Outline of the Requirements for Hydrogeologic Assessment Reports Required for Select Drilling and Production Permit Applications to the Mid East Texas Groundwater Conservation District

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Last Updated: 15 September 2025

1. Introduction

The rules of the Mid East Texas Groundwater Conservation District ("the District") list the minimum requirements for permit applications submitted to the district. Pursuant to District Rule 14.6(B)(1), certain applicants are required to produce a report that assesses and demonstrates the potential impact of the proposed well(s) and/or the proposed additional production on existing permit holders and the overall aquifer. Section (E) of that rule reads as follows:

> *"Except for wells not capable of producing more than 250 gpm, a report detailing the projected effect of the proposed withdrawal on the aquifer or any other aquifer conditions, depletions, subsidence, or effects on existing permit holders or other groundwater users in the district; in the case of wells capable of producing over 500 gpm, the report must be signed by a professional engineer or professional geoscientist"*

This document provides clarifications and additional details concerning the requirements for the preparation of the hydrogeologic impact assessment report (hereafter referred to as "the Report") required by the district rules.

2. Report Author Qualifications

The Report, and all technical work presented therein, needs to be prepared by a specialist with experience in general hydrogeology, aquifer drawdown calculations, and groundwater modeling. For the assessment of wells capable of producing greater than 500 gpm, the report needs to be signed and sealed by a professional engineer (PE) or professional geoscientist (PG) that holds a current license issued by the state of Texas. Though it is not required, permit applications for wells producing between 250 and 500 gpm are encouraged to also be sealed by a PE or PG.

Please visit engineers.texas.gov and www.tbpg.state.tx.us for more information about PE and PG licensing requirements and procedures for properly sealing and signing reports.

3. Objective of the Report

The purpose of preparing the Report is to demonstrate to the District the potential impact of the proposed well on nearby permit holders, other nearby well owners, and the aquifer as a whole. The assessment must be performed consistent with the District's management strategies; the report shall evaluate potential local drawdowns for all proposed well(s) and include a regional drawdown analysis only if any single well is capable of producing more than 500 gpm, or if two or more wells would collectively exceed 500 gpm. Potential local drawdowns should be evaluated relative to current registered wells within the Area of Influence (AOI) of the proposed well. Regional impacts of the well should be evaluated with respect to the current Desired Future Conditions (DFC) within the district, expressed as county-wide and district-wide average drawdowns within the target aquifer throughout the current 60-year planning period. See the following section for specific details concerning these technical demonstrations.

4. Required Information and Technical Demonstrations

A) Basic Information

The Report should present the following information:

1) A map or maps showing
    a. the location of the well relative to the District boundaries and the county boundaries within the District,
    b. the location of the applicant's property boundaries, and
    c. the locations of any off-site wells completed in the target aquifer within the AOI. Clearly distinguish wells permitted by the District from wells that are exempt. The AOI is based on the limits of the drawdown cone created by the proposed well and is defined in more detail below.
2) Information on the proposed well, including
    a. Latitude and longitude in decimal degrees (WGS 84 / EPSG:4326 preferred). If another format or system is used (e.g., GAM, State Plane, UTM), provide the spatial reference details (system/projection, datum, units, zone, and EPSG code if known),
    b. proposed total depth and screened interval (in feet),
    c. proposed target aquifer,
    d. maximum requested annual production rate in millions of gallons and in acre-feet,
    e. maximum requested short-term pumping rate in gallons per minute and in acre-feet per year (if greater than the requested annual production rate), and
    f. if the maximum requested pumping rate in the proposed well (i.e., the "short-term" pumping rate) is greater than the permitted maximum annual production rate, include the number of days that the well can be pumped constantly at the maximum short-term rate before the maximum annual production rate is exceeded.

To calculate the number of days in item 2-f, divide the maximum annual production rate in millions of gallons by the short-term production rate (in gpm) times the number of minutes in a day (1440). For example:

> *Assuming a maximum annual rate of 75 million gallons and a maximum short-term rate of 400 gpm; divide 75 million gallons by 576,000 gpd (400 gpm x 1440 minutes/day) to get 130.2 days. In this example, the well can be pumped continuously for 130 days without exceeding the maximum annual production rate.*

The Report should also present an evaluation of drawdowns associated with pumping from the proposed well or wells. All applications require an evaluation of local drawdowns caused by the new well, with an emphasis on demonstrating the impact of the proposed well(s) on existing wells in the same aquifer. Applications for a new production permit, or for an amendment to an existing permit that increases the maximum allowable production rate from the permit owner's wells over 500 gpm, also require an evaluation of the regional (i.e., district-wide) impact of the requested maximum production rate on the aquifer relative to the District's current DFCs.

