2025).

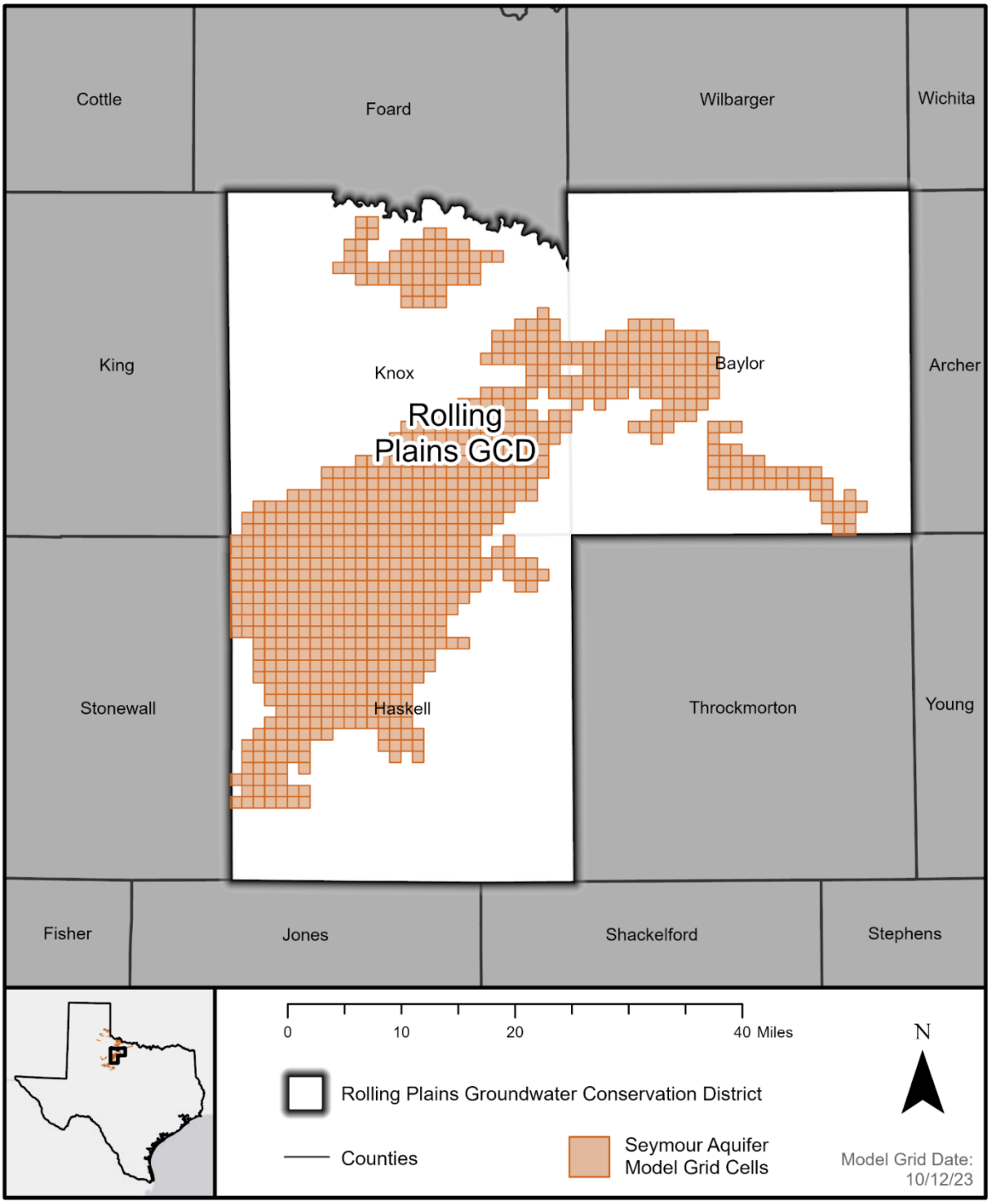
