

How to Submit a Groundwater Availability Model Run or Aquifer Assessment for the Development of Modeled Available Groundwater

Groundwater availability models are tools to help assess a variety of groundwater availability issues, including developing estimates of modeled available groundwater. The Texas Legislature tasked the Texas Water Development Board (TWDB) with obtaining or developing groundwater availability models (GAMs) for major and minor aquifers. To view a list of the groundwater availability models and TWDB approved alternative models currently available please see our web page: www.twdb.texas.gov/groundwater/models.

Texas Water Code § 36.108 (d) states that groundwater conservation districts shall consider groundwater availability models and other data or information for the groundwater management area during the development of the desired future conditions for relevant aquifers. The districts are also required to prepare an explanatory report that includes a description of each desired future condition, provides policy and technical justifications for each desired future condition, and documents consideration of the various factors listed in Texas Water Code § 36.108 (d). In most cases, groundwater model files will be generated by the district representatives in each groundwater management area to document the technical rationale for the selection of a desired future condition. These model files are an important component in the next step: developing modeled available groundwater estimates. If the groundwater management area anticipates using a numerical groundwater flow modeling code other than MODFLOW for desired future conditions development, please contact TWDB staff before proceeding with the model development or execution.

The TWDB recommends the following process to assist with the development of estimates for modeled available groundwater based on the submitted desired future conditions.

Who needs to submit the files?

If the files are delivered with the final submittal of the required desired future conditions packet, the groundwater management area technical coordinator needs to submit the electronic files and/or paper copies to the TWDB Executive Administrator, who will transmit this information to the TWDB Desired Future Condition coordinator in the Groundwater Division.

We encourage draft submittals prior to the groundwater management areas deciding on their desired future conditions so that TWDB staff can assess if the files or the approach matches the groundwater management areas expectations. These early draft submittals should be through the groundwater management area technical coordinator and directed to the TWDB Groundwater director. Please note the TWDB will accept draft files and

documentation for review until the point our workload shifts to processing final estimates of modeled available groundwater based on desired future condition submittals; we project this shift in workload will occur near the statutory deadline to adopt desired future conditions.

If the groundwater conservation districts decide to use a MODFLOW model other than an approved groundwater availability model, we encourage the groundwater management area technical coordinator provide the model files and supporting documentation to the TWDB Groundwater Availability Modeling manager at least 6 months prior to submitting draft predictive runs or final desired future condition runs to the TWDB for review. The TWDB will review the MODFLOW model and determine if the model meets the Groundwater Availability Modeling Program standards.

What needs to be submitted for desired future condition model runs or aquifer assessments?

TWDB staff must be able to replicate the approach and assumptions used to develop the desired future conditions.

The following items for a groundwater availability model or aquifer assessment approach are from the [TWDB Desired Future Conditions Submission Packet Checklist](#). Including all of the following items, depending on the approach, will expedite the review process.

If using a groundwater availability model approach (from desired future condition submittal checklist Part 4):

1. Summary report that includes the following:
 - a. Modeling contact information, if clarification is needed
 - b. Date and year of submittal
 - c. Seal by Texas Professional Geoscientist or Engineer, if a final submittal
 - d. Groundwater management area and requestor
 - e. Description of desired future condition
 - f. Groundwater availability modeling approach: modeling methods document must include parameters and assumptions, such as:
 - i. Groundwater availability model version or acceptable alternative model and version of acceptable pre- /post-processor used, if applicable
 - ii. Table or description of stress periods and corresponding years/months
 - iii. If the end of the calibration period is different from the start of the predictive simulations, describe assumptions for projecting model from end of calibration to beginning conditions for predictive simulation including pumping, recharge, and related surface water heads. Include targets and hydrographs, as applicable, in appendix as well as electronic copies

- iv. Assumptions for recharge, such as years that were averaged and/or drought and related stress periods, etc.
- v. Assumptions for pumping in predictive model runs, such as:
 - 1. Changes in pumping distribution and volumes relative to the end of calibration
 - 2. New wellfields (include maps)
 - 3. Some other method – please provide as much detail as possible
- g. Version of TWDB “model grid” file that associates model grid cells with counties, groundwater conservation districts, river basins, groundwater management areas, and regional water planning areas within the model study area using a centroid based approach. These files are available to download on each groundwater model webpage linked at the beginning of this document
- h. Description methodology employed to extract data from model such as: method and assumptions used to average drawdowns or springflows, including descriptions of the different aquifers/layers under consideration, any subdivision or geologic strata located in whole or in part within the groundwater management area, the stress period and year being used for initial heads in predictive runs—reference condition, and the periods and years for which drawdowns were calculated. If dry cells exist, please include a description of how dry cells were treated.
- i. Results Section with, but not limited to, appropriate tables of pumping versus drawdown, volume, surface water discharge by aquifer, layer, etc., as applicable to the desired future condition statement.
- j. References.
- 2. All related MODFLOW files:
 - a. If applicable, all input and output files related to an automatic parameter estimation program, such as PEST.
 - b. If a pre/post-processing program is included, please provide the source and executable code. If a graphic user interface program is presented to incorporate the MODFLOW model, please include all MODFLOW packages, targets, and basemap(s).
 - c. Read-me files shall be included to explain type and version of operating systems as well as instructions on how to run the computer programs related to the model development.

