Summary of Hydrologic Conditions in Georgia, 2008

The United States Geological Survey (USGS) Georgia Water Science Center (WSC) maintains a long-term hydrologic monitoring network of more than 290 real-time streamgages, more than 170 groundwater wells, and 10 lake and reservoir monitoring stations. One of the many benefits of data collected from this monitoring network is that analysis of the data provides an overview of the hydrologic conditions of rivers, creeks, reservoirs, and aquifers in Georgia.

Hydrologic conditions are determined by statistical analysis of data collected during the current water year¹ (WY) and comparison of the results to historical data collected at long-term stations. During the drought that persisted through 2008, the USGS succeeded in verifying and documenting numerous historic low-flow statistics at many streamgages and current water levels in aquifers, lakes, and reservoirs in Georgia. Streamflow data from the 2008 WY indicate that this drought is one of the most severe on record when compared to drought periods of 1950–1957, 1985–1989, and 1999–2002.

Precipitation deficits in 2008 continued from the previous 2 years,

¹Water year is the period October 1 through September 30 and is designated by the year in which it ends. For example, the 2008 water year began on October 1, 2007, and ended on September 30, 2008.

and new historic minimum flows were recorded at several streamgages with 20 or more years of record. New historic low water levels were recorded in some of Georgia's confined and unconfined aquifers, and many recorded water levels were below the historic median. Several lake and reservoir water levels were well below average and continued to decline as the end of the 2008 WY approached.

Historically, droughts in Georgia typically have lasted between 2 and 5 years. The latest drought began in spring 2006. Georgia's Drought Level One through Four are issued by the Georgia Environmental Protection Division (Regan and Cash, 2009). The drought levels implement water saving techniques with Level One Drought being the least conservative to Level Four Drought being the most conservative. Conditions in north Georgia developed from a Level One Drought in June 2006, with hourly limits on outdoor watering schedules, to a Level Four Drought in September 2007. On October 23, 2007, the State of Georgia mandated a 10-percent reduction or greater in water consumption in all areas designated as Level Four Drought. Outdoor water use was restricted in residential areas. Commercial water users, such as carwashes, were asked to voluntarily reduce their consumption by 10 percent (Regan and Cash, 2009).

Lake Sidney Lanier, Georgia. Photo by Brian E. McCallum, USGS, February 2008.

Local governments asked residents to limit showers to 5 minutes or less, reuse clean household water, and install low-flow toilets, faucets, and showerheads, if possible, in older homes (City of Union City, 2008).

Streamflow and Groundwater Data

The illustrations in this Fact Sheet were created using the daily, monthly, and yearly streamflow and groundwater statistics from the 2008 USGS Annual Data Report (ADR), (U.S. Geological Survey, 2009a). The ADRs for WYs 1999–2008 can be accessed online at <http://wdr.water.usgs.gov/adrgmap/index.html>. A digital map is available at this site to interface with current and historical data, graphics, and photographs from the Georgia WSC monitoring network.

New Minimum Streamflows

(A) New record-low monthly discharge occurred at 75 of 103 streamflow-gaging stations with 20 or more years of record in 2008. These 75 streamflow stations are located throughout Georgia. Most of the State received less than normal precipitation. Normal is defined as a 30-year average for 1971–2000.

(B) New record-low 7-day average discharge occurred at 23 streamgages with 20 or more years of record in 2008. More than half of these streamflow stations, 14 of 23, also had new 7-day average minimum streamflows in the 2007 WY. The majority of these streamflow-gaging stations were located in north Georgia, which received 75–90 percent of normal precipitation during WY 2008.

Coosawattee River near Ellijay 02380500

Coosawattee River near Ellijay, Georgia. Photo by USGS.

