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Troup County Board of Commissioners

Scientific Investigations Map 3058
Well Inventory and Geophysical Logging of Selected Wells in Troup County, Georgia, 2007–2008—SHEET 1 OF 1
Peck, M.F., Leeth, D.C., and Hamrick, M.D., 2008, Well Inventory and Geophysical Logging of Selected Wells in Troup County, Georgia, 2007–2008

Introduction

The U.S. Geological Survey (USGS)—in cooperation with the Troup County Board of Commissioners—conducted a well inventory to provide information to help evaluate ground-water resources for Troup County, Georgia. In addition, borehole geophysical logs were collected in selected wells to provide a better understanding of the subsurface geologic and water-bearing characteristics in specific areas of interest. This investigation provides information to help guide future ground-water development and water-management decisions for Troup County while enhancing understanding of the hydrogeology of fractured rocks in the Piedmont physiographic province. This report presents well data compiled from USGS files and from site visits to wells during November and December 2007. Data were entered into the USGS National Water Information System (NWIS) and made available on the Web at *http://waterdata.usgs.gov/ga/nwis/inventory*.

Previous studies of ground-water resources have been conducted in the vicinity, but did not include Troup County. The ground-water resources of Heard and Coweta Counties, located north and northeast, respectively, of Troup County were part of a larger study by Cressler and others (1983) that encompassed the Greater Atlanta Region. That study evaluated the quantity and quality of ground water in the Atlanta region and described the methods that could be used for locating high-yielding wells in the Piedmont Province. The geology underlying the Atlanta area is similar to that underlying Troup County. Clarke and Peck (1990) conducted a similar investigation that included Meriwether and Coweta Counties, located to the east and northeast of Troup County.

Well Identification System

All of the wells located during this study were assigned a well number according to a system based on the index of USGS 7½-minute topographic maps of Georgia. Each map in Georgia has been assigned a three- to four-digit number and letter designation (for example, 04X) beginning at the southwestern corner of the State. Numbers increase sequentially eastward and letters advance alphabetically northward. Quadrangles in the northern part of the State are designated by double letters: AA follows Z, and so forth. The letters "I," "O," "II," and "OO" are not used. Wells inventoried in each quadrangle are numbered consecutively, beginning with 001. Thus, the fourth well inventoried in the 04X quadrangle is designated 04X004. In the USGS NWIS database, this information is stored in the "Station Name" field (*http://waterdata.usgs.gov/ga/nwis/gw*).

Acknowledgments

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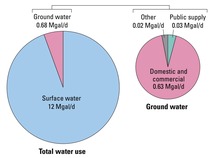
Description of the Study Area

Troup County encompasses about 414 square miles in west-central Georgia and lies entirely within the Greenville Slope District, Southern Piedmont Section of the Piedmont Province (Clark and Zisa, 1976). Topographic relief across the county ranges in elevation from 539 to 948 feet (ft). The Chattahoochee River flows across the county to the southwest and is impounded near West Point, Georgia, to form the 25,900-acre West Point Lake (*http://www.georgialakeinfo.com/westpointe/info.shtml*, accessed August 6, 2008). During 2006, about 65,000 people resided in Troup County, which is an increase of 7.6 percent from 2000 (*http://quickfacts.census.gov/qfd/states/13/13285.html*, accessed on August 6, 2008).

Total water use in Troup County for 2000 was 12.68 million gallon per day (Mgal/d), of which 12 Mgal/d was from surface-water sources—the Chattahoochee River—and 0.68 Mgal/d from ground-water sources (Fanning, 2003). The major uses of ground water were for domestic and commercial needs (0.63 Mgal/d) and public supply (0.03 Mgal/d).