If using an aquifer assessment (water budget or analytical model) approach (from desired future condition submittal checklist Part 5):

- 1. Summary report that includes the following:
 - a. Technical contact information if clarification is needed
 - b. Date and year of submittal

- c. Seal by Texas Professional Geoscientist or Engineer, if a final submittal
- d. Groundwater management area and requestor
- e. Description of desired future condition
- f. Aquifer assessment approach: Details of the water budget or analytical methods used, as applicable to the selected method:
 - i. Description and documentation of water budget, analytical formula/model, or other method used
 - ii. Recharge assumptions and data
 - iii. Water level data used, including hydrographs and maps
 - iv. Inflow and outflow data
 - v. Hydrologic parameters required by the method
 - vi. Structural data used in method
 - vii. Formulas and calculations used in assessment
 - viii. Geographic information system files or references used for assessment
 - ix. Any other applicable information used to assess the aquifer
- g. Description of method used to extract data from background data or geographic information file. For example, methods and assumptions used to average drawdown, recharge, or any other relevant method.
- h. Results section with appropriate summary tables, as applicable to the desired future condition statement
- i. References

If one or more official or alternative groundwater availability models exist, please also provide the reason(s) why a groundwater availability model was not used.

If using some other approach:

If a groundwater flow model other than one of the official groundwater availability models or acknowledged alternative models was used or is being considered, TWDB staff must first verify that the model under consideration is equal to or better than existing model(s) in use by the TWDB Groundwater Availability Modeling Program. It should be noted that any model submitted and approved would become publicly available.

At a minimum the following items should be submitted before the deadline discussed in the previous section to expedite the review process:

1. All applicable MODFLOW files
2. Documentation that includes modeling objectives, conceptual model, code description, model construction, model calibration, sensitivity analysis, model verification and prediction (if applicable), model limitation, and conclusions
3. All related field/laboratory test data and other supporting materials

4. All related assumptions and calculations
5. Table listing stress periods and associated time periods
6. Description and figure(s) of boundary conditions (if one boundary condition includes more than one hydraulic process, please also provide all processes separately)
7. Calibration statistics and approach
8. Model grid shapefiles with projection file (prefer GAM projection)
9. Electronic files of calibration targets with GAM coordinates or MODFLOW layer/row/column format (to verify calibration)
10. Appropriate base map(s) with GAM coordinates
11. Any related electronic files of data used for starting heads and surface water features
12. Enough metadata to understand the data structure and the units used
13. Any known or perceived limitations; and
14. Any applicable read-me files to expedite the review process.

What happens after I submit my model runs or aquifer assessments?

- The TWDB will send written acknowledgment to the groundwater management area technical coordinator upon receipt of the final desired future condition packet submittal or draft submittal.
- Requests for any clarifications required to develop modeled available groundwater estimates will come through your TWDB groundwater management area liaison. The most common items requiring clarification during the last round of joint planning include:
 - Whether to use the aquifer extent or the model extent for calculations
 - Dry cell assumptions
 - Variance assumptions. For example, if the variation of averaged drawdowns is within 5 percent of the desired future condition, the modeled desired future condition is deemed achieved.

How long will it take for my request to be completed?

The response time on a request will depend on the complexity of the request, clarifications required while processing the request, other requests, and current TWDB workload. The TWDB will communicate with the groundwater management technical coordinator through each TWDB groundwater management area liaison about progress.

For questions, contact:

- Cindy Ridgeway, Groundwater Availability Modeling manager
cindy.ridgeway@twdb.texas.gov; 512-936-2386
- Natalie Ballew, Groundwater Technical Assistance manager
natalie.ballew@twdb.texas.gov; 512-463-2779
- Larry French, Groundwater Division director
larry.french@twdb.texas.gov; 512-463-5067