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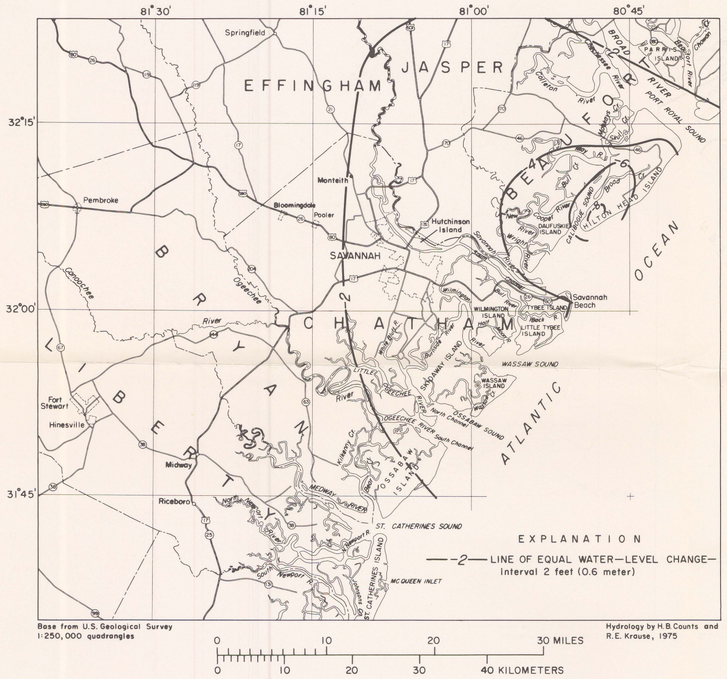
V. E. McKelvey, Director

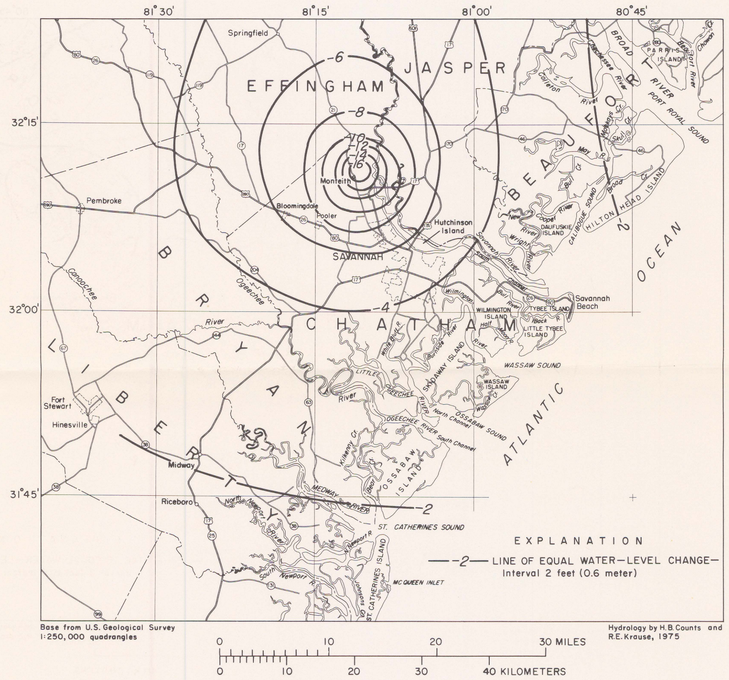
Prepared in cooperation with the
City of Savannah
Chatham County
Georgia Department of Natural Resources
Geologic and Water Resources Division

WATER RESOURCES INVESTIGATIONS
76-133
OPEN-FILE REPORT
SHEET 3 OF 4

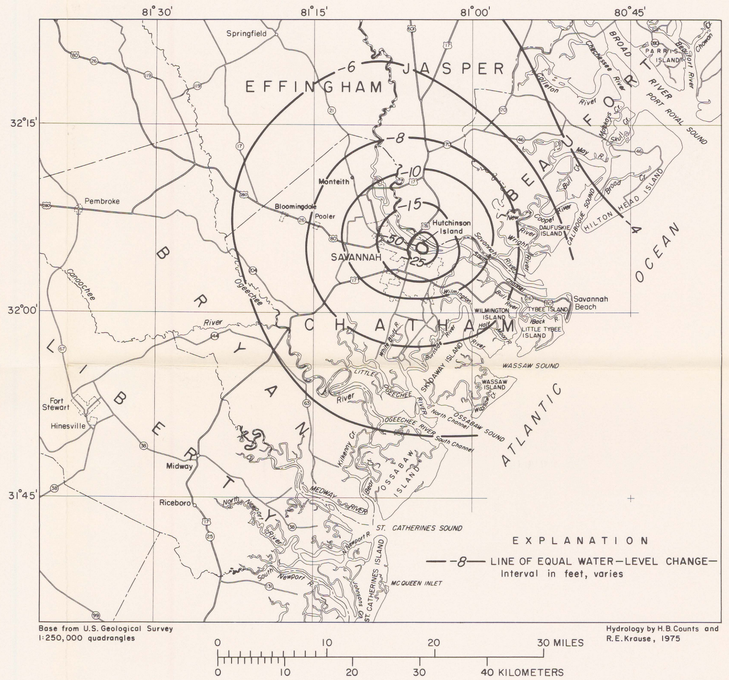
USE OF THE MODEL



COMPUTED WATER-LEVEL CHANGE, IN 2000, CAUSED BY ADDING TO THE 1970 PUMPAGE, 10 MILLION GALLONS PER DAY (440 LITERS PER SECOND) AT THEORETICAL SITES ON HILTON HEAD ISLAND, SOUTH CAROLINA