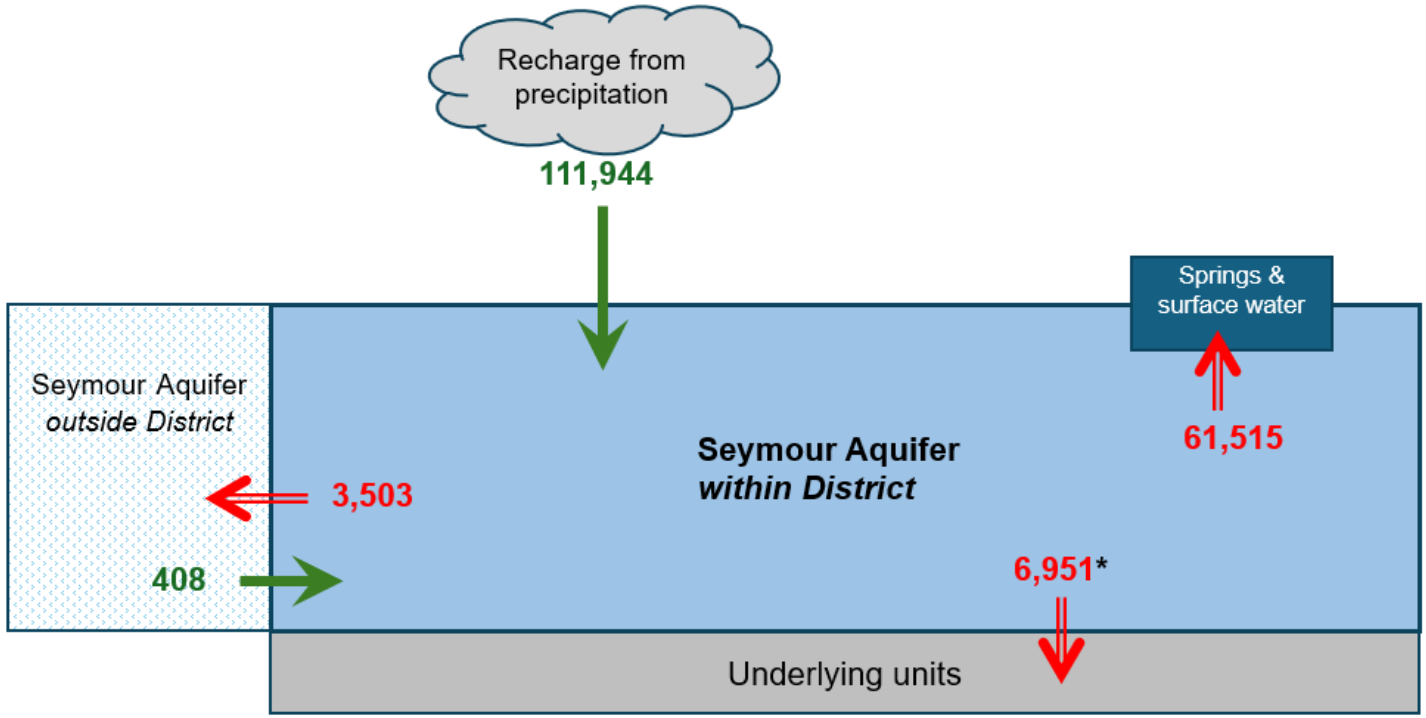