All drawdown calculations and model runs should include constant pumping at the maximum rate or rates for the required time periods to provide a worst-case scenario for impact. If the applicant expects that the proposed well will not be operated continuously, the applicant may include additional language and, if possible, reasonable estimates concerning the actual expected pumping durations, annual production rates, and resulting reduction in estimated drawdowns; and the District board can consider this information at their discretion.

Specific details are provided below.

B) Local Drawdown Estimates

Local drawdowns should be estimated using an analytical solution, such as the Theis equation, that calculates transient drawdowns in an aquifer that result from the pumping well(s). Assumptions concerning aquifer parameters (e.g., transmissivity and storativity) for the calculations should be clearly presented in the report. Drawdowns should be calculated at various distances from the production well(s) such that the distance from the well(s) with negligible drawdowns (i.e., less than 0.1 ft) is identified. For applications with a requested maximum short-term rate that is higher than the requested maximum annual production rate, the following sets of drawdown calculations should be presented:

1) A set of short-term drawdowns with continuous pumping at the maximum short-term rate for 1 day, 30 days, and the total number of days before the maximum annual rate is exceeded as described in item 2-f in Section 4.A above.

2) A set of long-term drawdowns with continuous pumping at the maximum annual production rate for 1 year, 20 years, and 50 years.

For applications that don't have separate maximum short-term and annual production rates, only the long-term drawdown calculations (item 2) are required. Instructions for presenting the drawdown calculations are given in Section 4.E below.

C) Area of Influence (AOI) Determination

The AOI is defined as the radius from the proposed well(s) to the point in the aquifer where the drawdown after 50 years of pumping continuously at the maximum annual production rate is equal to 25 feet, or a radius of 2.5 miles, whichever is greater. This is determined using the calculations described in item 2 in Section 4.B above. All known wells (both exempt and nonexempt) within the district that fall within the AOI need to be identified and tabulated, and the drawdowns at each well given the pumping and time conditions described in Section 4.B above should be calculated.

D) Regional (District-wide) Drawdown Estimates

Applicants requesting a new production permit, or an amendment to their current permit that would result in an increase in their maximum annual production rate, are required to also present an estimate of the regional impacts of the proposed production. Regional drawdowns should be estimated using the appropriate groundwater availability model (GAM) for the target aquifer. Applicants should evaluate the proposed well assuming constant pumping from the well from the beginning of the following calendar year throughout the remainder of the current planning period. For example:

> *Assuming that the current DFC planning period is from 2020 to 2080, an application submitted in 2025 should evaluate the drawdowns in the aquifer in question associated with constant pumping at the maximum requested rate from January 1, 2026 through December 31, 2079.*

Each GAM includes estimates of the current production within the aquifers in the district. The applicant should use the GAM to calculate the incremental and total average drawdowns throughout the district associated with pumping from the proposed well(s). "Incremental" drawdowns are defined as the drawdowns associated with the proposed well(s) only, and are calculated by running the model with and without the new well(s) and then subtracting the model-calculated drawdowns without the well(s) from those with the well(s).

For the Sparta Aquifer, the Queen City Aquifer, the Carrizo Aquifer, and the Wilcox Group formations (also known as the Hooper, Simsboro, and Calvert Bluff Aquifers), the appropriate GAM is the *Groundwater Availability Model for the Central Portion of the Sparta, Queen City, and Carrizo-Wilcox Aquifers* with the District's permit evaluation well files. For the formations in the Yegua-Jackson Aquifer system, the *Yegua-Jackson GAM* is the appropriate model. Information on the two models can be found at the following links:

- https://www.twdb.texas.gov/groundwater/models/gam/czwx_c/czwx_c.asp
- https://www.twdb.texas.gov/groundwater/models/gam/ygjk/ygjk.asp

A predictive version of the two models will be provided by the District's hydrogeologist upon request.

Specific details for each GAM are presented below:

Carrizo-Wilcox Aquifer (central portion) GAM

All drawdowns should be calculated from stress period 1 (model date 1/1/2020) in the GAM to the end of stress period 60 (model date 1/1/2080).

