GAM Run 06-04

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Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-3132
March 8, 2006

REQUESTOR:

Ms. Janet Adams on behalf of the Jeff Davis County Underground Water Conservation District (UWCD) and the Presidio County UWCD.

DESCRIPTION OF REQUEST:

Ms. Adams requested a Groundwater Availability Model (GAM) run to evaluate the impact of the 2000 estimated pumpage on water levels using the GAM for the Igneous and parts of the West Texas Bolsons aquifers.

METHODS:

To determine the impact of the 2000 estimated pumping on water levels in Jeff Davis and Presidio counties, we used the GAM for the Igneous and parts of the West Texas Bolsons aquifers. The portions of the West Texas Bolsons aquifer included the GAM are Wildhorse Flat, Michigan Flat, Ryan Flat, and Lobo Flat and are locally referred to as being part of the Salt Basin Bolson aquifer. To avoid confusion with other parts of the West Texas Bolsons aquifer, we refer to the West Texas Bolsons aquifer in this GAM as the Salt Basin Bolson aquifer in this report.

We used the 2000 estimated pumpage as the baseline pumpage in a previous GAM run done for Ms. Adams (GAM05-40). In GAM05-40 up to two acre-feet per acre per year of additional pumpage was added in both Jeff Davis and Presidio counties to this baseline pumpage. The current GAM run provides the impact of only the 2000 estimate pumpage with no additional pumpage added to it. This GAM run is a supplement to GAM05-40.

PARAMETERS AND ASSUMPTIONS:

- See Beach and others (2004) for assumptions and limitations of the GAM for the Igneous and West Texas Bolsons aquifers.

- The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) in the entire GAM for the period of 1990 to 2000 is 64 feet, or four percent of the range of measured water levels (Beach and others, 2004).

- The model includes three layers, representing the Salt Basin Bolson aquifer (Layer 1), the Igneous aquifer (Layer 2), and the underlying Cretaceous and Permian units (Layer 3).

- We simulated a 50-year time period for the predictive model run.

- We used an average annual recharge based on recharge determined through the calibration of the transient model covering the years 1950 to 2000.

- Pumpage is included in the model for all three layers, although pumpage in Layer 3, representing the underlying Cretaceous and Permian units, is minimal, and only occurs in Jeff Davis County on the northeastern margins of the aquifer. No pumpage is present in Presidio County from Layer 3 in the model.

- The GAM uses drains to simulate discharge to streams. Drains are included in both the Salt Basin Bolson aquifer and Igneous aquifer layers of the model. Drain parameters were held at conditions representing the 2000 stress period for the predictive simulations.

- The GAM uses general-head boundaries (GHB) to simulate cross-formational flow into and out of layer 3, which represents the Cretaceous and Permian units underlying the Igneous aquifer. GHB parameters were held at conditions representing the 2000 stress period for the predictive simulations.

- The GAM uses the MODFLOW evapotranspiration package (ET) to simulate discharge of water to evaporation and transpiration. ET parameters were held at conditions representing the 2000 stress period for the predictive simulations.

- The GAM includes pumpage representing rural domestic, municipal, industrial, irrigation, and livestock uses.

RESULTS:

The Salt Basin Bolson aquifer is present in limited extent in both Jeff Davis and Presidio counties (Figure 1). Initial (2000) water levels range from approximately 4,500 feet above mean sea level at the southern end of Ryan Flat to less than 3,900 feet above mean sea level where Ryan Flat crosses the Jeff Davis-Culberson county line (Figure 2). Initial (2000) saturated thicknesses range from zero at the bolson margins to more than 1,000 feet in portions of the center of the bolson (Figure 3). As shown in these figures, portions of the aquifer were dry at the start of all of the predictive model runs (black cells are dry areas).

Water levels in the Salt Basin Bolson aquifer after 50 years of pumping using the 2000 estimated pumpage are shown in Figure 4. This figure indicates that water levels are between 0 and 60 feet lower than the initial water levels (Figure 2) over the 50-year predictive model run. Water level declines were the smallest in the southern end of the aquifer in Presidio County and were the greatest at the Jeff Davis-Culberson County

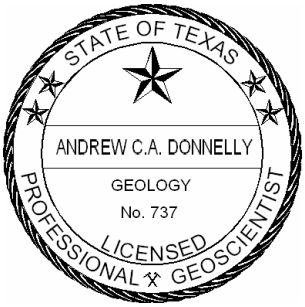
border. This is due to the large amount of pumpage included in the 2000 estimated pumpage in Culberson County.

