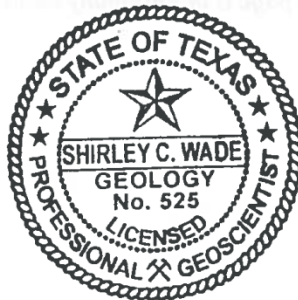

GAM RUN 18-011: PECAN VALLEY GROUNDWATER CONSERVATION DISTRICT GROUNDWATER MANAGEMENT PLAN

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May 21, 2018



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EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2015), 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 Pecan Valley Groundwater Conservation District in two parts. Part 1 is the Estimated Historical Water Use/State Water Plan dataset report, which will be provided to you separately by the TWDB Groundwater Technical Assistance Department. Please direct questions about the water data report to Mr. Stephen Allen at 512-463-7317 or stephen.allen@twdb.texas.gov. Part 2 is the required groundwater availability modeling information and this information includes:

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

The groundwater management plan for the Pecan Valley Groundwater Conservation District should be adopted by the district on or before February 6, 2019

and submitted to the Executive Administrator of the TWDB on or before March 8, 2019. The current management plan for the Pecan Valley Groundwater Conservation District expires on May 7, 2019.

We used three groundwater availability models to estimate the management plan information for the aquifers within the Pecan Valley Groundwater Conservation District. Information for the Carrizo-Wilcox Aquifer is from version 2.01 of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Kelley and others, 2004). Information for interaction between the Yegua-Jackson subcrop and parts of the Gulf Coast Aquifer System is from version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer (Deeds and others, 2010). Information for the Gulf Coast Aquifer System is from version 1.01 of the groundwater availability model for the central portion of the Gulf Coast Aquifer System (Chowdhury and others, 2004).

This report replaces the results of GAM Run 12-024 (Wade, 2012), as the approach used for analyzing model results has since been refined. Tables 1 and 2 summarize the groundwater availability model data required by statute and Figures 1 and 2 show the area of the models from which the values in the tables were extracted. If, after review of the figures, the Pecan Valley Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the three groundwater availability models mentioned above were used to estimate information for the Pecan Valley Groundwater Conservation District management plan. Water budgets were extracted for the historical model periods for the Carrizo-Wilcox, Aquifer (1980 through 1999), Yegua-Jackson subcrop (1980 through 1997) and Gulf Coast Aquifer System (1980 through 1999) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface-water outflow, inflow to the district, outflow from the district, and inter-aquifer flow for the aquifers within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Carrizo-Wilcox Aquifer

- We used version 2.01 of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. See Deeds and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater

availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.

- This groundwater availability model includes eight layers, which generally represent the Sparta Aquifer (Layer 1), the Weches Formation confining unit (Layer 2), the Queen City Aquifer (Layer 3), the Reklaw Formation confining unit (Layer 4), the Carrizo Formation (Layer 5), the Upper Wilcox Unit (Layer 6), the Middle Wilcox Unit (Layer 7), and the Lower Wilcox Unit (Layer 8).
- Because the Queen City and Sparta aquifers are not present in Pecan Valley Groundwater Conservation District, water budgets for the district were determined only for the Carrizo-Wilcox Aquifer (Layers 5 through 8, collectively).
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

Gulf Coast Aquifer System

- We used version 1.01 of the groundwater availability model for the central part of the Gulf Coast Aquifer System for this analysis. See Chowdhury and others (2004) and Waterstone and others (2003) for assumptions and limitations of the groundwater availability model.
- The model has four layers which represent the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), and the Jasper Aquifer and parts of the Catahoula Formation in direct hydrologic communication with the Jasper Aquifer (Layer 4).
- Water budgets for the district were determined for the Gulf Coast Aquifer System (Layers 1 through 4, collectively).
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).
- Because this model assumes a no-flow boundary condition at the base we used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer to investigate groundwater flows between the Catahoula Formation and the Yegua-Jackson subcrop (non-aquifer) and between the Catahoula Formation and the base of the Gulf Coast Aquifer System. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model for the Yegua-Jackson Aquifer.