Figure 1: Area of the groundwater availability model for the Seymour Aquifer from which the information in Table 1 was extracted (the Seymour Aquifer extent within the district boundary).



*6,951 acre-feet of flow includes 1 acre-foot of outflow to the Cross Timbers Aquifer and 6,950 acre-feet of outflow to other underlying units.

Caveat: This diagram only includes the water budget items provided in Table 1. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 2: Generalized diagram of the summarized budget information from Table 1, representing directions of flow for the Seymour Aquifer within the Rolling Plains Groundwater Conservation District. Flow values are expressed in acre-feet per year.

Table 2: Summarized information for the Blaine Aquifer. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Blaine Aquifer	702
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Blaine Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Blaine Aquifer	1,823
Estimated annual volume of flow out of the district within each aquifer in the district	Blaine Aquifer	3
Estimated net annual volume of flow between each aquifer in the district	From Blaine Aquifer to Blaine Aquifer equivalent units	4,922

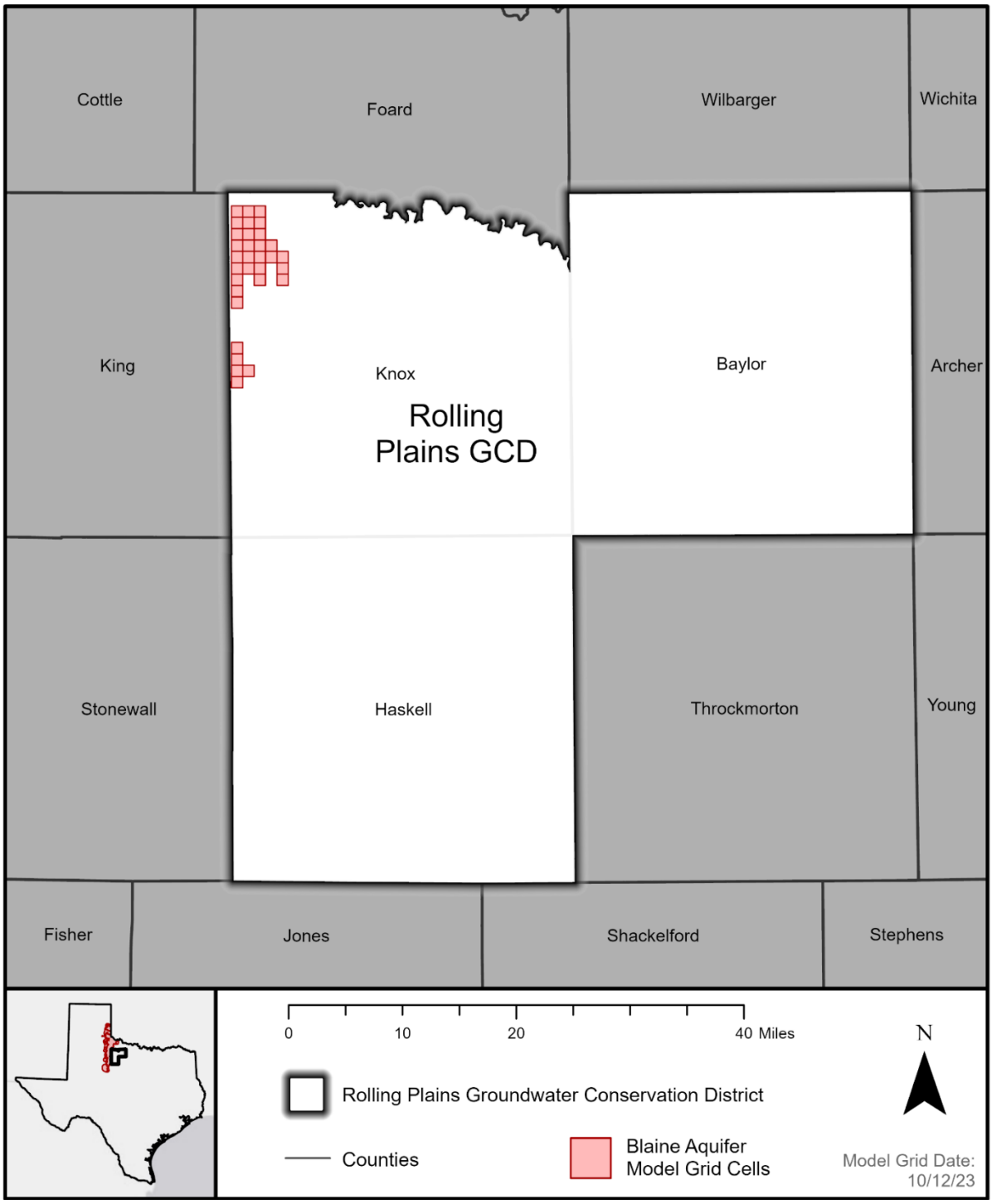
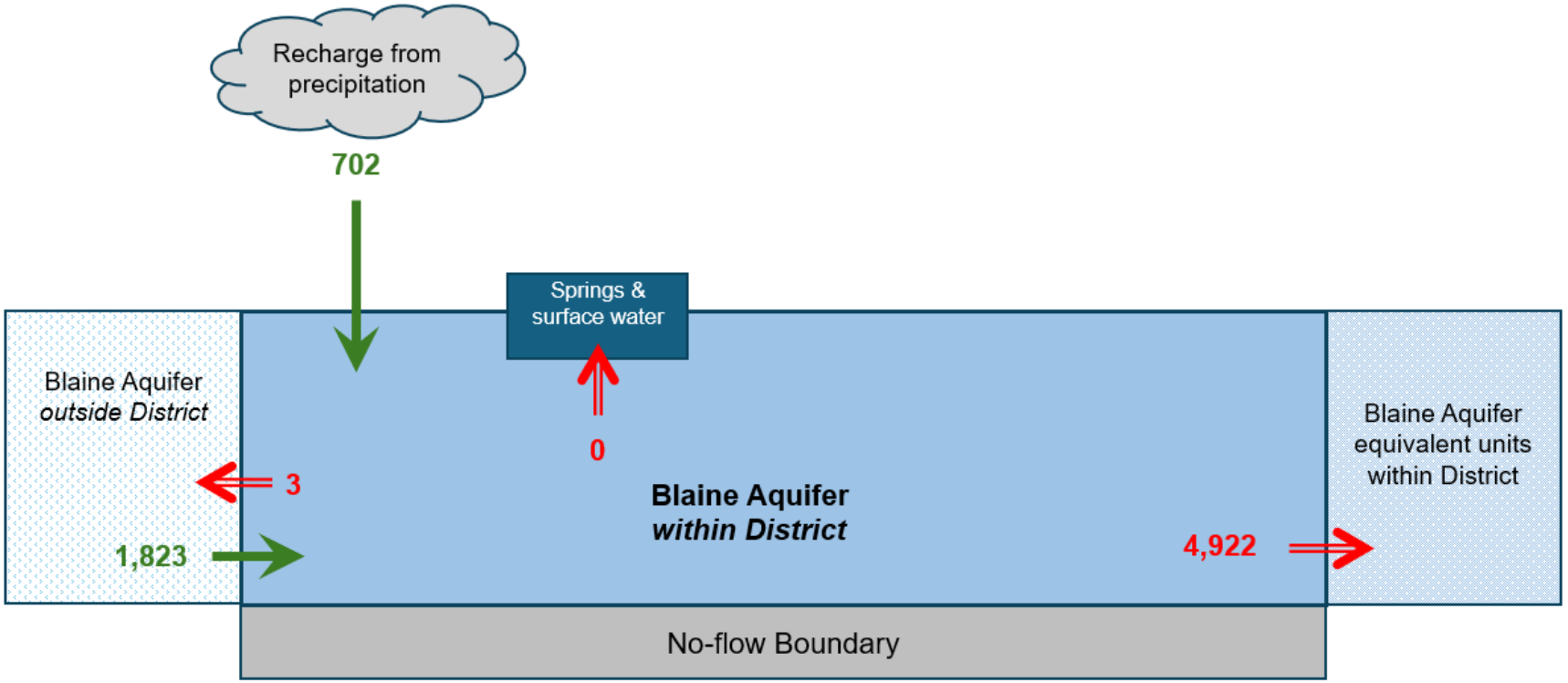


Figure 3: Area of the groundwater availability model for the Blaine Aquifer from which the information in Table 2 was extracted (the Blaine Aquifer extent within the district boundary).



