GEOHYDROLOGY AND WATER EXCHANGE IN THE AUCILLA–SUWANNEE–OCHLOCKONEE RIVER BASIN, SOUTH-CENTRAL GEORGIA AND ADJACENT AREAS OF FLORIDA: A PROJECT OVERVIEW

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Abstract. An 18-month project, which began during October 2006 by the U.S. Geological Survey—in cooperation with the Georgia Department of Natural Resources, Environmental Protection Division—is investigating the effect of long-term ground-water-level decline in the Upper Floridan aquifer on streamflow, springflow, recharge, and resource-development potential in the Aucilla–Suwannee–Ochlockonee River Basin of south-central Georgia and adjacent Florida. Measurements of ground-water level and of stream stage and discharge made during dry conditions during September 2006 provide information on current hydrologic conditions. Compilation of current and historical information regarding the hydrology, geology, climate, and water-use enables identification of hydrologic units contributing to the stream-lake-aquifer flow system and provides a framework for conceptualizing water exchange between ground-water and surface-water components.

INTRODUCTION

Unprecedented ground-water-level decline in the nearly 8,000 square-mile Aucilla–Suwannee–Ochlockonee (ASO) River Basin in south-central Georgia (Fig. 1) caused by increased agricultural pumpage from the Upper Floridan aquifer since the mid-1970s, and by drought conditions during the 1980s and from 1998 to 2002, has raised concern among State and local water managers about the sustainability of water resources to meet current and future demands. Since the early 1990s, increased use of center-pivot irrigation in outcrop areas of the Upper Floridan aquifer to the north and west of the ASO River Basin (Litts and others, 2001) has accelerated ground-water-level declines in that area and has intercepted regional ground-water flow that otherwise would enter the basin (Torak and Painter, 2006). Long-term ground-water-level decline in the Upper Floridan aquifer has the potential to reduce springflow, decrease ground-water discharge to streams (baseflow), and diminish regional ground-water flow entering the basin from the north and west. The ongoing study evaluates existing hydrologic, geologic, climatic, and water-use information and identifies hydrologic units that contribute to ground- and surface-water exchange as an initial step toward conceptualizing regional ground-water flow and stream-lake-aquifer interaction.

The diverse geologic setting of the ASO River Basin in Georgia controls the degree of hydraulic connection of the Upper Floridan aquifer with surface water. Hydraulic connection ranges from limited indirect connection through thick (more than 150 feet) overburden separating the aquifer from surface water in the northern and western parts of the basin, to direct contact of the limestone aquifer with major streams and lakes in the southern part of the basin. The water levels of Lakes Iamonia, Jackson, and Miccosukee, in the northern panhandle of Florida just north of Tallahassee (Fig. 1), mirror the water level of the Upper Floridan aquifer. Lake levels are controlled by regional ground-water flow from southwestern Georgia and by direct hydraulic connection of the lake bottoms with sinkholes and other solution features developed in the limestone, accessed on the Web on October 31, 2006, at *http://en.wikipedia.org/wiki/Lake_Iamonia,_Florida*; *http://en.wikipedia.org/wiki/Lake_Jackson_(Tallahassee,_Florida); http://www.answers.com/topic/lake-miccosukee*.

STUDY OBJECTIVES

- Improve understanding of the lithology and hydraulic properties of the Upper Floridan aquifer and of hydraulically connected geologic units that contribute to ground-water and surface-water exchange in the ASO River Basin;
- Identify spatial and temporal distributions of ground-water withdrawal from the Upper Floridan aquifer for agriculture, industry, and municipal supply. Define seasonal variability and the cause-and-effect relation of pumpage to streamflow decline;
- Develop a hydrogeologic framework and conceptual model to evaluate water exchange between the karst Upper Floridan aquifer and other hydraulically connected units and surface water;
- Collect and compile ground-water-level and streamflow measurements and generate a synopsis of current hydrologic conditions; and
- Assess the likelihood of pumpage from the Upper Floridan aquifer in Georgia affecting springflow and lake levels in northern Florida.

