A General Summary of Groundwater Conditions in South Georgia

William H. McLemore
Georgia Department of Natural Resources

The Coastal Plain of south Georgia is characterized by several large, and highly prolific, fresh water aquifers. So groundwater is the most important source of drinking water throughout south Georgia. It is not uncommon for a single well to produce more than a million gallons of water per day.

There are seven aquifer systems below the Fall Line which is the major physiographic feature dividing the State of Georgia. The Fall Line cuts the State roughly in half, running from Columbus in the west to Augusta in the east. In south Georgia these are:

1. the unconfined water table aquifer
2. the Pliocene-to-Recent Aquifer System
3. the Miocene Aquifer System
4. the Floridan Aquifer System (sometimes known as the Principal Artesian Aquifer)
5. the Claiborne Aquifer
6. the Clayton Aquifer, and
7. the Cretaceous-Tertiary Sand Aquifer System.

These aquifer systems form a series of wedges stacked one atop another thickening toward the Coast. The block diagram (Figure 1) shows the Coastal Plain of Georgia and illustrates the thickness, general outcrop areas, and the relationships of the aquifers.

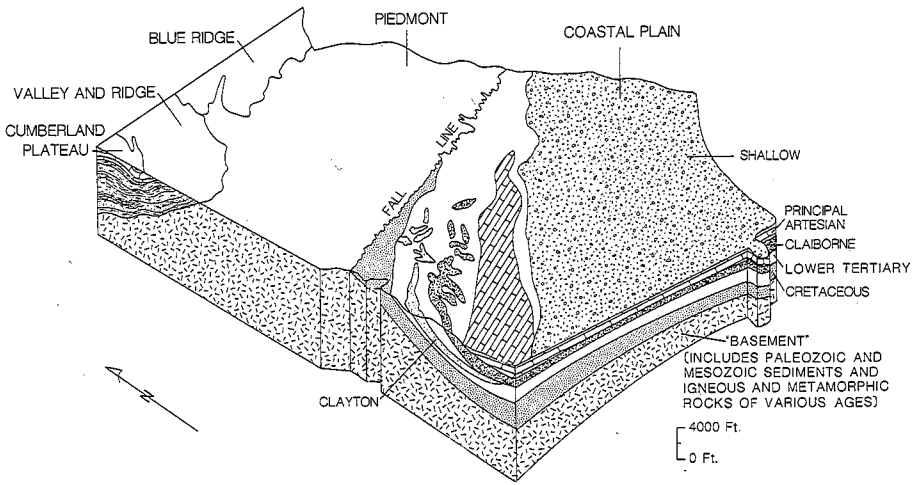
Even though the groundwater resource is quite large, some localized problems have occurred; namely:

1. the Clayton Aquifer, which supplies cities such as Albany and Americus, and irrigation in Randolph, Sumter and Terrell Counties, is slowly being depleted; and

2. extensive groundwater use in the Floridan Aquifer has lowered groundwater levels to a point where salt water intrusion next to the coast is possible.

Under current pumping conditions neither of the above noted problems has become critical. As long as groundwater use in these two areas does not increase significantly, the Georgia Department of Natural Resources should be able to carry out water management procedures so both areas can continue to supply groundwater to farmers, industries, and municipalities. Due to conservation and water management measures, water use for industrial and municipal water supply programs has declined slightly over the past few years. Irrigation water use however, has grown dramatically recently, and during drought years is the single largest user of groundwater in the State.

Figure 1
Block Diagram of Georgia Showing Coastal Plain Aquifers and Major Physiographic Provinces



Groundwater Conditions in South Georgia

Aquifer Recharge. Although Georgia receives abundant rainfall, most of the precipitation does not recharge the aquifers. About 12 to 16 percent of the rainfall infiltrates the ground, the rest flows off or is lost to the atmosphere via evapotranspiration. The bulk of all recharge comes from winter rains. Winter rainfall occurs at a slower rate than summer showers, allowing greater infiltration. Therefore, seasonal water-level highs occur in early spring, and water-level lows occur in the fall, coincident with the seasons of relatively low rainfall and high evapotranspiration. Superimposed on these natural fluctuations are the effects of human withdrawals.

Figure 2 illustrates the downward trend in water levels for the Floridan Aquifer at Tifton for the period 1968 to 1986. The yearly highs and lows, associated with recharge are shown. Also, the 1980-1981 drought, where water levels dropped to about − 140 feet below land surface, and the 1986 drought, where levels dropped to about − 145 feet are illustrated.