Model simulations should be run by adding the proposed well(s) to the appropriate model layer in two separate well files:

> **METGCD_CCW_2020-Permit.wel**; which represents current total exempt use, the current total permitted groundwater within the district, and estimates of current actual use from non-exempt wells

Total and incremental average drawdowns by county and for the entire district should be calculated using the provided well file and presented in the report. The results from the simulation should be used to develop a map showing contours of the incremental drawdowns in the aquifer resulting from pumping in the proposed well at the end of model stress period 60 (1/1/2080). Instructions for preparing the map and a summary table of drawdown results are presented below in Section 4.E.

Yegua-Jackson GAM

All drawdowns should be calculated from the end of stress period 39 (model date 1/1/2010) in the GAM to the end of stress period 89 (model date 1/1/2060). These model dates are proxies for a 50-year production window and need not align with the current calendar year.

Model simulations should be run by adding the proposed well to the appropriate model layer in the Yegua-Jackson well file provided with the model. Total and incremental average drawdowns by county and for the entire district should then be calculated and presented in the report. The results should be used to develop a map showing contours of the incremental drawdowns in the aquifer resulting from pumping in the proposed well at the end of model stress period 89 (1/1/2060). Instructions for preparing the map and a summary table of drawdown results are presented below in Section 4.E.

E) Presentation of Results

The calculated local drawdowns described in Section 4.B should be presented in a set of graphs similar to Figures 1 and 2 in Section 6 below. If the distance to the nearest property boundary is greater than 500 feet, the graphs should also include an indication of the location of the nearest property boundary relative to the proposed well(s).

The AOI as described in Section 4.C, and all known wells within the AOI, should be presented on a map similar to Figure 3 in Section 6 below. All wells should be numbered and keyed to a table that contains the well owner's name, the maximum amount in their district permit (or an indication if the well is exempt), and all the calculated drawdowns per well as requested in Section 4.C above. See Table 1 in Section 6 below for an example.

The average and maximum drawdowns determined by the GAM simulations should be tabulated and presented as in Table 2 in Section 6. The incremental drawdowns map described in Section 4.D should be at a scale that shows the borders of the county in which the proposed well is located and the extent of the 1-foot incremental drawdown contour. See Figure 4 in Section 6 below for an example.

5. Available Information and Assistance from the District

The District will provide the following to the applicant upon request:

- A table of current registered wells in the district, including permitted and exempt wells.
- A copy of the latest version of the appropriate GAM for the aquifer in question, including
    - the basic MODFLOW input files, and

- the current District well files used for the regional DFC drawdown evaluations.

6. Example Figures and Tables

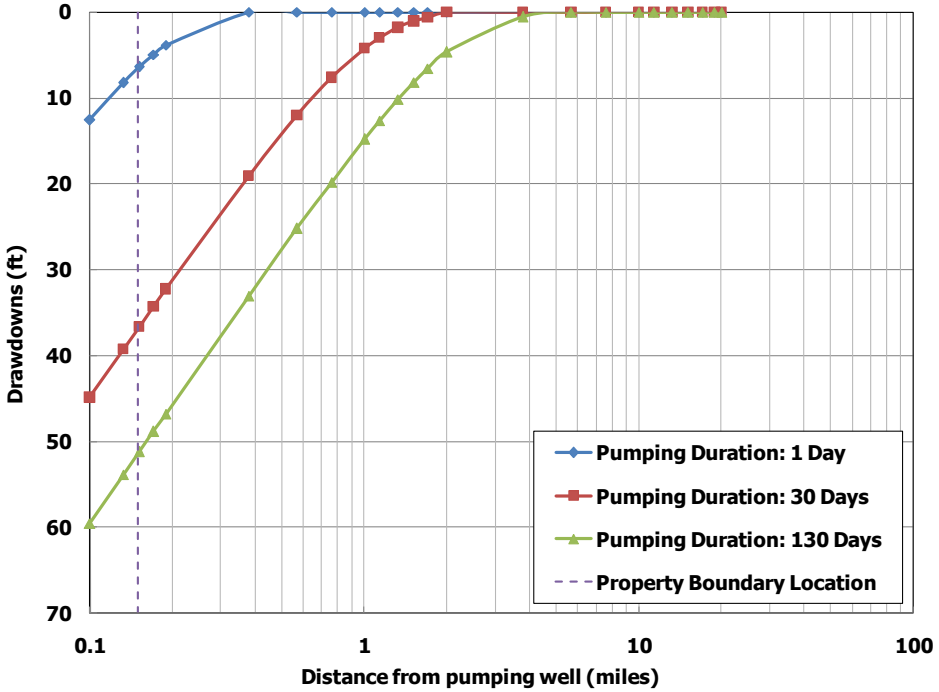

Figure 1. Short-term Drawdowns in the *xxx* Aquifer Near the Proposed *xxx* Well at the Maximum Pumping Rate (*xx* gpm)