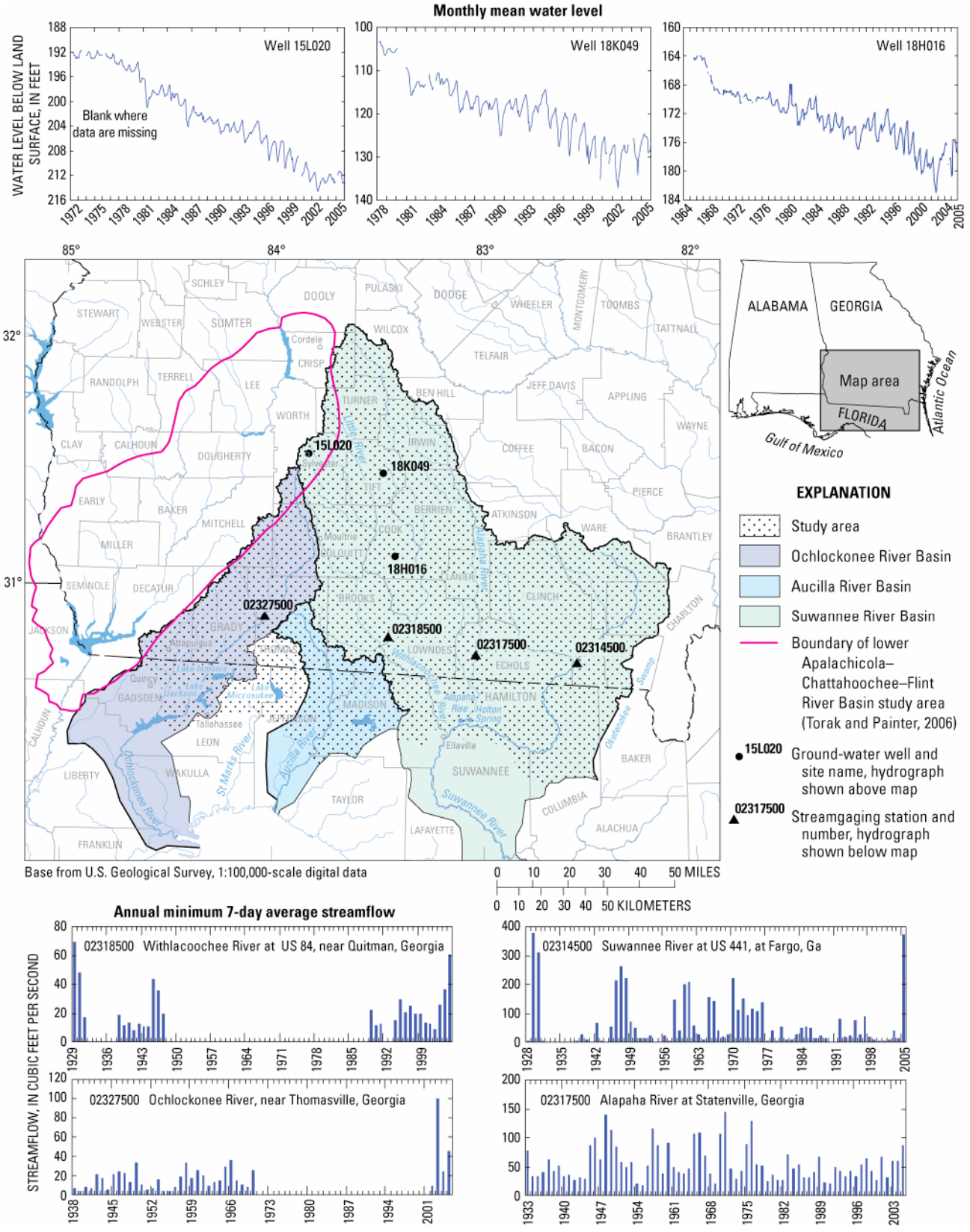

Figure 1. Ground-water-level and streamflow hydrographs for selected observation wells and streamgaging stations, respectively, in the Aucilla–Suwannee–Ochlockonee River Basin. Daily mean water level in well 15L020, Worth County, Ga., declined about 24 feet (ft) since the beginning of record during 1973. About 36 ft of decline in daily mean water level occurred in well 18K049, Tift County, Ga., since the beginning of record during 1978; about 24 ft of this decline occurred during 1995–2003. Daily mean water level in well 18H016, Cook County, Ga., declined about 20 ft since well-installation during 1964; about half of this decline occurred during 1993–2003. Streamflow hydrographs for the Alapaha River at Statenville, Ga., streamgaging station 02317500; and Suwannee River at Fargo, Ga., streamgaging station 02314500, show declines in annual minimum seven-day average streamflow since the late 1970s.

PURPOSE AND SCOPE

The 2-year study addresses technical needs regarding development of a hydrogeologic framework, conceptualization of stream-lake-aquifer interaction, and establishment of cause-and-effect relations between groundwater withdrawal and declines in streamflow and springflow in the ASO River Basin, in support of the State of Georgia's Comprehensive Statewide Water Management Planning Act and consistent with the Mission of the U.S. Geological Survey (available on the Web, respectively, at *http://www.gadnr.org/gswp/index.html* and *http://www.usgs.gov/stratplan/vision.html*, both accessed October 2, 2006). Data and analyses resulting from this study will provide a "sound scientific foundation" to key elements of the comprehensive statewide water management plan that address water-resource sustainability, protection of public health and natural systems, and enhancement of quality of life (*http://www.gadnr.org/gswp/index.html*, accessed October 2, 2006).

The study is identifying geologic units in hydraulic connection with surface water in the ASO River Basin, including but not limited to the Upper Floridan aquifer and upper semiconfining unit, and the underlying Lisbon Formation. Simultaneous measurements of ground-water level at about 330 wells and of stream stage and discharge at 83 streamgaging stations during the dry conditions of September 2006 provide a synopsis of current hydrologic conditions in the ASO basin. The study focuses on the stream drainage of the ASO River Basin in Georgia and includes adjacent areas of the panhandle of northwestern Florida (Fig. 1) as needed to complete the geohydrologic evaluation and regional flow-system conceptualization. The study assesses the feasibility and value of further analysis of the stream-lake-aquifer flow system by using numerical-simulation techniques to address the State's water-management objectives and assesses the potential to integrate any newly developed model with existing models to form a regional water-management tool.

LITERATURE CITED

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