In Troup County, ground water is obtained from shallow bored wells completed in the regolith and from deeper drilled wells completed in the fractured crystalline bedrock. In the Piedmont Province, the crystalline-bedrock aquifer is composed of highly deformed metamorphic and igneous rocks and ranges in thickness from about 10 to 10,000 ft (Cressler and others, 1983). Primary permeability in the crystalline rocks is low; however, there are areas of secondary permeability where high-yielding wells are present (Williams and others, 2005). Ground water is transmitted through the regolith and secondary openings in the bedrock, such as along foliation, fractures, veins, joints, and contacts between different rock units that have undergone some degree of weathering (Cressler and others, 1983). The geologic map shown in this report (Lawton and Marsalis, 1976) indicates most of the county is underlain by three rock units: (1) hornblende gneiss/amphibolite, (2) mica schist/gneiss/amphibolite, and (3) granite gneiss/granite. Each of these rock units is composed of different rock types with varying hydrologic properties. More detailed geologic mapping would be required to identify specific rock types with potential for high-yielding wells.

Well Inventory

Well-construction, water-level, lithologic, and yield data provide important background information to evaluate the hydrogeology of a particular area; these data can be used in conjunction with geophysical-log and detailed geologic-mapping data to better understand the relation between well yield and geology. For this study, well-construction, yield, and location data were compiled from existing well records and then field verified by USGS personnel during a well inventory.

Prior to this study, data pertaining to the geology and ground-water resources of Troup County were limited, so an extensive field inventory of wells was conducted to obtain additional information. Well data were obtained from local well drillers and from the USGS NWIS database, and a preliminary location map was constructed. Wells were selected for field inventory to provide a good areal distribution and to fill voids in areas of sparse coverage. Data collected and verified in the field included owner name, total well depth, casing depth and diameter, open or screened intervals, driller, latitude and longitude, use of water, year drilled, land-surface elevation, static and pumping water levels, and estimated yield. Well owners were asked about any problems with the quality of the water or effects from recent droughts, such as having to lower the pump because of water-level decline. Collected data were entered into the NWIS system and are now available on the Web at *http://waterdata.usgs.gov/ga/nwis/*. During this study, 132 wells were added to the database, which already included 80 wells in Troup County.

Results of the well inventory indicate that well yields vary greatly across the county ranging from 0.5 to more than 150 gallons per minute (gal/min). Of the wells inventoried, 97 had estimated yields from 0.5 to 25 gal/min, 13 wells from 26 to 50 gal/min, 14 wells from 51 to 100 gal/min, and 1 well had an estimated yield of 150 gal/min. There would seem to be potential for development of high-yielding wells because 28 of the wells had yields of 26 gal/min or greater. The majority of the existing wells in the county were probably located out of convenience in relation to an existing home or business. A combination of detailed geologic mapping, well inventory, and geophysical logging may increase the probability of drilling a high-yielding well (Cressler and others, 1983; Williams and others, 2005).

Geophysical-Log Data Collection

Geophysical logging was performed in two wells identified during the well inventory. Well 05Y011 had a reported yield of 10 gal/min, whereas well 07X009 had a reported yield of 40 gal/min. Geophysical logging tools measure properties of the rock units, water quality, and help to identify the water-bearing zones or fractures in the well (Williams and Peck, 2007). The caliper tool records the borehole diameter and is used to identify fractures and detect changes in borehole diameter that may be related to changes in rock type or well construction. Natural gamma logs measure gamma radiation emitted by the rock units and can detect the presence of radioactive zones, which may degrade water quality. Electric logs (long- and short-normal and lateral resistivity) measure the apparent resistivity of the rock units and can be used to identify water-bearing zones (typically areas of low resistivity). Fluid logs measure the fluid resistivity and temperature of the water in the well, which may indicate water-producing zones due to changes in resistivity (water quality) and temperature (indication of flow into or out of the borehole). Flowmeter logging measures the direction and volume of vertical flow in the well and can be used to identify fractures where water is entering or exiting the well (Williams and Peck, 2007). High-resolution, oriented color digital images of the borehole were obtained using an optical televiewer tool. Data acquired by this tool can help to identify rock units and fractures and determine their orientation, which can then be correlated to surface geologic mapping.