The Coosawattee River is the primary inflow for Carters Lake in north Georgia. The peak flow recorded for the 2008 WY at Coosawattee River near Ellijay was 3,420 cubic feet per second (ft³/s), the 12th lowest annual peak flow in 68 years of record. Annual runoff was less than one-half of the long-term average. New historic low 7-day average streamflows were observed from October through February, and streamflows rarely reached "normal" conditions throughout the year. The peak flow of the year was in August when Tropical Storm Fay brought short-term relief, but conditions quickly returned to "much below normal" because of persistent drought conditions.

Hydrologic Drought Map, 7-day average streamflow conditions August 8–14, 2008

This map represents hydrologic conditions in the context of available historical data. Only stations having at least 30 years of record were used (U.S. Geological Survey, 2009b).

Flint River near Oakfield 02350512

Flint River near Oakfield, Georgia. Photo by USGS.

The Flint River flows from the Piedmont to Lake Seminole in southwest Georgia (U.S. Geological Survey, 1975). The Flint River is one of only 40 rivers in the contiguous United States that flow unimpeded for more than 200 river miles (Georgia Humanities Council, 2009).

In 2000, the General Assembly passed House Bill 1362, "Flint River Drought Protection Act" (Georgia General Assembly, 2000). This Act aims to maintain a minimum flow by providing incentives for farmers in southwest Georgia to not irrigate their land during a severe drought.

The peak flow for the 2008 WY was 11,700 ft³/s, this is the second lowest in 52 years of record. Annual runoff was one-half the long-term average. New historic low 7-day average discharge and historic low daily-mean streamflows were observed. Flow was "normal" from January to April and during Tropical Storm Fay in August and September but otherwise was "below normal."

Daily Discharge

Hydrographs show 2008 daily-mean streamflow, in cubic feet per second, as compared to historical minimum and median streamflow for the entire period of record (U.S. Geological Survey, 2009a).

EXPLANATION

Historical daily flow
Minimum Median
— 2008 daily mean

7-Day Average Discharge

Hydrographs show the 7-day average for 2008 as compared to historical 7-day averages. Data are categorized in percentile ranges from "much above normal" (greater than the 90th percentile) to "much below normal" (less than the 10th percentile) (U.S. Geological Survey, 2009b).

EXPLANATION

Historical (percentile)
Much above normal, ≥ 90
Above normal, 76 to 89
Normal, 25 to 75
Below normal, 11 to 24
Much below normal ≤ 10
— 2008 water year

Middle Oconee River near Arcade 02217475

Middle Oconee River near Arcade, Georgia. Photo by USGS.

The Oconee River, which begins in the Piedmont, joins the Ocmulgee River to form the Altamaha River in Georgia's Upper Coastal Plain. Several cities are located along the Oconee River, including Athens, Milledgeville, and Dublin (U.S. Geological Survey, 1975).

The peak flow for the 2008 WY was 1,670 ft³/s, this is the lowest annual peak discharge in 22 years of record. Annual runoff was one-third of the long-term average. New historic low 7-day average discharge and historic low daily-mean streamflows were observed from October through December, and streamflow rarely reached normal conditions throughout the year. The annual peak was in August when Tropical Storm Fay brought short-term relief, although conditions quickly returned to "much below normal" because of persistent drought conditions.

Altamaha River near Baxley 02225000

Altamaha River near Baxley, Georgia. Photo by USGS.

The Altamaha River basin is 14,000 square miles (mi²) and drains nearly one-fourth of the State of Georgia. The Altamaha River is the third largest contributor of fresh-water to the Atlantic Ocean on North America's eastern shore (Georgia Humanities Council, 2009). The watershed extends from the upper Piedmont to the Lower Coastal Plain and encompasses the cities of Athens, Macon, Milledgeville, and parts of Atlanta (U.S. Geological Survey, 1975).

The peak flow recorded for the 2008 WY at Altamaha River near Baxley was 23,600 ft³/s, the seventh lowest peak flow in 51 years of record. Annual runoff was about half of the long-term average. New historic low 7-day average discharge and historic low daily-mean flows were observed from October through December and "much below normal" flow was observed from June through September.