RESULTS:

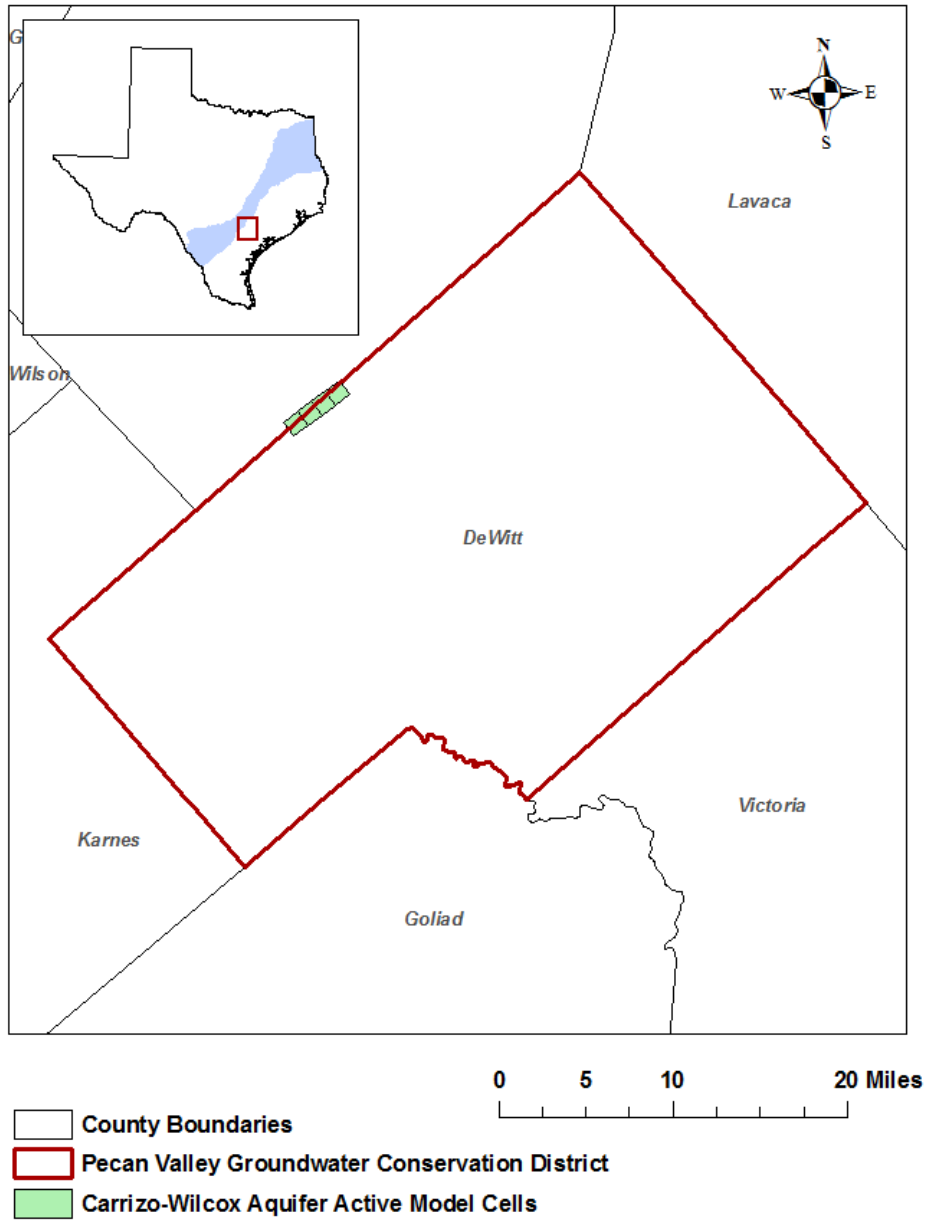
A groundwater budget summarizes the amount of water entering and leaving the aquifers according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the groundwater availability model results for the Carrizo-Wilcox Aquifer and the Gulf Coast Aquifer System, located within Pecan Valley Groundwater Conservation District and averaged over the historical calibration periods, as shown in Tables 1 and 2.

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 and 2. 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.

TABLE 1. SUMMARIZED INFORMATION FOR THE CARRIZO-WILCOX AQUIFER FOR PECAN VALLEY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. 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	Carrizo-Wilcox Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	346
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	0
Estimated net annual volume of flow between each aquifer in the district	Flow from Carrizo-Wilcox Aquifer into the overlying Reklaw Confining Unit	16
	Flow from Carrizo-Wilcox Aquifer to brackish Carrizo-Wilcox units	317



gcd boundaries date = 01.22.18, county boundaries date = 02.02.11, czwx_s_qcsp model grid date = 08.26.15

