Establishment of a Permanent Groundwater Monitoring Site in Calhoun County, South Carolina

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Increased groundwater use for crop irrigation in Calhoun County, South Carolina has raised concern among citizen groups that the increase may be affecting water levels in aquifers that are used for domestic supplies. Irrigation use increased from 1,559 MGD (million gallons per day) in 2001 to 3,420 MGD in 2012, and the number of registered irrigation wells increased from 23 to 73 during this same period (South Carolina Department of Health and Environmental Control). To address this concern, the South Carolina Department of Natural Resources (DNR), in collaboration with Calhoun County, drilled a test hole in the Town of Creston in south-central Calhoun County during the summer of 2013. The test hole was continuously cored by a depth of (698 ft) feet using wireline core gauges operated by the U.S. Geological Survey. A suite of geophysical logs was obtained from the hole after the cores were collected. The logs and cores were used to delineate local aquifer zones and to correlate them to regionally defined aquifers. Some analyses were made to determine grain size and sorting.

Four aquifers were delineated and are, in descending order: 1) surficial; 2) Gordon (Tertiary sand); 3) Crouch Branch (aka, Black Creek); and 4) McQueen Branch aquifer. The surficial aquifer occurs from land surface to 43 ft (below land surface). It consists of gravels, poorly sorted, fine to very coarse quartz sand, interbedded with 3- to 21-ft clay layers towards the top of the aquifer. Gravels compose up to 20 percent of some intervals. The Gordon aquifer occurs from 40-130 ft bls and consists of interbedded quartz sand and clay. Sand beds are moderately sorted and medium to very coarse grained, often containing trace or minor amounts of lignite and muscovite. The Crouch Branch aquifer occurs from 150-180 ft bls and consists of interbedded quartz sand and clay. Sand fractions are moderately sorted, and medium to very coarse grained. Muscovite, pyrite, feldspar, and heavy minerals are present in trace to minor amounts. The McQueen Branch aquifer occurs from 193-385 ft bls and consists of interbedded quartz sand and clay. The sand fraction is moderately to poorly sorted and generally fine to coarse grained. Trace to minor amounts of lignite, muscovite, pyrite, and heavy minerals occur. Gravels compose up to 54 percent of some intervals.

Four monitoring wells were completed at the site—one each in the surficial and Gordon, and two in the Crouch Branch. Future work will include the installation of a well in the McQueen Branch aquifer. Automated water-level recorders installed in each well indicate that water levels are about 20 ft bsl in the surficial, 60 ft in the Gordon, and 80 ft in the Crouch Branch. Water levels in both wells compiled in the Crouch Branch are nearly identical, reflecting hydraulic continuity across fine-grained beds that occur in the middle of the aquifer.

It is believed that most of the irrigation water in the County is being pumped from the Crouch Branch aquifer. Nearly pumping from the Crouch Branch in the summer of 2014 is reflected in the well hydrographs, which show sharp water-level declines of more than 25 ft in both wells compiled in the Crouch Branch. No effects from the pumping are observed in wells screened in the overlying Gordon or surficial aquifers, indicating that the Crouch Branch confining unit, which separates the Gordon from the Crouch Branch, is continuous and relatively impermeable in the area. The upper part of the confining unit consists of black clay interbedded with white, fine to coarse sand. The lower part of the confining unit consists of mollusk, multi-colored fine to very coarse sand and gravel interbedded in a dense clay matrix. The confining unit has been mapped as far west as the Savannah River Site and as far south as Charleston.

The Crouch core is stored at the South Carolina Geological Survey in Columbia. The core site will serve as a long-term groundwater monitoring site for the State. Water-level data from these wells and others can be found at DNR's webpages http://dnr.sc.gov/water/hydro-groundwater/index.html. The authors wish to thank Alex Butler (SCDHEC) for providing water use data.