While the Floridan Aquifer is Georgia's largest and most prolific aquifer, groundwater declines should be expected during droughts if irrigation pumpage were to increase. In fact, computer modelling performed by the Georgia Environmental Protection Division has shown that the farther a Floridan well is from the Lake Seminole-lower Flint River area in southwest Georgia, the greater will be the decline. Such declines, for instance in Lee County, could approximate 75 feet during a major drought. If such declines were to occur, most irrigation wells would go dry.

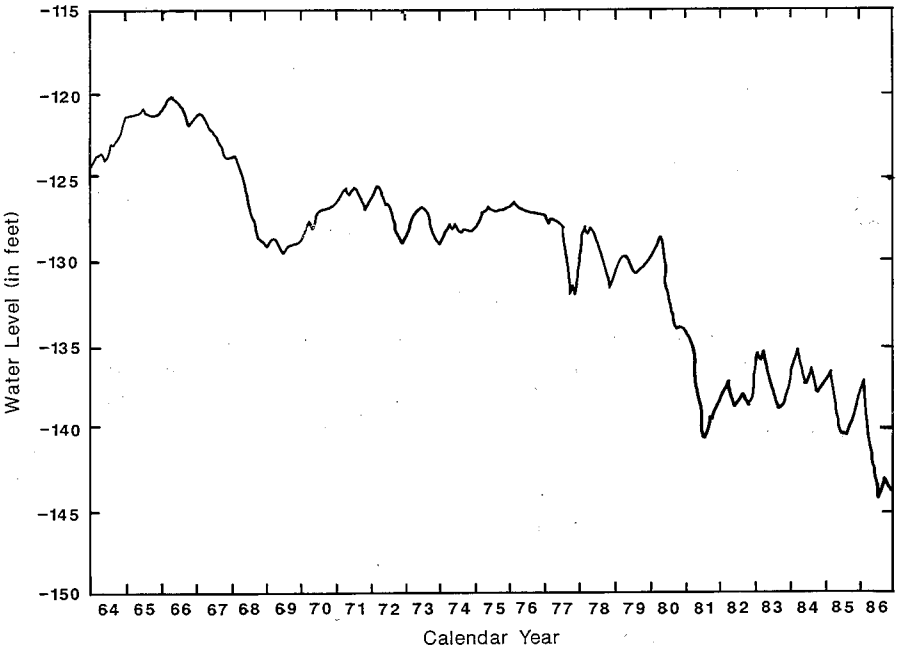
Water levels fell to all time lows through both north and south Georgia as a result of the 1986 drought. Declining water levels mean that a well's ability to supply water is reduced. Some shallow wells experienced capacity drops on the order of 50 to 70 percent.

General Groundwater Conditions. Some of the more important groundwater conditions are:

1. Every day, nearly five and a half billion gallons of freshwater are withdrawn from Georgia's rivers, streams and groundwater aquifers. Total groundwater use for 1985 (a relatively wet year) was about 1,075 million gallons per day (mgd), as follows (see Figure 3):

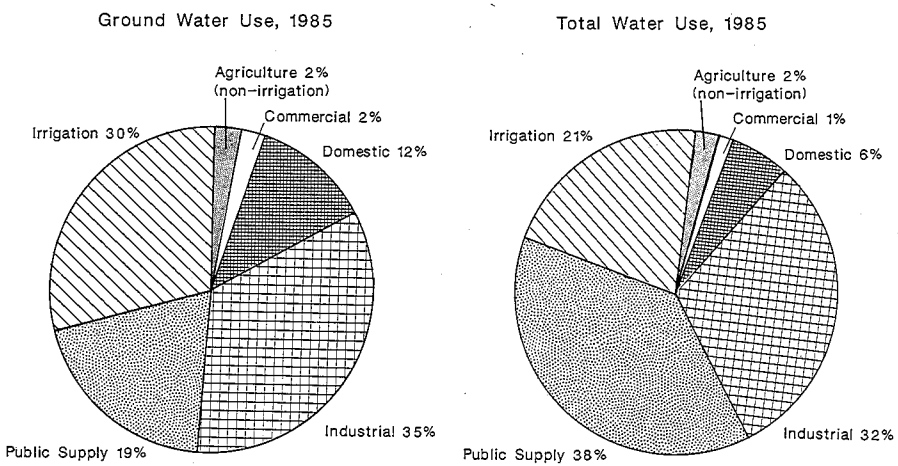
public supply	= 205 mgd
industrial	= 367 mgd
irrigation	= 313 mgd
domestic	= 123 mgd
commercial	= 24 mgd
misc. agriculture	= 40 mgd