Data from geophysical logs collected in wells 05Y011 and 07X009 showed that water-bearing zones are present along contacts between lithologic units, where abundant moderate- to high-angle joints occur, and along subhorizontal fractures. Also apparent from the geophysical logs are the relatively low yields associated with rock units with few fractures.

The caliper and optical televiewer logs from well 05Y011 indicate only one major fracture in the well at 337 ft. Although flowmeter logs were not run in this well because of the reported low yield, most of the water (10 gal/min) likely is coming from this zone. Overall, this well has few fractures in the borehole, as shown on the electric logs as areas of high resistivity.

The geophysical and flowmeter logs from well 07X009 indicate two water-bearing zones in the well that contribute a total reported yield of 40 gal/min. Overall, this well has abundant moderately-to-steeply-dipping fractures in the borehole, areas of low resistivity on the electric logs, which increase the movement of water through the crystalline rock to the main water-producing fractures. The two water-bearing zones were identified by flowmeter logging and optical televiewer and are evident on the caliper log at 100 and 230 ft. These zones occur as partings along foliation at contacts between different rock types. The white lines on the optical log at 100 ft are sections where the tool did not record any data. Data obtained from logs indicate that about 85 percent of the water is coming from the zone at 230 ft and 15 percent of the water is coming from the zone at 100 ft. The flowmeter did not show any flow from the zone near the fracture at 106 ft.

Selected References

Chapman, M.J., Crawford, T.J., and Tharpe, W.T., 1999, Geology and ground-water resources of the Lawrenceville area, Georgia: U.S. Geological Survey Water-Resources Investigations Report 98–4233, 46 p.

Clark, W.Z., Jr., and Zisa, A.C., 1976, Physiographic map of Georgia: Georgia Geologic Survey, scale 1:2,000,000.

Clarke, J.S., and Peck, M.F., 1990, Ground-water resources of the South Metropolitan Atlanta Region, Georgia: Georgia Geologic Information Circular 88, 56 p.

