

Hydrology and Quality of Water in Polk County, Florida

Rick M. Spechler¹ and Sharon Kroening¹

¹U.S. Geological Survey, Florida Integrated Science Center, Orlando, Florida

Local water managers usually rely on information produced at the State and regional scale to make water-resource management decisions. Current assessments of hydrologic and water-quality conditions in Polk County commonly end at the boundaries of three water management districts (St. Johns, South Florida, and Southwest Florida Water Management Districts), which make it difficult for local managers to determine conditions throughout the County. The last comprehensive water-resources assessment of Polk County was published almost 40 years ago. To address the need for current county-wide information, the U.S. Geological Survey began a 4-year study in 2002 to evaluate the current hydrologic and water-quality conditions in Polk County and identify changes that have occurred.

The study area, a 1,823-square-mile area of central Florida, is underlain by three principal hydrogeologic units. The uppermost water-bearing unit of the study area is the surficial aquifer system, which is unconfined and composed primarily of clastic deposits. The surficial aquifer system is underlain by the intermediate confining unit or by the intermediate aquifer system, which consists of up to two water-bearing units composed of interbedded clastic and carbonate rocks. The lowermost hydrogeologic unit is the Floridan aquifer system. The Floridan aquifer system, a sequence of permeable limestone and dolostone, consists of the Upper Floridan aquifer, a middle semiconfining unit, a middle confining unit, and the Lower Floridan aquifer. The Upper Floridan aquifer provides most of the water required to meet current (2005) demand in Polk County.

Data from about 350 geophysical and geologist's logs were used to construct detailed hydrogeologic maps showing the tops and thicknesses of the aquifers and confining units within Polk County. Thickness of the surficial aquifer system ranges from less than 25 feet in parts of western Polk County to more than 200 feet along the southern part of the Lake Wales Ridge in eastern Polk County. Thickness of the intermediate aquifer system/intermediate confining unit is highly variable throughout the study area because of past erosional processes and sinkhole formation. Thickness of the unit ranges from less than 25 feet in the extreme northwestern part of the County to more than 300 feet in southwestern Polk County. The altitude of the top of the Upper Floridan aquifer ranges from about 50 feet above National Geodetic Vertical Datum of 1929 (NGVD29) in the northwestern part of the County to more than 250 below NGVD29 in the southern part.

The Upper Floridan aquifer is the primary source of water supply in the study area. In 2000, withdrawals totaled about 331 million gallons per day in Polk County. Of the total ground water used in 2000, 48 percent was for agricultural irrigation, 23 percent for public supply, 21 percent for commercial/industrial self-supplied, 4 percent for domestic self-supplied, 3 percent for recreational, and 1 percent for thermoelectric power generation.

The potentiometric surface of the Floridan aquifer system is constantly fluctuating, mainly in response to seasonal variations in rainfall and ground-water withdrawals. In September 2003, the altitude of the potentiometric surface of the Upper Floridan aquifer ranged from about 46 to 130 feet above NGVD29. Potentiometric surface altitudes in May 2004 were about 1 to 17 feet lower than those measured in September 2003. Water levels in the Upper Floridan aquifer have risen in some wells in Polk County since 1975. The rise in water levels is associated with the decrease in pumpage related mostly to phosphate mining; however, some wells in the northern part of the County have shown small declines in water levels. The decline in water levels is probably related to increases in water use associated with public supply or agricultural irrigation.

Ground-water quality was assessed by compiling data collected by State and Federal agencies. Also, monitoring wells were installed at key locations in the County where data had not been collected. Inorganic constituents were the focus of water-quality analysis. Concentrations of total dissolved solids, sulfate, and chloride in water samples from the surficial and intermediate aquifer systems generally were below State and Federal drinking water standards. Nitrate concentrations, however, were elevated (as high as 26 milligrams per liter (mg/L)) in the surficial aquifer system along the Lake Wales Ridge. The application of fertilizers related to citrus farming is a likely source of nitrate to the ground water in this area.

Constituent concentrations in water from the Floridan aquifer system generally were below State and Federal drinking water standards. Water from the Upper Floridan aquifer in most of the County is hard and has a dissolved-solids concentration of less than 500 mg/L. Chloride concentrations in water from the Upper Floridan aquifer range from 4.2 to 61 mg/L, and sulfate concentrations range from about 0.2 to 44 mg/L. In contrast to results from the surficial aquifer system, nitrate concentrations in the Upper Floridan aquifer generally were low and exceeded 1.0 mg/L in only three wells. Lower nitrate concentrations in the Upper Floridan aquifer indicate that denitrification may be occurring in the ground water.

Polk County contains the headwaters of the Peace River, which is a major source of fresh water to Charlotte Harbor and a source of drinking water to people in Charlotte, DeSoto, and Sarasota Counties. Human activities, especially phosphate mining, have resulted in decreased streamflows in the headwaters of the Peace River. Mean annual streamflows in the Peace River at Bartow have decreased substantially over the last 60 years from about 200 cubic feet per second (ft³/s) in 1940 to about 75 ft³/s in 2000. Decreased streamflows likely are related to lowered ground-water levels in the Upper Floridan aquifer. Historically, the Peace River was a gaining stream that received springflow from the Upper Floridan aquifer along its entire length. Pumpage from the Upper Floridan aquifer in the County has lowered ground water levels; a major spring (Kissengen Spring) no longer contributes flow to the Peace River. Reduced water use has resulted in stabilized streamflows in the Peace River at Bartow over the last 20 years; however, streamflows have not returned to 1940s conditions.

There are about 900 lakes or open-water features in Polk County greater than 10 acres. Ground-water inflow is important to sustain lake levels, particularly on the ridge areas. Many of these lakes naturally have no surface-water inlet or outlet and rely on the ground-water system to transport inflow and outflow to the lakes. Ground-water inflow to the lakes on the ridges varies substantially, ranging from 4 to 285 inches per year (1999-2000) or 7 to 83 percent of the total inflows. From 1960 to 2003, lake levels declined in 5 of the 14 lakes in the County in which sufficient data are available for trend analysis. Lowered lake levels also have been attributed to lowered ground-water levels in the Upper Floridan aquifer.