Climate Response Network

The USGS maintains a network of wells to monitor the effects of droughts and other climate variability on groundwater levels. These wells are part of the Climate Response Network, which is designed to reflect the effects of climate on groundwater levels in unconfined aquifers or near-surface confined aquifers where minimal pumping or other human influences on groundwater levels occur (U.S. Geological Survey, 2007). The national network consists of about 140 wells, and 15 of these wells are located in Georgia. Information obtained for the 2008 WY from 4 of these wells is summarized in this section. These wells are monitored as part of the USGS Groundwater Resources and Cooperative Water Programs. Current conditions of groundwater wells in the Climate Response Network can be accessed online at <http://groundwaterwatch.usgs.gov>.

Well 07H003

is located in Miller County in southwestern Georgia and is completed in the surficial aquifer. The water level in this well generally rises rapidly during wet periods and declines slowly during dry periods. A new record-low water level was recorded on December 28, 2007. The highest water level below land surface was recorded during Tropical Storm Fay in August

when some locations in southwestern Georgia received more than 13 inches of rainfall during August 21–27, 2008 (Georgia Automated Environmental Monitoring Network, 2008). The water level in well 07H003 responds to seasonal change similarly to streamflow at nearby streamgage Spring Creek near Iron City 02357000, which indicates atmospheric, surface-water, and groundwater interactions.

Georgia's Climate Response Network

Hydrographs are presented on the Climate Response Network Web site for wells with at least 5 years of continuous data. The 2008 WY data are shown here for selected wells.

Well 21T001 is located in Laurens County in east-central Georgia and is completed in a semiconfined part of the Upper Floridan aquifer. Water levels in semiconfined areas of the Upper Floridan aquifer fluctuate seasonally in response to variations in precipitation, evapotranspiration, and natural drainage or discharge (Peck and others, 2009). A new record-low water level was recorded on December 14, 2007. Water levels remained below the historical daily median for the entire 2008 WY. The water levels reacted gradually during and after Tropical Storm Fay in August when the Dublin area received more than 4 inches of rainfall during August 21–27, 2008 (Georgia Automated Environmental Monitoring Network, 2008). The water level in well 21T001 responds to seasonal change similarly to streamflow at nearby streamgage Oconee River near Dublin 02223500, which indicates atmospheric, surface-water, and groundwater interactions.

Well 35P094 is located in Chatham County in southeastern Georgia and is completed in the surficial aquifer. Water levels generally rise rapidly during wet periods and decline slowly during dry periods. During the 2008 WY, the water level was normal until several months of dry weather caused the water level to dip below the historical daily median from May through July. In August, Tropical Storm Fay brought relief with more than 5 inches of rainfall during August 19–25, 2008 (Georgia Automated Environmental Monitoring Network, 2008). The water level in well 35P094 responds to seasonal change similarly to streamflow at nearby streamgage Peacock Creek at McIntosh 02203559, which indicates atmospheric, surface-water, and groundwater interactions.

Well 16MM03 is located in White County in northeastern Georgia and is completed in the crystalline-rock aquifer. Water is stored in the regolith and fractures, and the water level is affected by precipitation and evapotranspiration (Cressler and others, 1983). Precipitation can cause a rapid water-level rise in wells tapping aquifers overlain by thin regolith (Peck and others, 2009). The water level was near a record low at the start of the 2008 WY and rarely rose above the historical daily median. The highest water level below land surface was recorded during Tropical Storm Fay in August when the Dahlonega area received more than 10 inches of rainfall during August 24–28, 2008 (Georgia Automated Environmental Monitoring Network, 2008). The water level in well 16MM03 responds to seasonal change similarly to streamflow at nearby streamgage Chattahoochee River at Helen 02330450, which indicates atmospheric, surface-water, and groundwater interactions.