Figure 2
Tift County—Floridan Aquifer



2. Virtually the entire Coastal Plain of Georgia, at some depth, is underlain by salt water. In some places, such as Glynn County, salt water is moving upward along geologic faults or through improperly constructed wells. Extensive groundwater withdrawals around Brunswick and in other coastal areas for industrial, municipal or irrigation pumpage, have the potential to accelerate this upward flow of salt water, contaminating shallow fresh water aquifers.
3. Infiltration rates and aquifer recharge in the Coastal Plain is much more limited than was believed. While surface soils are sandy, they often become quite clay-like where depth and infiltration of rainwater is inhibited. Thus, the bulk of precipitation that falls on the Coastal Plain does not recharge the aquifers, but is lost via evapotranspiration or runoff to the ocean.
4. Use of groundwater for irrigation has been growing at a rapid rate since the late 1970s. Between 1975 and 1980, groundwater use for irrigation grew at a rate of 15 to 20 percent per year. In 1984, there were 1.09 million acres under irrigation representing a 9 percent increase in total irrigation since 1980. For irrigation, the proportion

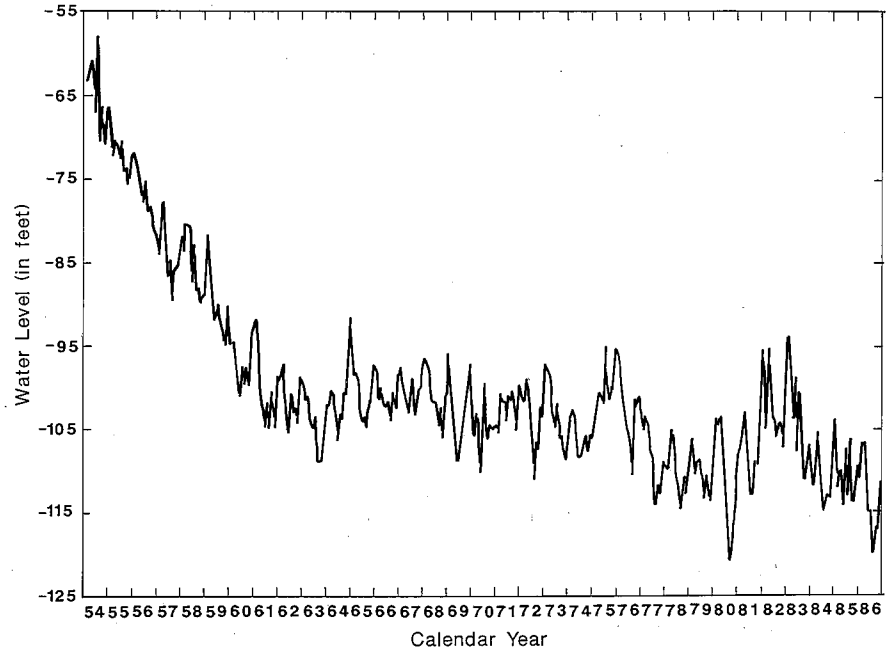
Figure 3
Comparative Water Use, 1985, Excluding Power Generation



of groundwater to surface water use is increasing as farmers continue to shift from low-capacity systems such as portable pipe and solid set to center pivot systems. In many parts of the Coastal Plain, the higher pumping rates required by the new systems are easier to obtain from wells than from farm ponds. There was a 33 percent increase in the number of systems supplied by wells between 1980 and 1984. At least 80 percent of the center pivot systems use groundwater for their water source.