COMPUTED WATER-LEVEL CHANGE, IN 2000, CAUSED BY ADDING TO THE 1970 PUMPAGE, 6 MILLION GALLONS PER DAY (260 LITERS PER SECOND) AT MONTEITH, 7 MILES (11 KILOMETERS) NORTHWEST OF THE CENTER OF THE CONE OF DEPRESSION



COMPUTED WATER-LEVEL CHANGE, IN 2000, CAUSED BY ADDING TO THE 1970 PUMPAGE, 10 MILLION GALLONS PER DAY (440 LITERS PER SECOND) AT HUTCHINSON ISLAND, EAST OF U.S. HIGHWAY 17-A, ABOUT 3 MILES (5 KILOMETERS) EAST OF THE CENTER OF THE CONE OF DEPRESSION

DISCREPANCIES IN THE MODEL RESULTS

The model of the Savannah area does not exactly duplicate conditions in the principal artesian aquifer, as minor discrepancies occur between computed and measured water levels. This is due partly to errors in estimating data at node points where field data were not available, and partly by the different manner in which they are plotted. For example, a data point for a computed water level represents the average value of a large rectangular area of a grid block, which can vary in size and shape as specified by the model grid dimensions. Thus, each nodal value in the model represents an average value for a large area. Data points for measured data, on the other hand, are point data because each represents a water-level measurement made in a single well.

The model can be used as a management tool to predict changes in water level that will result from pumpage redistribution. It also can be useful to predict the water level that will result from the same or from increased pumpage at existing or new sites. Some of these situations were modeled and are described in the following paragraphs.

To predict what effect a continuation of the 1970 pumping rate will have on the water level at Savannah, the transient model was extended from 1970 to 2000. Data used for this run were the computed 1970 water-level values and the 1961-70 pumpage rates. This projection assumes that the rate and distribution of pumpage from 1970-2000 will be the same as it was from 1961-70, and that all other hydrologic controls used in the model will remain unchanged.

The maximum predicted water-level decline for the 30-year period was about 1.5 ft (0.45 m) at the center of the cone of depression, and less than 1 foot (0.3 m) at most other nodes. Therefore, if pumping at Savannah continues at the 1970 rate, the water level in 2000 will be essentially the same as it was in 1970.

This means that if pumpage at Savannah could be stabilized at the 1970 rate, water levels in outlying areas eventually would stop declining. At that time, discharge from wells would be balanced by recharge and the water level would stabilize above the top of the aquifer. However, if pumpage increases significantly above the 1970 rate, the water level at the center of the cone of depression may decline below the top of the aquifer (210 ft or 64 m below sea level). This would result in dewatering of the aquifer and possible land subsidence and should be avoided.

Where future management programs will include added pumpage by a new or expanding industry, the proposed withdrawal can be incorporated into the model by including the amount and starting date of the withdrawal for the proposed site, or sites. The model then can predict a water level that should reasonably match the one that will result if the pumpage is added.

Several model runs incorporating hypothetical pumping changes were made to 2000 to illustrate the water-level changes that would result. The computed water-level changes and the resulting maps illustrating the changes that will occur in the water level by 2000 are shown on the maps above and on sheet 4.

Hypothetical pumpage was added to the 1970 pumpage to illustrate the change in water level that would result by 2000. These changes are shown on the maps above.

The map at left shows the change in the water level that will result by 2000 with an addition of 10 Mgal/d (440 L/s) to the 1961-70 pumpage, started in 1971, at theoretical sites on Hilton Head Island, South Carolina. The greatest predicted change would be -8 ft (-2 m) at the nodes that include most of the hypothetical pumpage.

The map at center shows the water-level change that will result if an additional pumpage of 6 Mgal/d (260 L/s) is added 7 mi (11 km) northwest of the center of pumpage in Savannah. The greatest predicted change would be -23 ft (-7 m) at the node that included the added pumpage.

The map at right shows the change in water level that would be caused by adding a pumpage of 10 Mgal/d (440 L/s) on Hutchinson Island east of U.S. Highway 17-A, about 3 mi (4.8 km) east of the center of the cone of depression in Savannah. The greatest predicted change would be about -50 ft (-15 m) at the node that includes the added pumpage.

The map at left, sheet 4, shows the predicted water-level change that would result from moving 10 Mgal/d (440 L/s) of pumpage in Savannah to Bloomingdale, 10 mi (16 km) west. The greatest predicted changes would be a rise of 38 ft (12 m) at the pumping center in Savannah and a decline of 17 ft (5 m) at Bloomingdale.

The map at right, sheet 4, shows the rise in water level that would be caused by decreasing pumpage 20 Mgal/d (880 L/s) at or near the center of the cone of depression in Savannah. The greatest change would be a water-level rise of 92 ft (28 m) at the center of pumpage.

In all of the projections, most of the decreases and increases in water level would occur during the first year after the pumpage change, as it did each time the pumpage was increased in the transient model run to 1970. The water-level changes for 2000, therefore, would be nearly the same as for a year or so after the pumpage was changed.

The projections are particular cases in which a specified amount of pumpage is added or subtracted from selected nodes at a specified time. The projections shown were selected because they may possibly be imposed on the aquifer in the future. Any other sites, pumping changes, or starting dates may be used in making other projections.

Cartography by W. G. Hester

DIGITAL MODEL ANALYSIS OF THE PRINCIPAL ARTESIAN AQUIFER, SAVANNAH, GEORGIA AREA

By
H. B. Counts and R. E. Krause

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