Lakes and Reservoirs

Major lakes and reservoirs throughout Georgia are managed primarily by the U.S. Army Corps of Engineers and Georgia Power Company to provide water to the public and industry, flood protection, power generation, wildlife management, and recreation. Managing lakes and reservoirs requires computer models, climate forecasts, water-demand forecasts, and USGS data to address all of these needs. During the 2008 WY, Georgia's lakes and reservoirs continued to have record minimum levels as a result of the continued drought. Emergency water-conservation efforts by both State and local authorities were in place for the entire 2008 WY. The drought has further emphasized the need for accurate, timely data to make informed decisions regarding the management and conservation of Georgia's water resources.

Lake Sidney Lanier (Lake Lanier) is the primary drinking-water source for the Atlanta metropolitan area and is located on the Chattahoochee River. Lake Lanier is the most upstream reservoir in a series of reservoirs that include West Point Lake, Walter F. George Lake, and Lake Seminole. Lake Lanier had 3.7 times more outflow than inflow and the pool elevation declined more than 7 feet from October through December 2007. On December 26, 2007, Lake Lanier reached an all-time historic low elevation of 1,050.79 feet. The U.S. Army Corps of Engineers releases water from Lake Lanier to manage water in downstream reservoirs and to help assure a healthy environment for aquatic and animal life.

Lake Lanier water levels increased from January through May 2008; however, the levels were still well below the average of 1,067.5 feet. Water levels began to decline again in June. Outflows were necessary to manage downstream reservoirs, including Walter F. George, to meet power-generation needs. The low lake levels adversely affected recreation. The July 4 holiday is typically one of the busiest recreational times of the year for boating and other water recreation.

On July 4, 2008, the lake elevation was 15 feet below full pool and more than half of the public launch sites were closed causing significant economic impact (Lake Lanier Association Inc., 2008).

Hartwell Lake is a manmade lake bordering Georgia and South Carolina on the Savannah, Tugaloo, and Seneca Rivers. Hartwell is the most upstream reservoir on the Savannah River. Water is released to the downstream reservoirs Richard B. Russell and J. Strom Thurmond. These three lakes on the Savannah River are managed by the U.S. Army Corps of Engineers for water supply, power generation, and water quality needs of the Savannah River from below Thurmond Dam all the way to Savannah, Georgia, and the Atlantic Ocean (U.S. Army Corps of Engineers, 2009b). Hartwell Lake had twice as much outflow as inflow, and the pool elevation fell more than 4 feet from October through December 2007.

(Data from U.S. Army Corps of Engineers, 2009a)

Hartwell Lake water levels increased from January through April 2008; however, levels remained well below the average of 657.0 feet. Water levels declined rapidly from May to September 2008, and the lake elevation approached a new historic low. J. Strom Thurmond Lake is the largest reservoir in Georgia, and it is used primarily for flood control and power generation. Water levels are affected by inflow from Hartwell Lake and Richard B. Russell Lake, but outflows remain nearly constant.

Tropical Storm Fay, August 17–29, 2008

Tropical Storm Fay provided Georgia with some relief from drought conditions during 2008. Fay dropped as much as 20 to 25 inches of rain in the southwest corner of the State and 3 to 10 inches along the Georgia–Alabama border (National Oceanic and Atmospheric Administration, 2008). Georgia WSC personnel made 133 discrete discharge measurements at 101 streamgaging stations before, during, and after Tropical Storm Fay during August 21–31, 2008, to verify and extend streamflow ratings.

Upatoi Creek near Columbus, Georgia. A USGS technician making a flood measurement using an acoustic Doppler current profiler (ADCP). Photo by Andrew E. Knaak, USGS.

Runoff

Runoff is the average streamflow per unit area, or streamflow yield. Runoff for the 2008 WY was computed from data recorded at 174 streamgages in Georgia. The median runoff from these gages is shown in the bar chart for selected drought years. The median runoff for the 2007 and 2008 WYs was less than one-half of the average of the medians from 1955 to 2008 (U.S. Geological Survey, 2009b).

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