5. There are some aspects of irrigation which are not well known. Irrigation water, while falling on the soil, does not return to the groundwater regime. Rather, the bulk of the water soaks into the upper few inches of the soil and is then taken up by plants and transpired to the atmosphere. Thus, irrigation use of water is almost 100 percent consumptive and the water used is lost from that area. The result of such consumption is that Georgia's underground aquifers may be locally depleted. Local depletion may result in the forced abandonment of shallowwells (either domestic, municipal, or other irrigation wells).
6. The heavy use of groundwater for municipal supply, industrial, or irrigation purposes, is capable of changing the character of underground flow regimes. Irrigation, for example, is growing to the north of Savannah in both Georgia and South Carolina. So irrigation wells

Figure 4
Chatham County—Floridan Aquifer



are intercepting groundwater that historically flowed to Savannah. As such interception occurs, less groundwater is available for Savannah and the cone of depression in the water-table at Savannah will deepen and enlarge. This will accelerate the flow of salt water toward Savannah. Figure 4 illustrates long term water-level trends at Savannah. Although municipal and industrial water-use has remained relatively constant for the past decade, and Savannah is 75 miles south of the aquifer recharge area in Burke County, water levels were significantly lowered as a result of the 1980-81 and 1986 droughts. Also lowering water levels was irrigation pumpage.

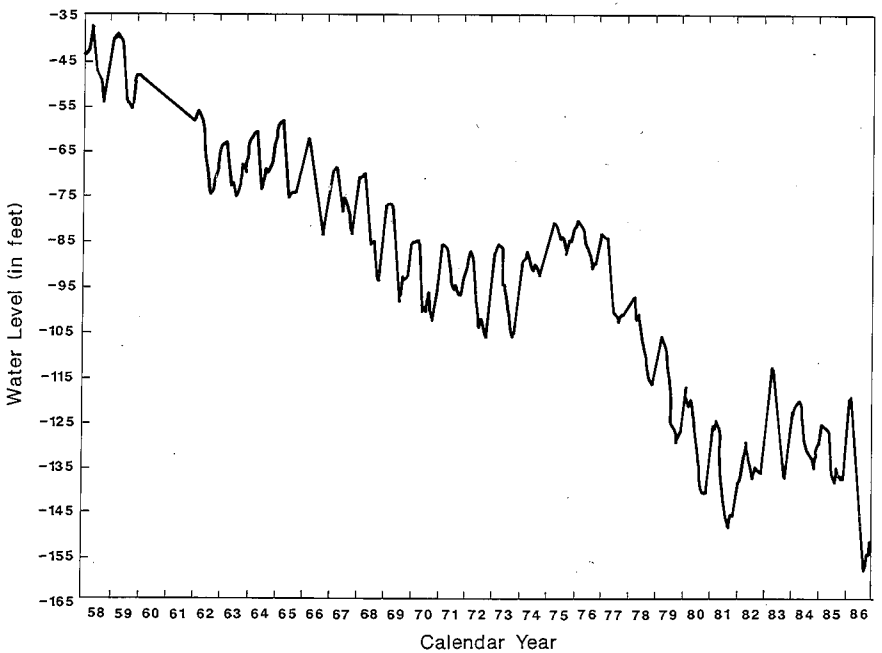
7. Extensive irrigation withdrawals from the Clayton Aquifer in Randolph, Sumter and Terrell Counties are rapidly dropping groundwater levels. The aquifer may thus cease to be a viable source for Albany and Americus. In fact, the Clayton Aquifer is the first aquifer in the State where groundwater mining occurs—more water is being pumped out of the ground than is being naturally recharged. The water level

declines in the Clayton Aquifer are well illustrated in Figure 5. Water levels in the Clayton Aquifer in Dougherty County have declined by 90 to 100 feet during the last 30 years. Half of the decline has occurred in the last ten years. Figure 5 shows a marked decline in water levels beginning in 1976 with the advent of irrigation expansion. The decline continued until 1982, when water levels stabilized during the wet 1982 to 1985 years. It then reached all time lows during the 1986 drought.

Conclusions

The aquifers in nearly all of south Georgia below the Fall Line show a trend of slightly declining water levels during the last ten years due to increasing municipal, industrial, and agricultural use of groundwater. Nevertheless, the overall groundwater supply picture in Georgia is very good. Except for localized areas such as Albany and along the Georgia coast, aquifers have room for considerable growth without creating serious depletion problems. Some aquifers support only a few wells and therefore

Figure 5
Dougherty County—Clayton Aquifer



represent a relatively unused resource. Though groundwater is abundant in many areas, it is not unlimited; without proper management, the aquifers may be locally depleted or become locally contaminated by salt water. When such depletion or contamination occurs, the aquifer will no longer be a viable resource of drinking water. The Georgia Department of Natural Resources, however, has an extensive program of system mapping and system monitoring. The system is capable of identifying potential problems and with this knowledge, the department can begin proper management and water conservation programs.