The Igneous aquifer is present in much of Jeff Davis and Presidio counties (Figure 5). Initial (2000) water levels range from nearly 6,000 feet above mean sea level in the Davis Mountains to less than 3,000 feet above mean sea level in southern Presidio County (Figure 6). Initial (2000) saturated thicknesses range from zero at the aquifer margins to more than 6,000 feet (Figure 7). As shown in these figures, portions of the aquifer were dry at the start of all of the predictive model runs (black cells are dry areas).

Water levels in the Igneous aquifer after 50 years of pumping using the 2000 estimated pumpage are shown in Figure 8. This figure indicates that water levels decline very little from initial water levels (Figure 6) over the 50-year predictive model run over most of the two-county area.

REFERENCES:

Beach, J. A., Ashworth, J. B., Finch, Jr., S. T., Chastain-Howley, A., Calhoun, K., Urbanczyk, K. M., Sharp, J. M., and Olson, J., 2004, Groundwater availability model for the Igneous and parts of the West Texas Bolsons (Wild Horse Flat, Michigan Flat, Ryan Flat and Lobo Flat) aquifers: contract report to the Texas Water Development Board, 208 p.



The seal appearing on this document was authorized by Andrew C.A. Donnelly, P.G. 737, on March 8, 2006.

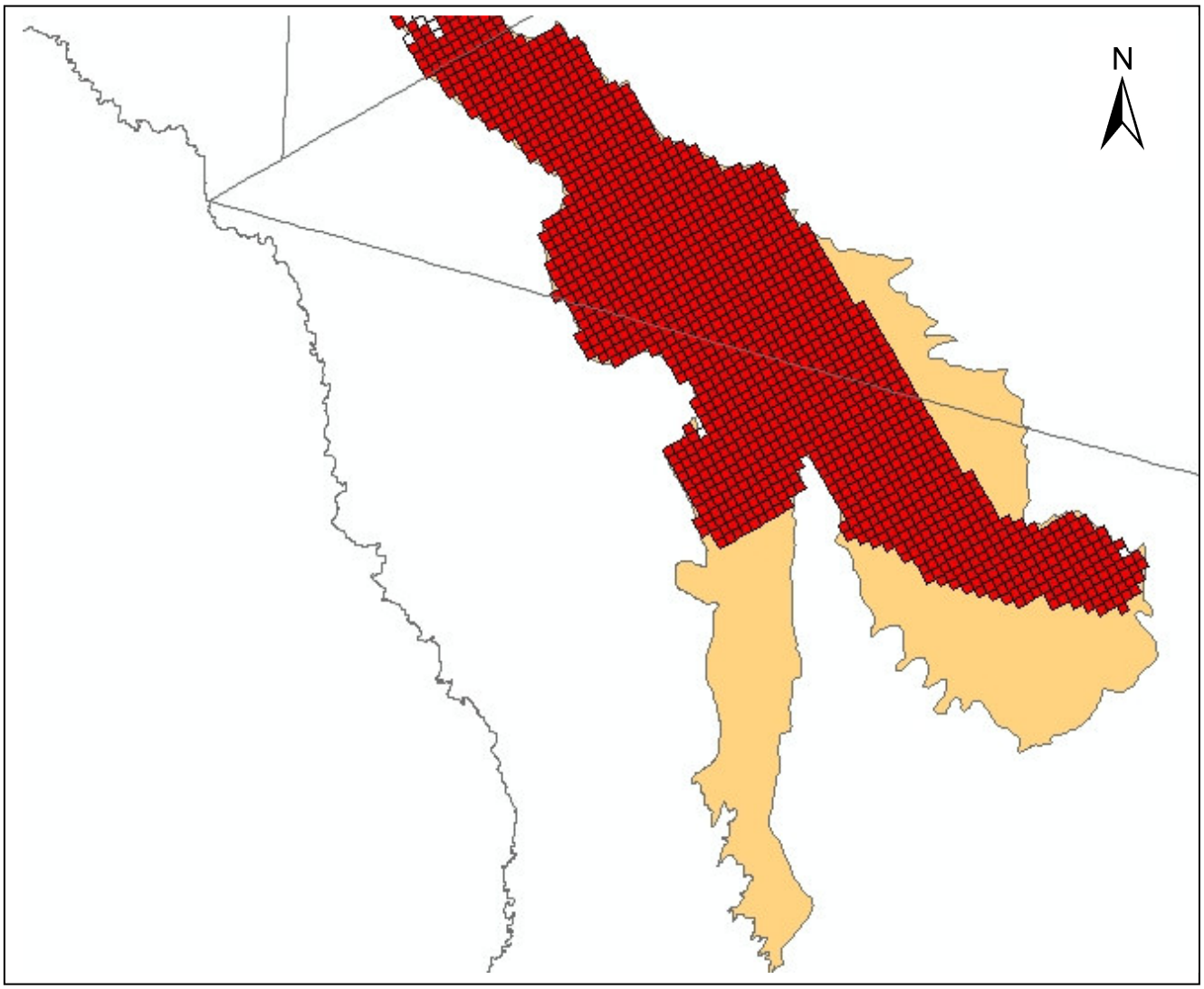


Figure 1. Extent of the Salt Basin Bolson aquifer in the GAM. Model cells in red are active cells that contain pumpage in 2000. Model cells in white are active cells without pumpage. The actual extent of the Salt Basin Bolson aquifer is shown in tan.

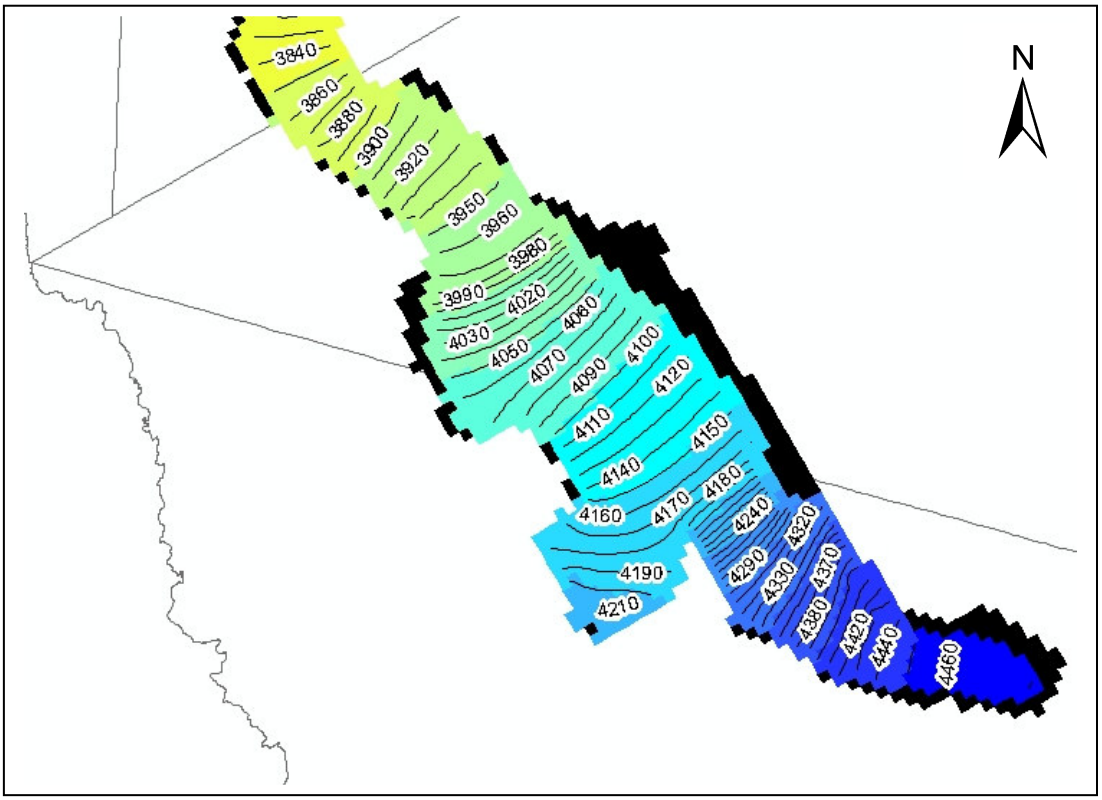


Figure 2. Initial water levels in the Salt Basin Bolson aquifer in the year 2000. Contour interval is 10 feet. Black areas are where the aquifer is dry.