Caveat: This diagram only includes the water budget items provided in Table 2. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 4: Generalized diagram of the summarized budget information from Table 2, representing directions of flow for the Blaine Aquifer within the Rolling Plains Groundwater Conservation District. Flow values are expressed in acre-feet per year.

Table 3: Summarized information for the Cross Timbers Aquifer. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Cross Timbers Aquifer	3,888
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Cross Timbers Aquifer	3,876
Estimated annual volume of flow into the district within each aquifer in the district	Cross Timbers Aquifer	1,292
Estimated annual volume of flow out of the district within each aquifer in the district	Cross Timbers Aquifer	1,347
Estimated net annual volume of flow between each aquifer in the district	To Cross Timbers Aquifer from Seymour Aquifer	1
	From Cross Timbers Aquifer to Marble Falls formation	<1

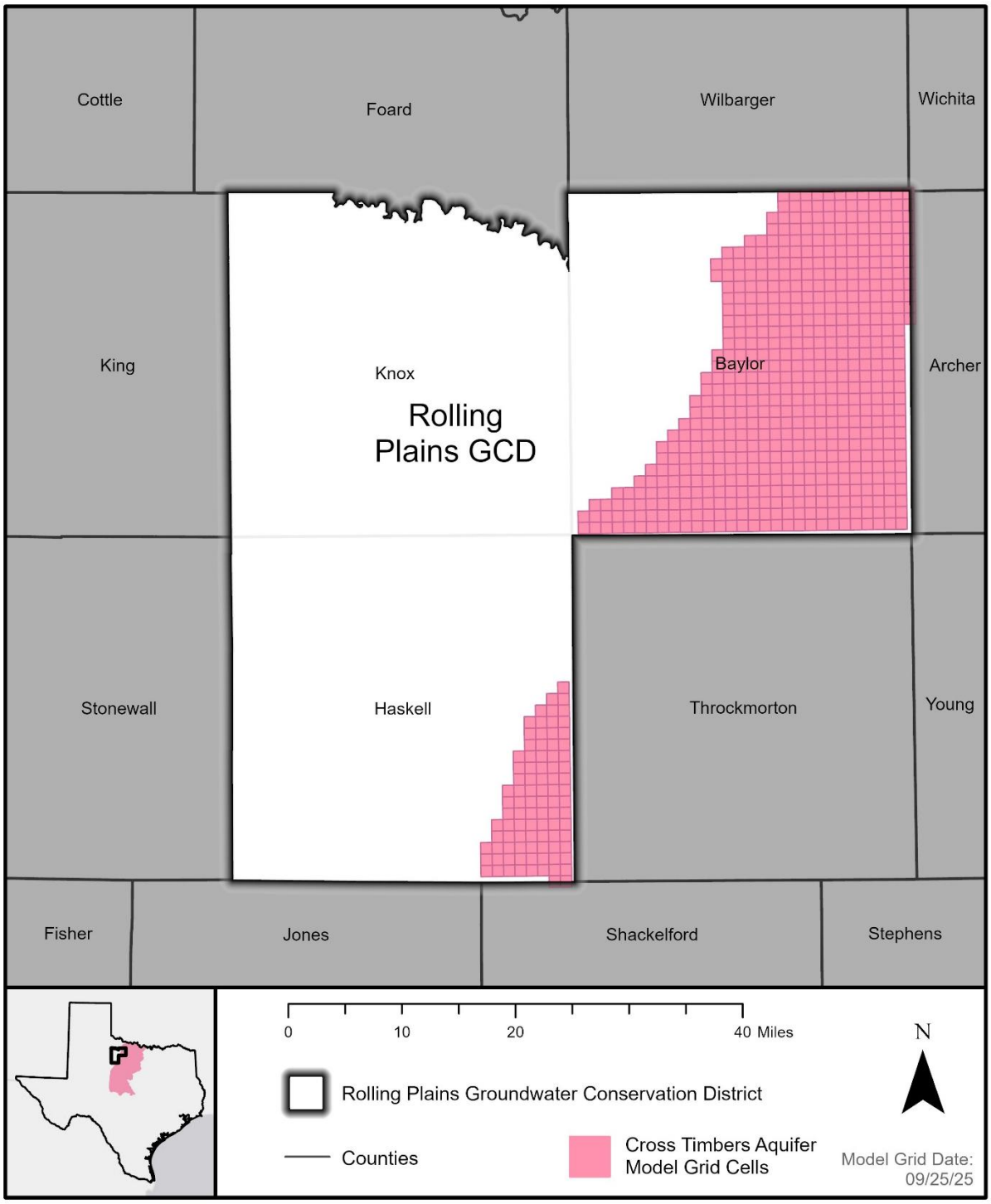
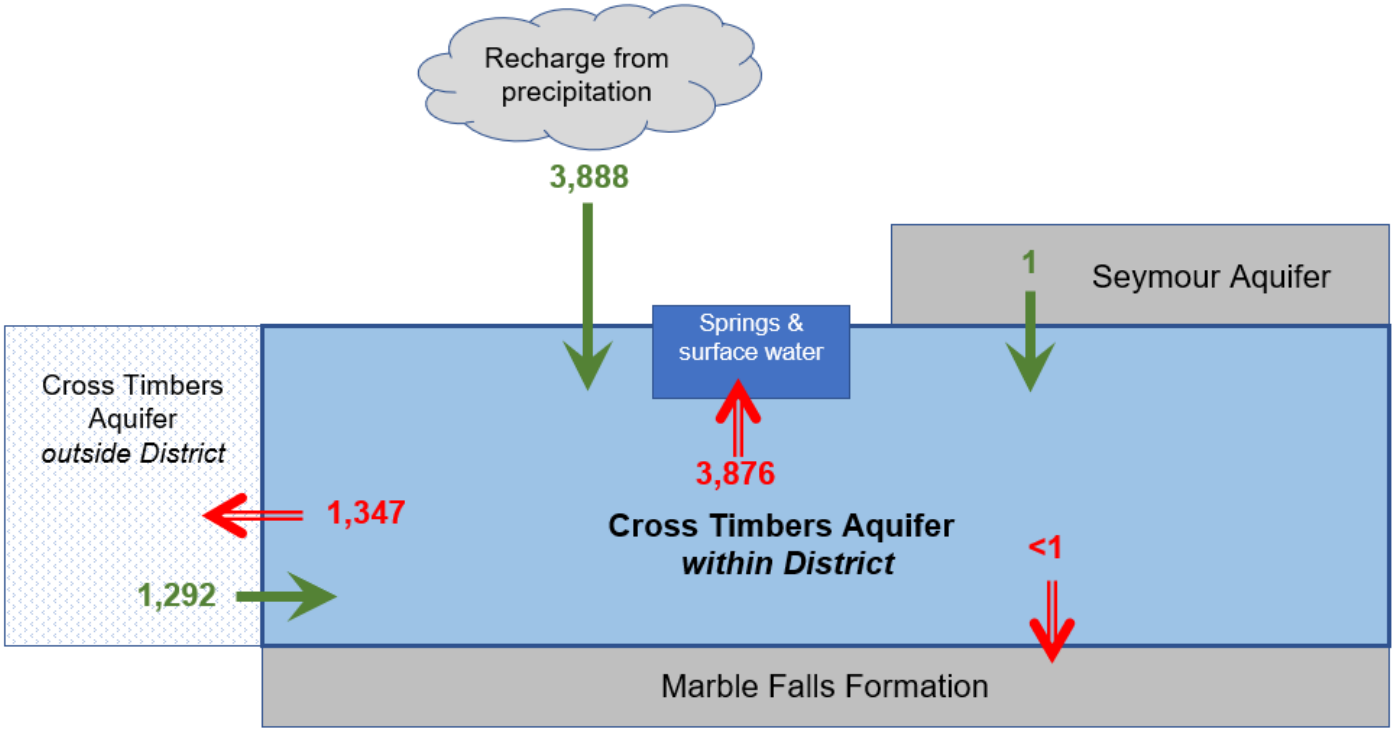