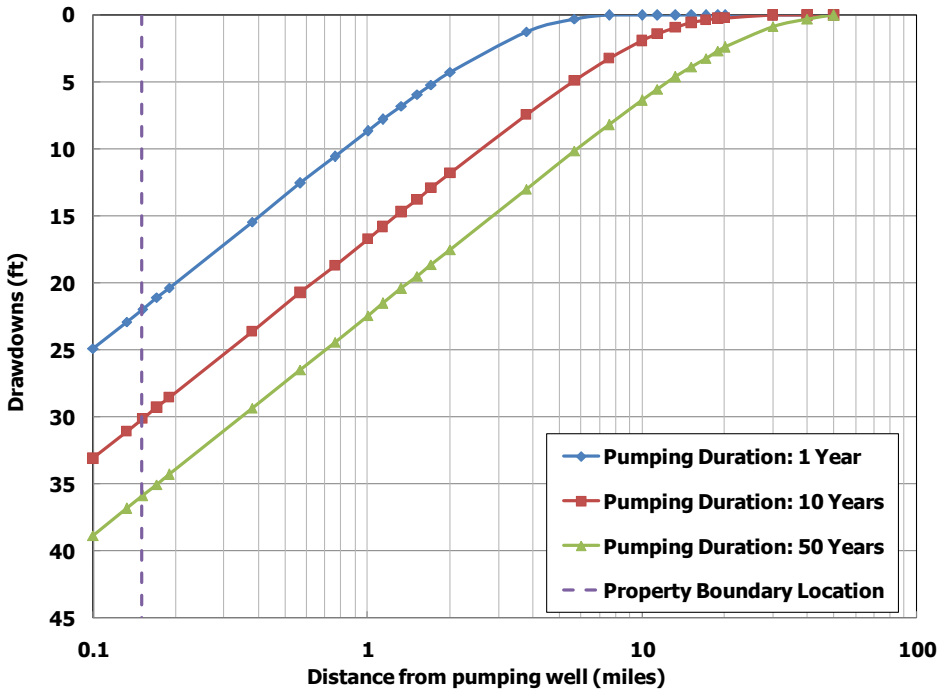

Figure 2. Long-term drawdowns in the *xxx* Aquifer near the proposed *xxx* well at the maximum requested annual production rate (*xx* million gallons)