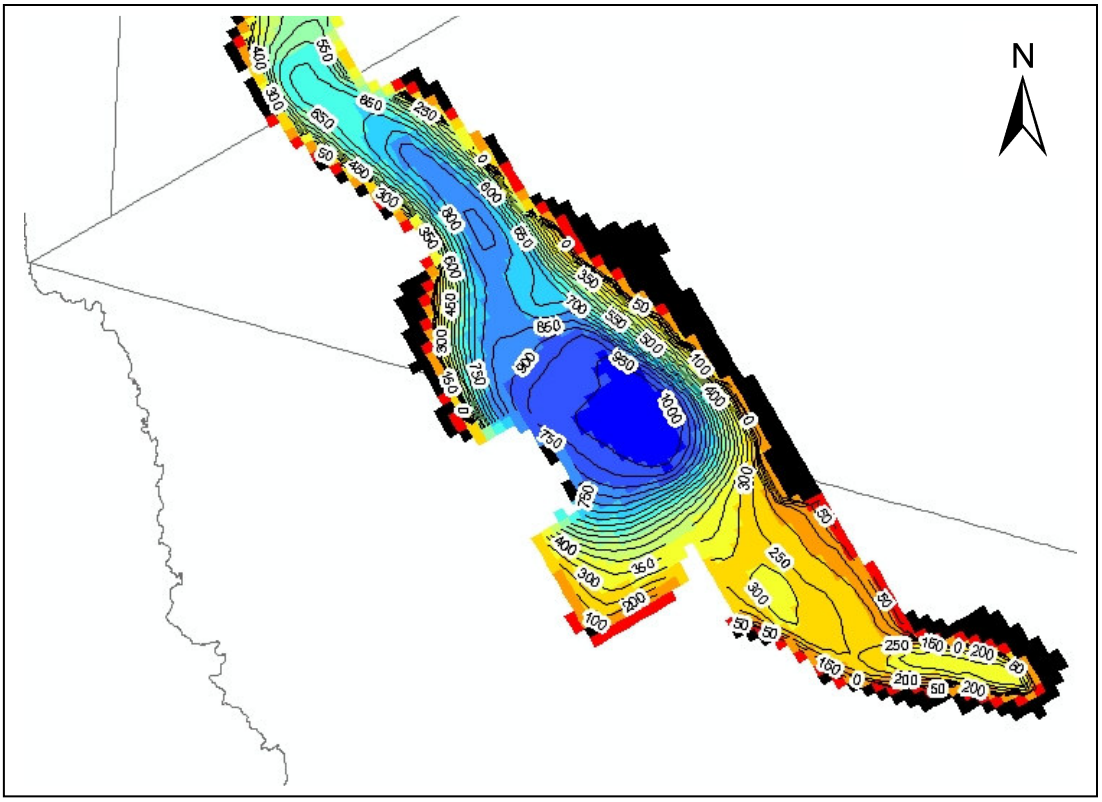


Figure 3. Initial saturated thicknesses in the Salt Basin Bolson aquifer in the year 2000. Contour interval is 50 feet. Black areas are where the aquifer is dry.