Figure 5: Area of the groundwater availability model for the Cross Timbers Aquifer from which the information in Table 3 was extracted (the Cross Timbers Aquifer extent within the district boundary).



Caveat: This diagram only includes the water budget items provided in Table 3. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 6: Generalized diagram of the summarized budget information from Table 3, representing directions of flow for the Cross Timbers Aquifer within the Rolling Plains Groundwater Conservation District. Flow values are expressed in acre-feet per year.

LIMITATIONS

The groundwater models used in completing this analysis are the best available scientific tools that can be used to meet the stated objectives. To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

> *"Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."*

A key aspect of using a groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historical pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and interaction with streams are specific to particular historic time periods.

Because the application of groundwater models was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations related to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of groundwater models and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

REFERENCES

Ewing, J.E., Jones, T.L., Pickens, J.F., Chastain-Howley, A., Dean, K.E., and Spear, A.A., 2004, Groundwater availability model for the Seymour Aquifer: Final report prepared for the Texas Water Development Board by INTERA, Inc., 533p., http://www.twdb.texas.gov/groundwater/models/gam/symr/SYMR_Model_Report.pdf.

Harbaugh, A. W., Banta, E. R., Hill, M. C., and McDonald, M. G., 2000, MODFLOW-2000, the U.S. Geological Survey modular ground-water model -- User guide to modularization concepts and the Ground-Water Flow Process: U.S. Geological Survey Open-File Report 00-92, 121 p.

Harbaugh, A. W., 2009, Zonebudget Version 3.01, A computer program for computing subregional water budgets for MODFLOW ground-water flow models, U.S. Geological Survey Groundwater Software., water.usgs.gov/nrp/gwsoftware/zonebud3/zonebudget3.html.

Harmon, R., Miller, S., Moore, S., White, J., and Ellis, J., 2025, Groundwater Availability Model for the Cross Timbers Aquifer: Final report prepared for the Texas Water Development Board by INTERA, Inc 222 p., Cross Timbers Aquifer Groundwater Availability Model | Texas Water Development Board

Jigmond, M., Hutchison, W. R., and Shi, J., 2014, Final Report: Groundwater Availability Model of the Seymour Aquifer in Haskell, Knox, and Baylor Counties, 185 p., http://www.twdb.texas.gov/groundwater/models/gam/symr_hkb/Seymour_HKB_GAM_Report_Sealed_021414.pdf.

Jones, I., 2019, GAM Run 19-020: Texas Water Development Board, GAM Run 19-020 Report, 12 p., https://www.twdb.texas.gov/groundwater/docs/GAMruns/GR19-020.pdf

Langevin, C.D., Hughes, J.D., Banta, E.R., Niswonger, R.G., Panday, S. and Provost, A.M., 2017. *Documentation for the MODFLOW 6 groundwater flow model* (No. 6-A55). US Geological Survey.

Langevin, C.D., Hughes, J.D., Banta, E.R., Provost, A.M., Niswonger, R.G., and Panday, S., 2021, ZONEBUDGET for MODFLOW 6, 14 p., https://doi.org/10.5066/F76Q1VQV

National Research Council, 2007, Models in Environmental Regulatory Decision Making Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p., www.nap.edu/catalog/11972/models-in-environmental-regulatory-decision-making.

Texas Water Code § 36.1071