THE DEVELOPING WATER CRISIS IN SOUTHEAST GEORGIA & NORTHEAST FLORIDA AND HOW TO AVERT IT

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Abstract. Groundwater levels in the Upper Floridan aquifer in northeast Florida and southeast Georgia have declined significantly from pre-development conditions. Comparison of current levels to those of the U.S. Geological Survey's 1936 groundwater level map indicate that the decline is in the range of 15 to 20 feet at the northeastern boundary of the Suwannee River Water Management District (SRWMD) and Georgia. An extensive evaluation of available hydrologic data indicates that this decrease is apparently a result of groundwater withdrawals originating in the SRWMD and St.John's River Water Management Districts (SJRWMD) in Florida and in numerous counties in southeast Georgia. Figure 1 shows the location of Florida's northern water management districts.

Figure 1. Location of the Suwannee River, St. John's River, Northwest Florida, and Southwest Florida Water Management Districts.

Figure 2 illustrates the southwestward migration of the groundwater basin divide resulting from the decline in groundwater levels. The divide has migrated more than 35 miles to the southwest over the past 70 years. The result of this migration is a decrease in the size of the groundwater contributing area to the eastern SRWMD by more than 20 percent or 1,900 square miles (Jones, Ashby, and Davis, 2010). The significance of the divide migration is that flow in the Upper Floridan aquifer that once moved southwestward into the SRWMD, has been redirected to the northeast. This is suspected to have impacted a number of rivers and springs to the degree that they are not currently meeting or will not meet flow constraints established by the SRWMD prior to 2030 (Jones, Ashby, and Davis, 2010). An example is the cessation of flow at White Springs. Modeling investigations conducted by the US Geological Survey assigned the spring an average discharge of 53.4 cubic feet per second (Sepulveda and Nicasio, 2002). The spring apparently ceased regular discharge in the mid 1970s. There are also anecdotal accounts of flow declines and cessation of flow in other minor springs in the vicinity of White Springs. An additional impact is a possible decline in baseflow to the Upper Suwannee River.

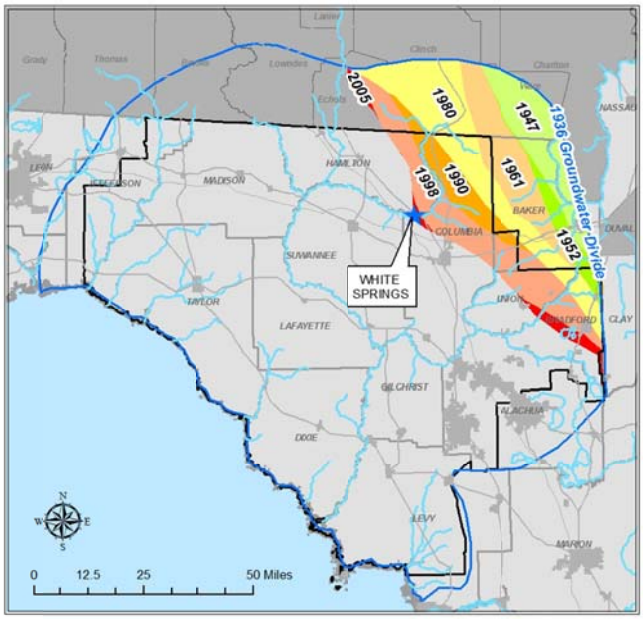

Figure 2. Migration of the Groundwater Basin Divide in Northeast Florida and Southeast Georgia.

Because of similar impacts to water resources across Florida, the state's five water management district's are now required to periodically complete water supply assessments (WSA) to determine how much groundwater can be withdrawn before negative water resource impacts occur. Cardno ENTRIX was retained in 2008 by the SRWMD to assist with development of their

WSA. As part of the WSA, Cardno ENTRIX utilized the SRWMD's North Florida Model; a three-dimensional, five-layer, steady-state groundwater flow model (Schneider and others, 2008). The model used current and projected groundwater withdrawal rates in the model domain to predict water resource impacts through the year 2030.

The model domain, the area inside the blue line in Figure 1, included all of the SRWMD, the northern nine counties in the SJRWMD, smaller areas in the Northwest Florida Water Management District (NWFWMD) and Southwest Florida Water Management District (SWFWMD), and all or part of ten counties in southeast Georgia. The area beyond the boundaries of the SRWMD was included in the model domain to ensure that the model had the ability to assess the degree of impacts that could occur to natural systems in the SRWMD from current and future groundwater withdrawals throughout the region. Figure 3 shows how the current and projected groundwater withdrawals in the model domain are proportioned between the Florida water management districts and southeast Georgia (Jones Ashby, and Davis, 2010).