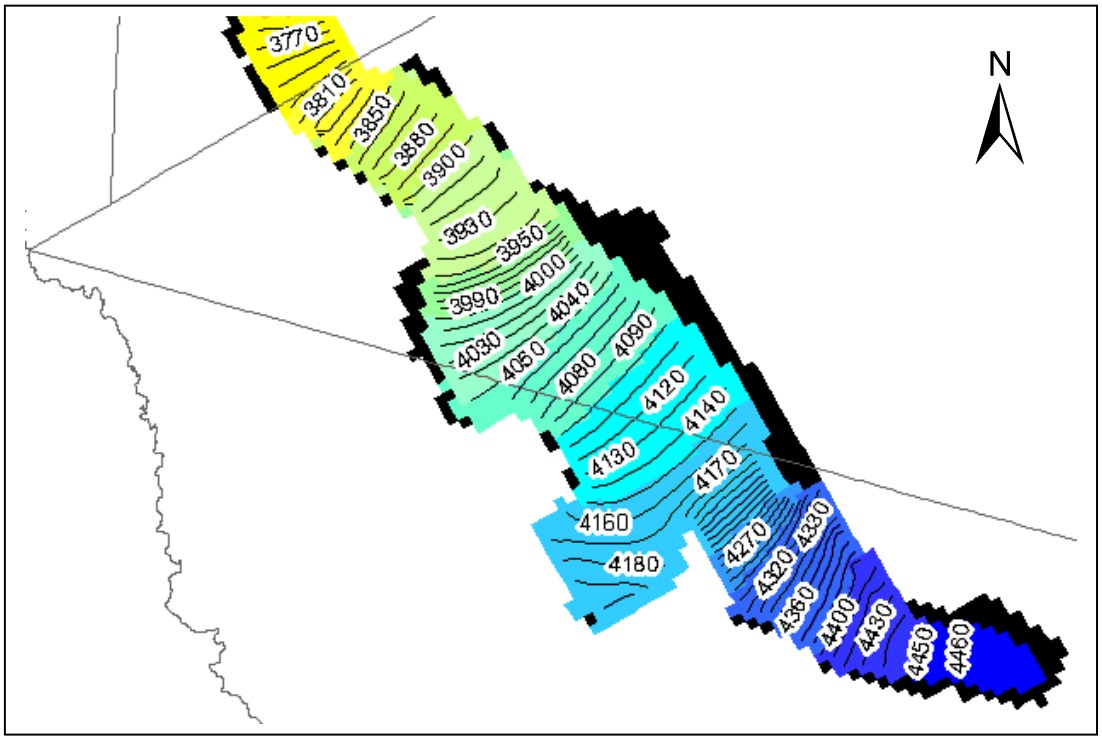


Figure 4. Water levels in the Salt Basin Bolson aquifer after 50 years of pumping using the 2000 estimated pumpage. Contour interval is 10 feet. Dry model cells are shown in black.