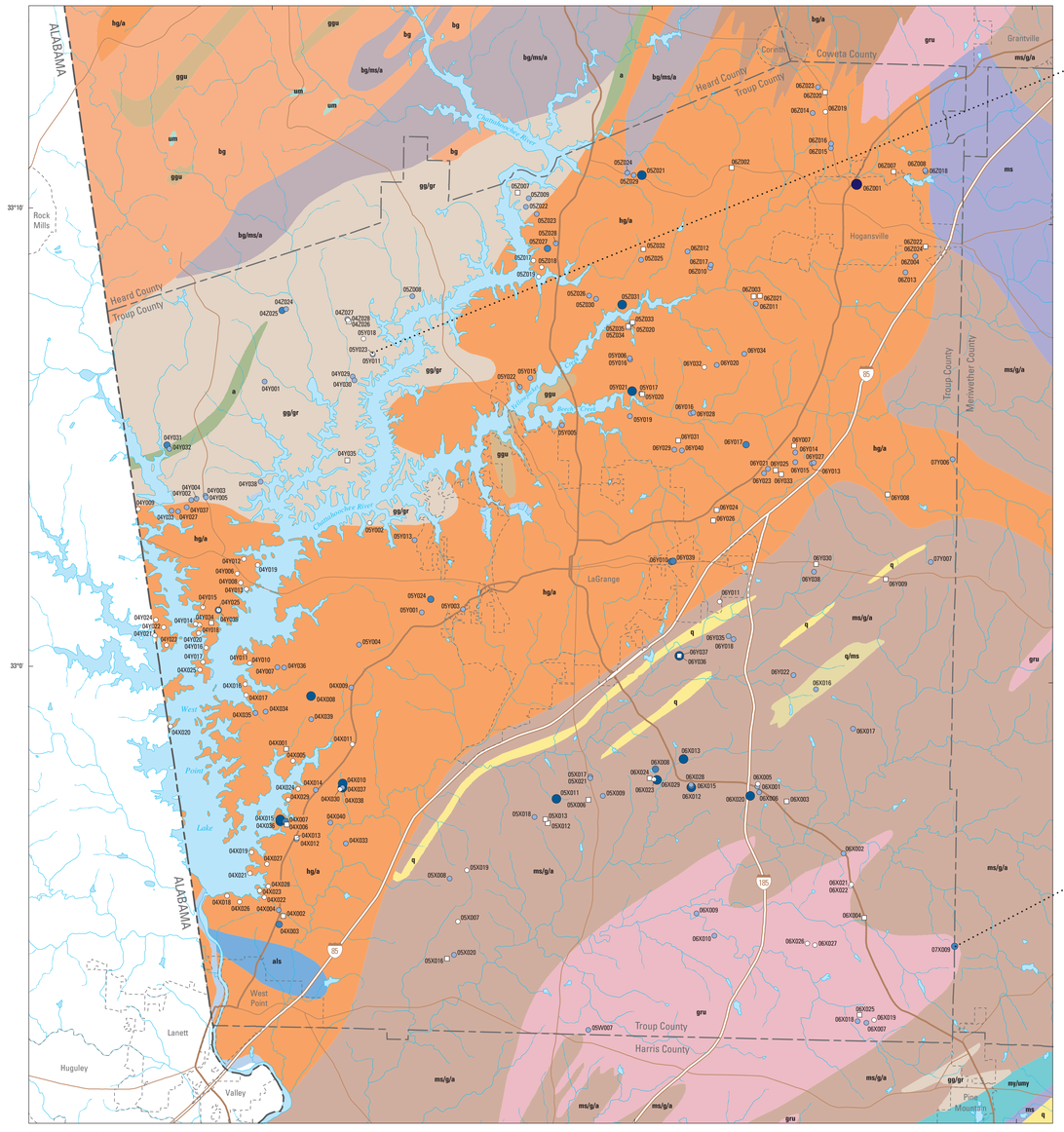
Cressler, C.W., Thurmond, C.J., and Hester, W.G., 1983, Ground water in the Greater Atlanta Region, Georgia: Georgia Geologic Survey Information Circular 63, 144 p.

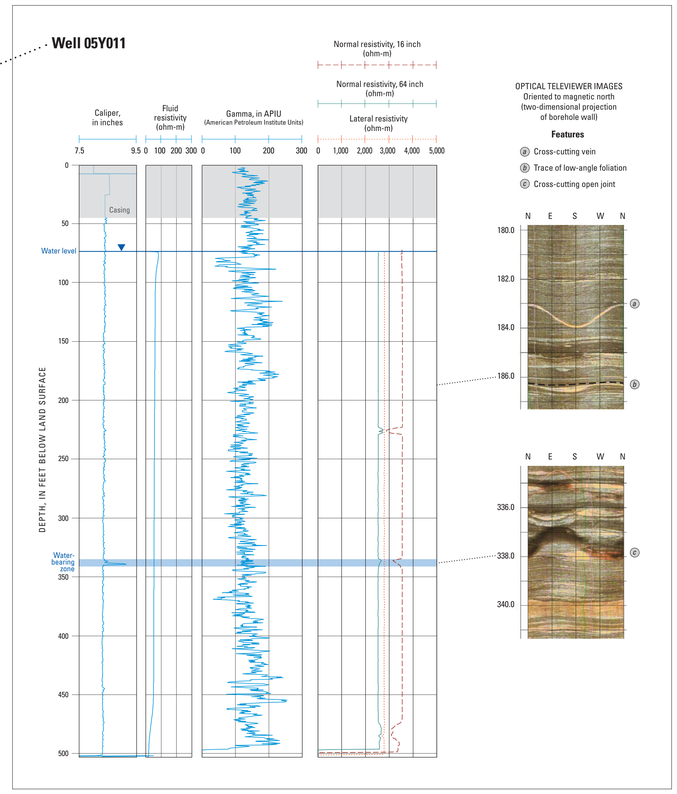
Fanning, J.L., 2003, Water use in Georgia by county for 2000 and water-use trends for 1980–2000: Georgia Geologic Survey Information Circular 106, 176 p, available online at *http://ga.water.usgs.gov/pubs/other/ggs-ic106/*