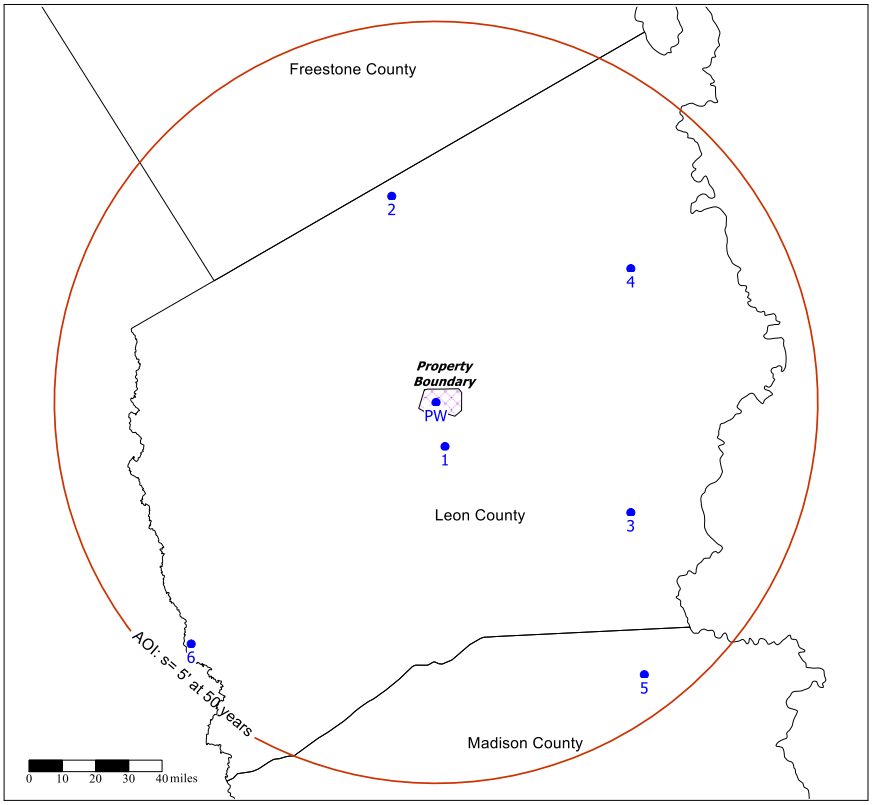

Figure 3. Map showing known wells within the AOI

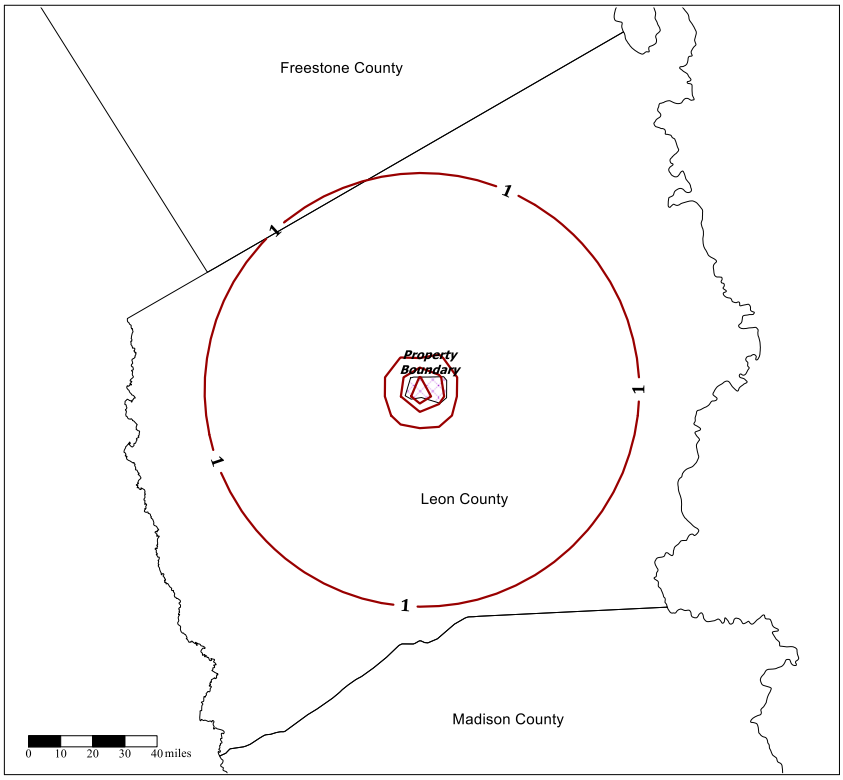

Figure 4. Map showing incremental drawdowns associated with the proposed new well.

Table 1. Estimated drawdowns at the proposed well and at off-site wells resulting from continuous pumping of the proposed well at the short-term maximum rate (xxx gpm) and at the maximum annual production rate (yy mg/yr). See Figure 3 for well locations.

Well ID#	Well Owner	METGCD Permit Amount	Estimated Drawdowns					
			xxx gpm, 1 day	xxx gpm, 30 days	xxx gpm, 120 days	yy mg/yr, 1 year	yy mg/yr, 10 years	yy mg/yr, 50 years
PW	Proposed Well	75 mg/yr	96.0	118.3	127.4	32.8	36.5	39.0
1	City of Anytown	50 mg/yr	0.0	0.0	3.6	2.2	5.6	8.2
2	John C. Doe	exempt	0.0	0.0	1.1	1.2	4.3	6.9
3	Agro Industries, Inc.	82 mg/yr	0.0	0.0	0.9	1.0	4.2	6.7
4	Texas Power Co-op	21 mg/yr	0.0	0.0	0.7	0.9	4.0	6.5
5	David M. Smith	exempt	0.0	0.0	0.0	0.3	2.9	5.3
6	Mary Q. Public	exempt	0.0	0.0	0.0	0.3	2.9	5.3

Table 2. GAM -calculated maximum and average drawdowns in the *xx* aquifer associated with continuous pumping of the proposed well at the maximum requested annual rate (*xx* million gallons) from 20__ through 2080 using the .

		METGCD	Freestone	Leon	Madison
Total Drawdown without Proposed Pumping	**Max.**	187.3	103.0	175.3	187.3
	Avg.	96.0	46.0	108.8	154.2
Total Drawdown with Proposed Pumping	**Max.**	188.0	123.3	176.0	188.0
	Avg.	98.4	50.4	110.3	155.1
Incremental Drawdown from Proposed Pumping	**Max.**	0.7	20.0	0.7	0.7
	Avg.	2.4	4.4	1.5	0.9