



# Groundwater Modeling

Groundwater, along with surface water, is important for maintaining the viability of the state's natural resources, health, and economic development. The projected 73 percent increase of the state's population by the year 2070, coupled with the constant threat of drought, makes it imperative that effective plans are developed to meet Texas' future water needs. Effective planning requires accurate assessments of water availability, and accessing the availability of groundwater is often much more difficult than assessing that of surface water. Surface water is easily observed at the land surface, and the response of rivers and lakes to rainfall can be repeatedly measured over time. Groundwater is more difficult to observe and measure because it resides below the land surface and responds to rainfall much more slowly than rivers and lakes. Aquifer systems are complex because of flows into and out of the aquifer, the interaction between surface water and groundwater, and the uncertainty of aquifer properties.

Because of this complexity, computer models are excellent tools for assessing the effect of groundwater use on groundwater availability. Groundwater modeling is the process of developing and using computer programs to simulate how an aquifer behaves, based on hydrogeologic principles, actual aquifer measurements, and guidance from people interested in the models and the program. In Texas, groundwater modeling is used to estimate future trends in an aquifer's water availability.

## What is the goal of the program?

Recognizing the importance of accurate groundwater availability estimates, the 76th Texas Legislature approved initial funding for the Groundwater Modeling Program in 1999. The program's goal is to provide useful and timely information for determining groundwater availability for the people in Texas. The Groundwater Modeling Program produces standardized, thoroughly documented, and publicly available groundwater availability models. These models are important tools for groundwater conservation districts and regional water planning groups in evaluating water management strategies and assessing present and future groundwater availability trends under normal and drought conditions.

## Are other groups involved in the program?

Stakeholder involvement is critical to the success of the program. The Texas Water Development Board (TWDB) relies on participation in stakeholder advisory forums to voice concerns and provide information. Stakeholder input ensures the models address the important water resource issues for

each aquifer represented in the models. The forums typically consist of representatives from groundwater conservation districts, regional water planning groups, the Texas Commission on Environmental Quality, the Texas Department of Agriculture, the Texas Parks and Wildlife Department, industry, water utilities, higher education, agriculture, and private landowners.

## What information does a groundwater availability model include?

Groundwater availability models include comprehensive information on each aquifer, such as recharge (amount of water entering the aquifer); geology and how that conveys into the framework of the model; rivers, lakes, and springs; water levels; aquifer properties; and pumping. Each model is calibrated to ensure that the models can reasonably reproduce past water levels and groundwater flows.

## How many models have been developed for the state's major aquifers?

The nine major aquifers in Texas currently require 16 different models to provide full coverage.

The TWDB developed five of the models: (1) the southern portion of the Trinity Aquifer (Hill Country Trinity Aquifer), (2) the northern segment of the Edwards Aquifer, (3) the southern portion of the Gulf Coast Aquifer, (4) the central portion of the Gulf Coast Aquifer, and (5) the Edwards-Trinity (Plateau) and Pecos Valley aquifers. TWDB contractors developed six of the current models: (6) the High Plains Aquifer System (originally two models: the northern and southern parts of the Ogallala Aquifer); the (7) northern, (8) central, and (9) southern portions of the Carrizo- Wilcox Aquifer; (10) the Seymour Aquifer; and (11) the Barton Springs segment of the Edwards Aquifer. Groundwater conservation districts in Groundwater Management Area 8 funded the update of (12) the northern portion of the Trinity Aquifer (originally developed by a TWDB-contractor team). The Lone Star Groundwater Conservation District and the Harris-Galveston and Fort Bend Subsidence Districts funded a project for the U.S. Geological Survey to update the original model of (13) the northern portion of the Gulf Coast Aquifer. The U.S. Geological Survey, in cooperation with the U.S. Department of Defense and the Edwards Aquifer Authority, developed a model for (14) the San Antonio segment of the Edwards Aquifer. El Paso Water Utilities and the U.S. Geological Survey supported the development of models for the (15) Mesilla and (16) Hueco Bolsons aquifers.

### **How are the models being used?**

Completed models have already proven valuable to water planning. Statute requires groundwater conservation districts and regional water planning groups to use values of total pumping and modeled available groundwater, based on the desired future conditions of relevant aquifers located within 16 groundwater management areas, in their management and regional water plans. Groundwater availability models have been and will continue to be used to estimate the modeled available groundwater for each aquifer for each groundwater conservation district, as appropriate and applicable.

### **Will the models be updated?**

The success of the Groundwater Modeling Program depends on the continued interest and support of stakeholders and the Texas Legislature. Ongoing interest is vital to ensure that the most up-to-date model information will be available to address

groundwater resource issues for each aquifer. Continued funding is required to update existing models and develop models for the minor aquifers. The original models for the major aquifers were completed by October 1, 2004. Nearly all of these models have undergone updates as new data and improved modeling techniques are available.

Information and reports on the existing models are available to the public on the TWDB's website, and the currently completed models are available upon request via a download from Amazon Drive.

### **Where may I get more information?**

Please contact Natalie Ballew at 512-463-2779 or Daryn Hardwick at 512-475-0470 or visit [www.twdb.texas.gov/groundwater/models](http://www.twdb.texas.gov/groundwater/models) for more information about the Groundwater Modeling Program.