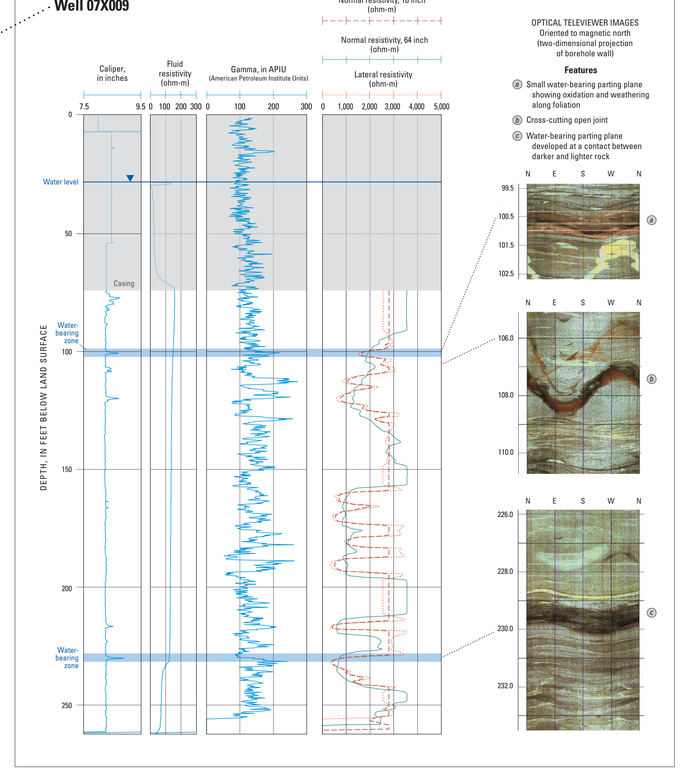
Lawton, D.E., and Marsalis, W.E., comps., 1976, Geologic map of Georgia: Atlanta, Georgia Geological Survey, scale 1:500,000.

Williams, L.J., Kath, R.L., Crawford, T.J., and Chapman, M.J., 2005, Influence of geologic setting on ground-water availability in the Lawrenceville area, Gwinnett County, Georgia: U.S. Geological Survey Scientific Investigations Report 2005–5136, 43 p, Web-only publication available at *http://pubs.usgs.gov/sir/2005/5136/*

Williams, L.J., and Peck, M.F., 2007, Borehole geophysical logging of water-supply wells in the Piedmont, Blue Ridge, and Valley and Ridge, Georgia: U.S. Geological Survey Fact Sheet 2007–3048, 4 p, Web-only publication available at *http://pubs.usgs.gov/fs/2007/3048/*







EXPLANATION

Rock type

- als Aluminous schist
- a Amphibolite
- bg Biotite gneiss
- bg/a Biotite gneiss/amphibolite
- bg/ms/a Biotite gneiss/mica schist/amphibolite
- gg/gr Granite gneiss/granite
- gru Granite, undifferentiated
- ggu Granitic gneiss, undifferentiated
- hg/a Hornblende gneiss/amphibolite
- ms Mica schist
- ms/g/a Mica schist/gneiss/amphibolite
- my/umy Mylonite and ultramylonite
- q Quartzite
- q/ms Quartzite/mica schist
- um Ultramafic rocks, undifferentiated

Well type—Number in parentheses is number of wells of each type

- Bored (37)
- Drilled (180)

Reported well yield in drilled wells, in gallons per minute—Number in parentheses is number of wells in each range

- No yield data available (55)
- 0.5 to 25 (97)
- 26 to 50 (13)
- 51 to 100 (14)
- 101 to 150 (1)

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