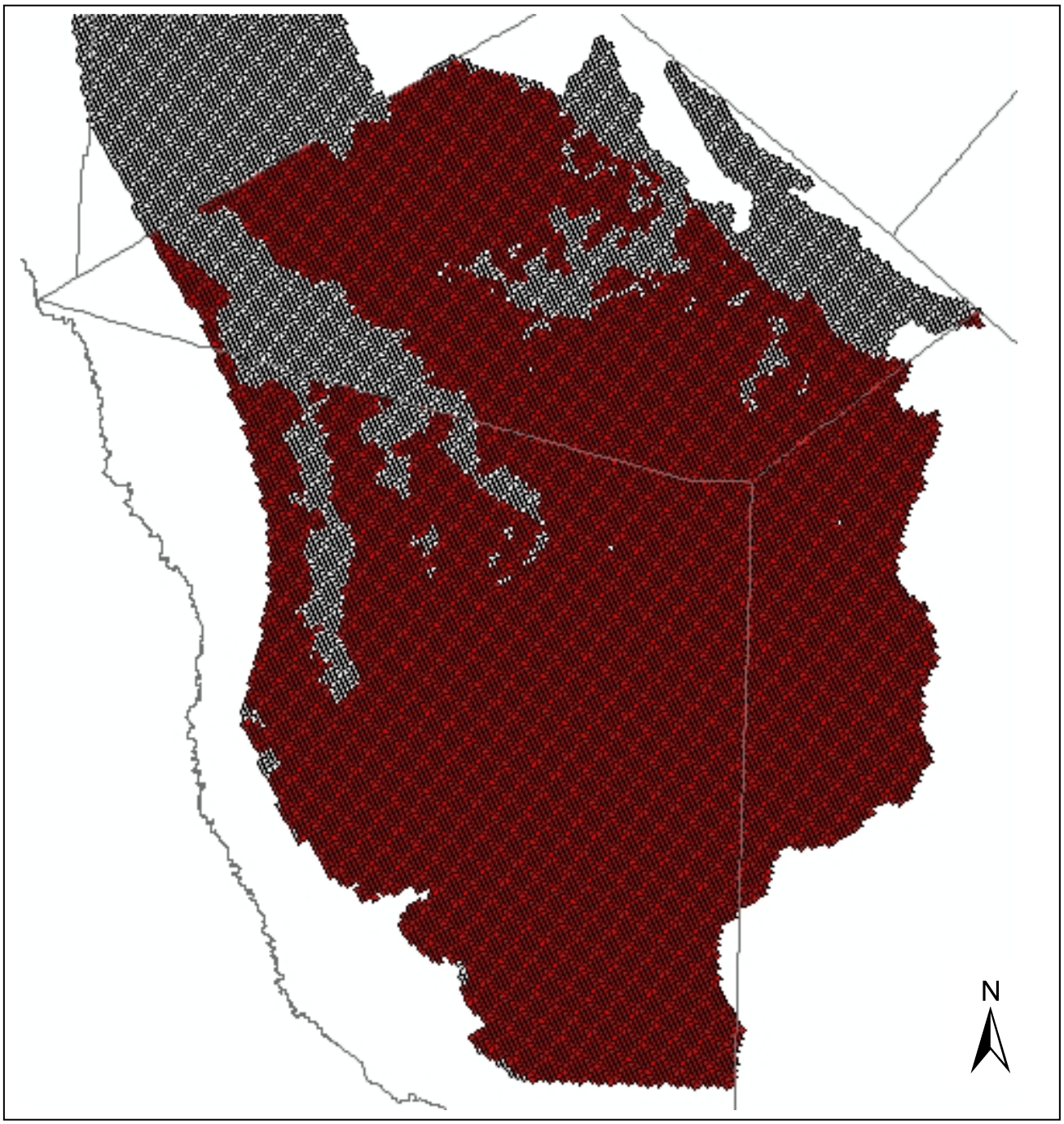


Figure 5. Extent of the Igneous aquifer in the GAM. Model cells in red are active cells that contain pumpage in 2000. Model cells in white are active cells without pumpage. The scale of this figure makes it difficult to see individual model cells.