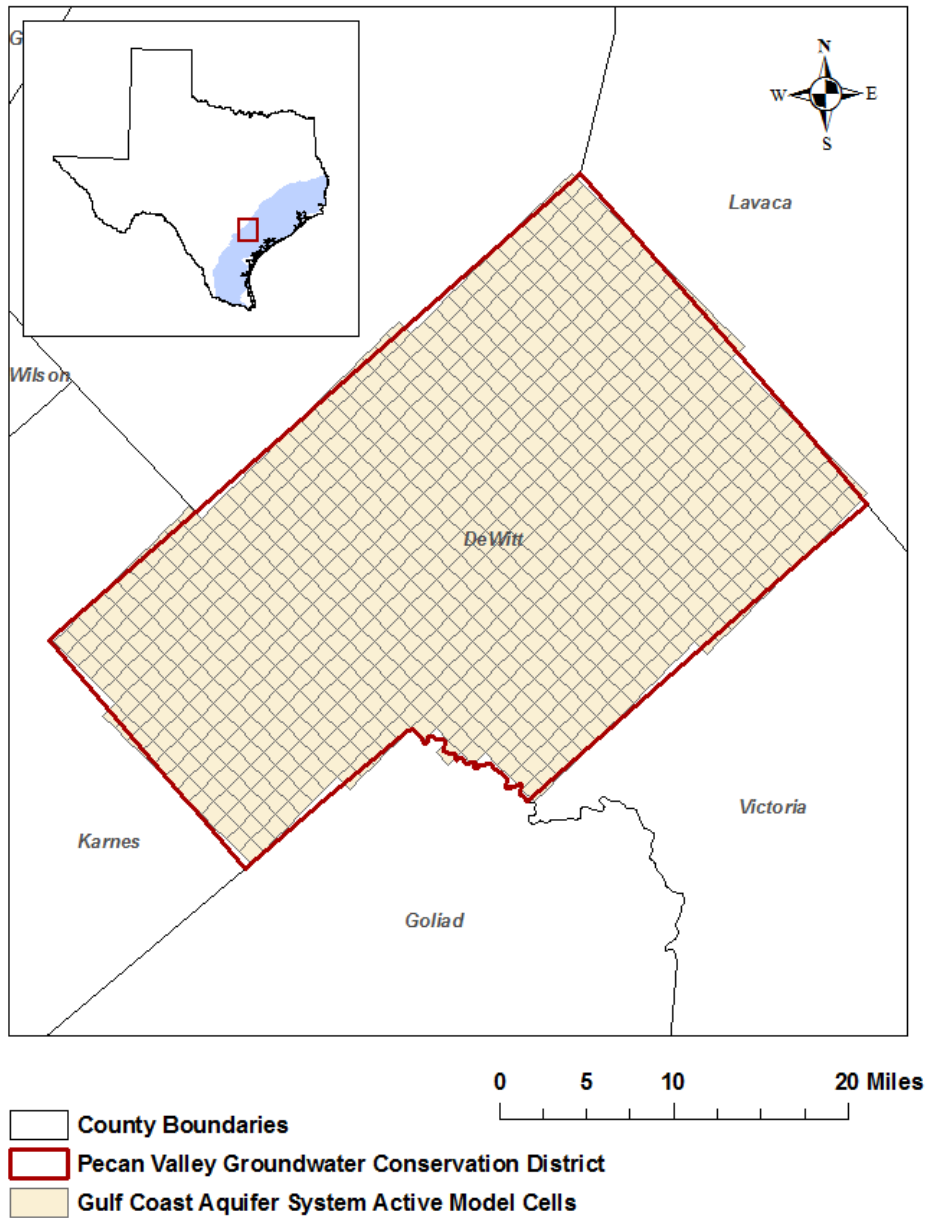
FIGURE 1. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CARRIZO-WILCOX AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2. SUMMARIZED INFORMATION FOR THE GULF COAST AQUIFER SYSTEM FOR PECAN VALLEY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. 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	Gulf Coast Aquifer System	9,832
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Gulf Coast Aquifer System	9,967
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	1,854
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	10,652
Estimated net annual volume of flow between each aquifer in the district	Flow from the Catahoula Formation into the Jasper Aquifer ¹	381
	Flow into the Catahoula Formation from underlying formations ²	175

¹ Based on the general-head boundary flux from the groundwater availability model for the Yegua-Jackson Aquifer. A part of the flow from the Catahoula Formation confining system to the Jasper Aquifer represents flow to the Gulf Coast Aquifer System from deeper units and part represents flow within the Gulf Coast Aquifer System.

² Based on flux between layers 1 and 2 in the groundwater availability model for the Yegua-Jackson Aquifer.



gdc boundaries date = 01.22.18, county boundaries date = 02.02.11, glfc_c model grid date = 12.30.15

FIGURE 2. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE GULF COAST AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

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 the groundwater model to evaluate historical groundwater flow conditions includes the assumptions about the location in the aquifer where historical 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 historical time periods.

Because the application of the 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 the groundwater model 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. Historical 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.

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GAM Run 18-011: Pecan Valley Groundwater Conservation District Groundwater Management Plan
May 21, 2018
Page 13 of 13

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