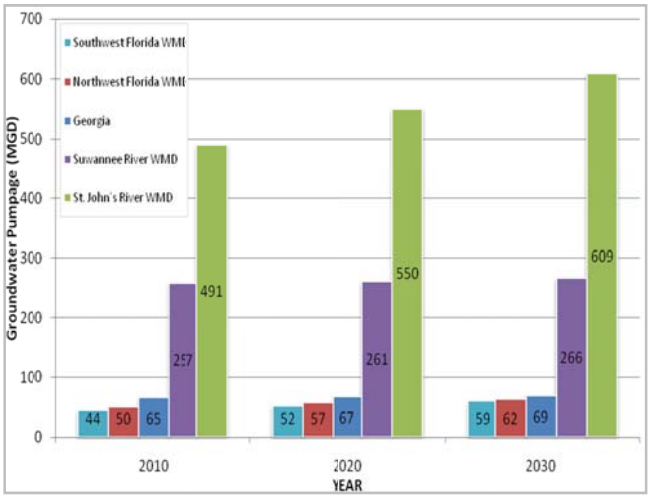

Figure 3. Current and Projected Groundwater Withdrawals in the North Florida Model Domain.

The model predicted impacts from current and projected groundwater withdrawals on water levels in the surficial and Upper Floridan aquifers . The model related these changes to flow at gages in rivers and springs, which allowed reductions in springflow and streamflow to be predicted. Each river and spring in the model domain was given a constraint by the SRWMD, which is a flow that must be maintained to prevent ecological harm to the water resource (Farrel and others, 2005-2008). The model was run and the resulting changes in flow in rivers and springs were analyzed in five-year increments and compared to the flow constraints to determine whether they would be exceeded between 2010 and 2030 (Jones, Ashby, and Davis, 2010). Table 1 shows the results of this analysis.

Table 1. Rivers and Springs in the SRWMD Predicted to Exceed Flow Constraints between 2010 and 2030.

Water Resource	Five-Year Increment when Exceedance is Predicted to Occur
Alapaha River At Jennings	2010-2015
Upper Santa Fe River at Worthington Springs	2010-2015
Lower Santa Fe River at Ft. White	2025-2030
Upper Suwannee River at White Springs	2010-2015
Hornsby Spring	2015-2020
Santa Fe River Rise	2025-2030

The SJRWMD is also completing a WSA that indicates that a number of water resources may currently be impacted and more may be impacted prior to 2030 as a result of existing and projected groundwater withdrawals. It is highly likely that water resource impacts are also occurring in southeast Georgia.

The key to avoiding or mitigating water resource impacts in the region is a much greater level of interstate cooperation between the agencies that monitor and regulate ground and surface water resources, with assistance from the US Geological Survey, in northeast Florida and southeast Georgia (Jones, Ashby, and Davis, 2010). Actions that should be taken to identify, investigate, and manage impacts are listed below.

- Inventory all types of hydrologic data currently collected in the region and develop and maintain a common database to store it.
- Develop common methodologies for 20-year demand projections for major water users in the region including agriculture, public supply, domestic self supply, industrial, commercial, institutional, thermo-electric power generation, and recreational.
- Develop a strategy for data collection, data analysis and groundwater modeling to better define current and future regional water resource impacts. As part of this process, identify additional data collection needs, i.e., additional

monitor wells, stream gaging stations, precipitation and evapotranspiration stations, etc.

- Produce periodic, regional groundwater level maps to develop a more complete understanding of long-term aquifer trends in the region.
- Develop a common process to establish flow and water level constraints for rivers, springs, lakes, wetlands, and aquifers.
- Develop a groundwater flow model with a domain that would encompass the entire region. Input the demand projections into the model to determine how much of the projected demand could be met with groundwater from the Upper Floridan aquifer before constraints on wetlands, lakes, springs, and streams are violated.
- Establish a process to identify current and future regional water resource impacts, determine causes, and develop strategies to recover or prevent the impacts.
- Coordinate the review of groundwater use permits in the region to ensure consistency in requirements, restrictions, and special conditions.
- Develop a technical working group consisting of representatives from water resource agencies, the U.S. Geological Survey, and Universities to oversee the development and implementation of the preceding recommendations.
- Develop a group of non-technical stakeholders consisting of representitives from all the major water use categories, local governments, environmental groups, and private citizens. Educate the stakeholders on the issues, include them in the process to develop solutions, and work with them to gain support to implement solutions.

LITERATURE CITED

Farrell, Mark D. and Upchurch, Sam B., 2007. MFL Establishment of the Upper Santa Fe River. Suwannee River Water Management District Technical Report, 294 pages.

Jones, Gregg W., Ashby, Brandon, and Davis, R., 2010. Water Supply Assessment, Suwannee River Water Management District.Available on line at www.srwmd.state.fl.us

Schneider, James W., Upchurch, Sam B., Chen, Jian, and Cain, Crystal, 2008. Simulation of Groundwater Flow in North Florida and South-Central Georgia: A Three-Dimensional Model of Groundwater Flow in the Surficial, Intermediate, and Floridan Aquifer Systems. Suwannee River Water Management District, 99 pages.

Sepulveda, Nicasio, 2002. Simulation of Ground-Water Flow in the Intermediate and Floridan Aquifer Systems in Peninsular Florida. U.S. Geological Survey Water Resources Investigations Report 02-4009, 138 pages.