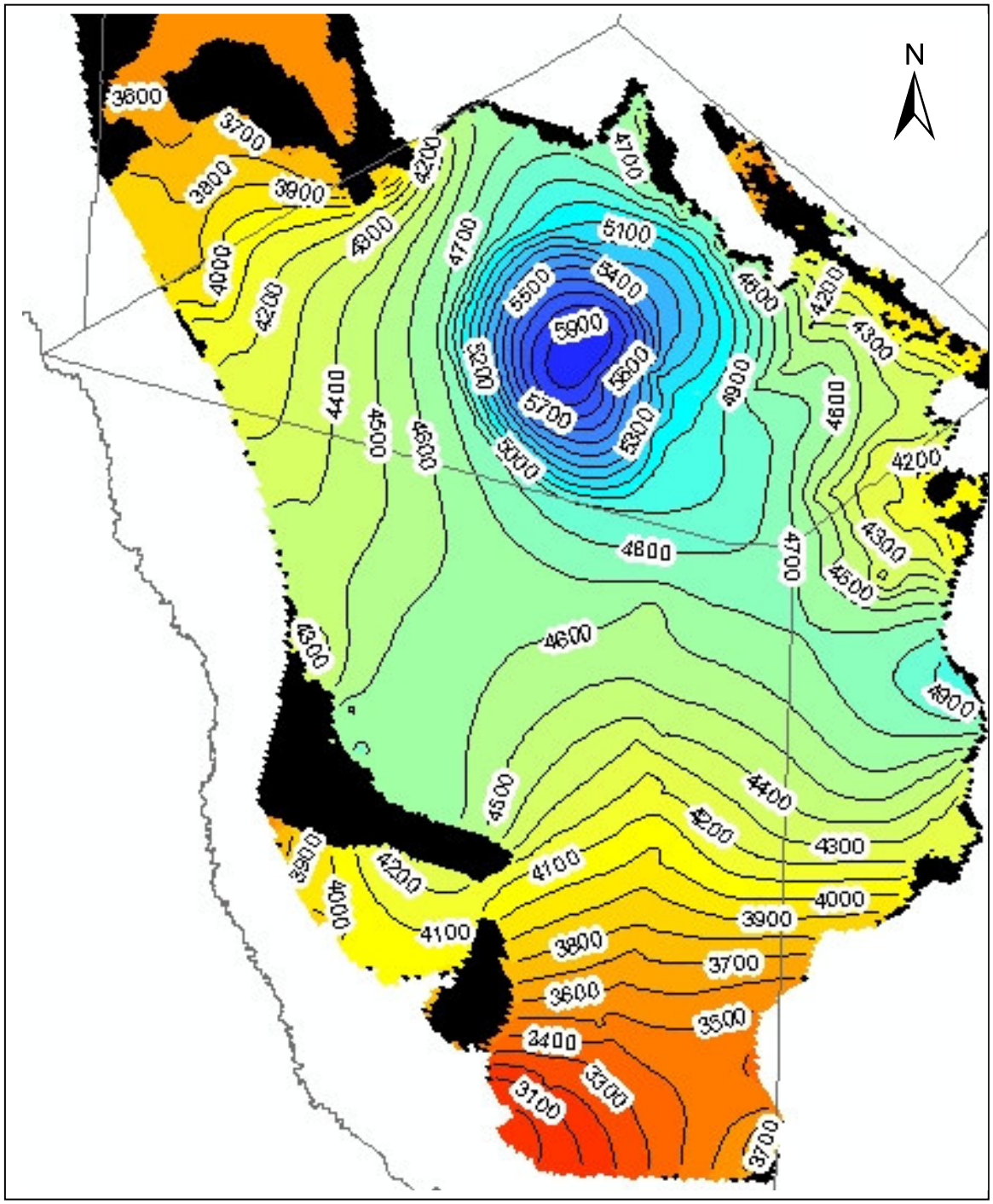


Figure 6. Initial water levels in the Igneous aquifer in the year 2000. Contour interval is 100 feet. Black areas are where the aquifer is dry.

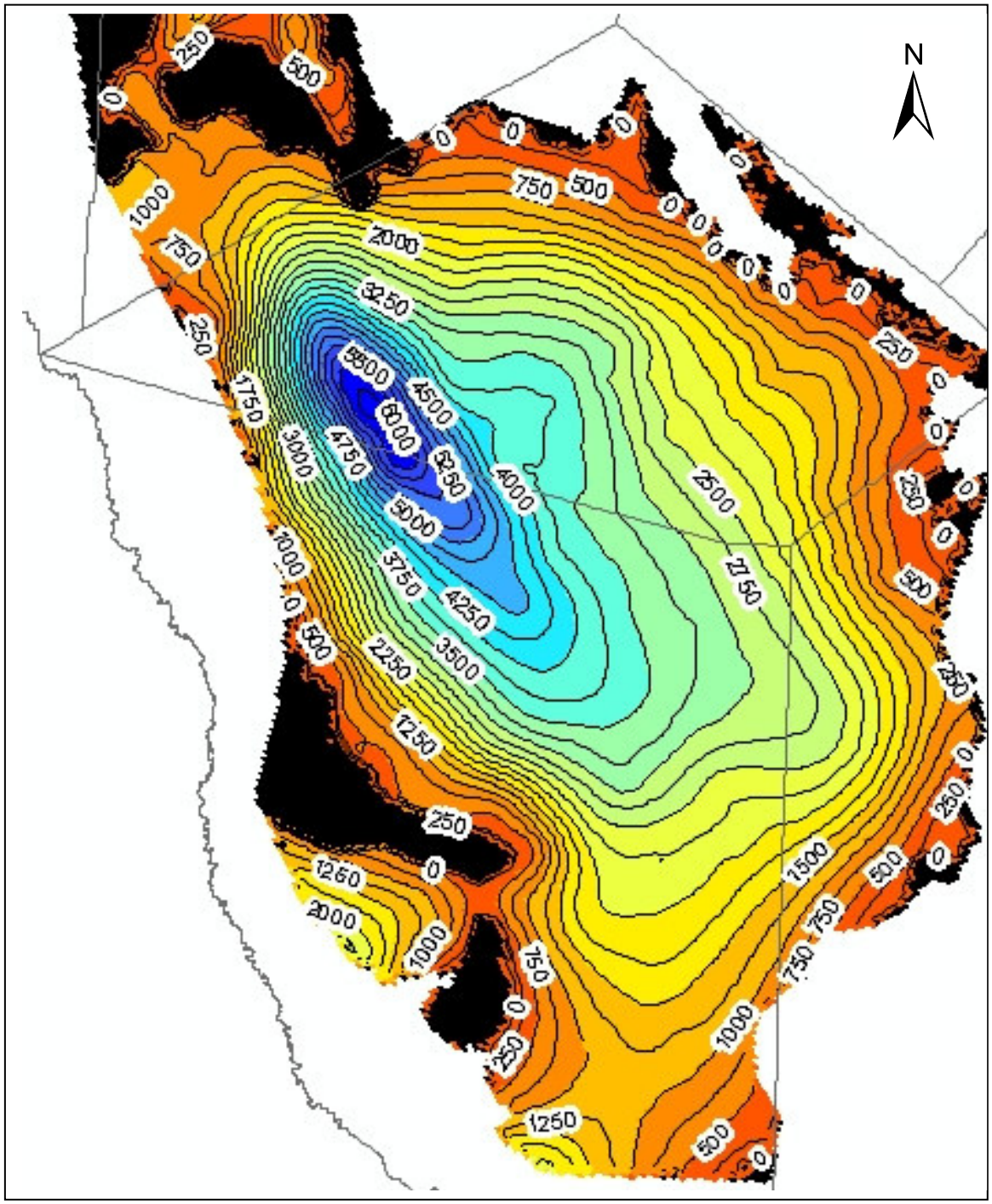


Figure 7. Initial saturated thicknesses of the Igneous aquifer in the year 2000. Contour interval is 500 feet. Black areas are where the aquifer is dry.

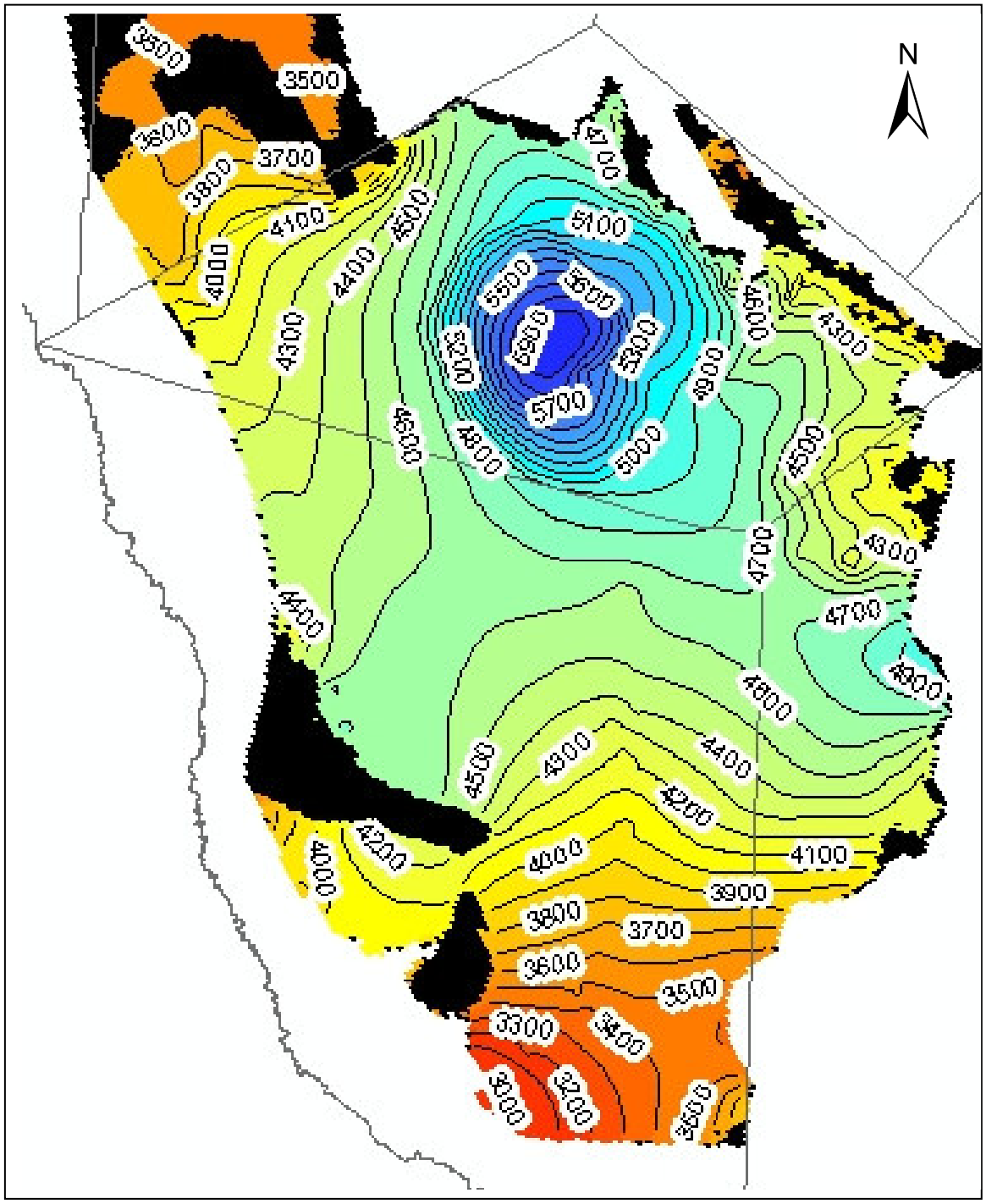


Figure 8. Water levels in the Igneous aquifer after 50 years of pumping using the 2000 estimated pumpage. Contour interval is 100 feet. Dry model cells are shown in black.