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Fact Sheet 18f: Aquia Aquifer Test Wells Located near Church Hill, Queen Anne's County, Maryland

This fact sheet is one in a series presenting results of test-drilling activities conducted as part of the Maryland Coastal Plain Aquifer Study to fill key data gaps. The test wells will help to better understand the structure, flow system, water-bearing properties, and natural water quality of the Monmouth-Aquia-Hornerstown, Miocene-age, and Manokin aquifers on the Eastern Shore of Maryland. In addition, the test wells will provide long-term water-level monitoring for resource assessment and flow-model calibration. The Maryland Coastal Plain Aquifer Study is a long-term, multi-phase initiative for comprehensive regional aquifer assessment developed in response to recommendations of the 2004 Maryland Advisory Committee on the Management and Protection of the State's Water Resources (the "Wolman Commission"). The study is being conducted by the Maryland Geological Survey and the U.S. Geological Survey (USGS), with funding support from the Maryland Department of the Environment.

Key Results

- Each of the two wells completed in different parts of the Aquia aquifer showed a significant, rapid response when the other was pumped, indicating hydraulic connection between the Aquia and Hornerstown Formation.
- No significant confining unit between the Aquia and Hornerstown Formations was indicated in lithologic and geophysical logs.
- None of the U.S. Environmental Protection Agency's Primary Drinking-Water Standards were exceeded in samples collected from the wells.

Introduction

In northern Queen Anne's County, the Aquia aquifer comprises two geologic units, the Aquia Formation and the Hornerstown Formation. It is uncertain whether these two units act as a single aquifer or two separate aquifers. The Aquia aquifer is used extensively in this area for both drinking water supply and irrigation. If the Hornerstown functions as a separate aquifer from the Aquia, it would have significantly more available drawdown than if the units function as a single aquifer, and could be pumped more heavily without exceeding the 80-percent management level.

In order to determine whether the Aquia and Hornerstown Formations act as a single aquifer in this area, a cluster of two test wells was drilled at Church Hill Park, just east of the town of Church Hill, in northern Queen Anne's County.

Well Construction and Testing

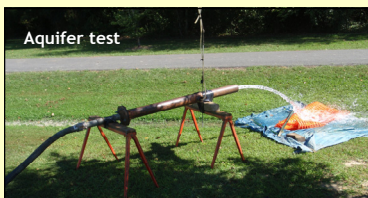
Test wells QA Cf 77 and QA Cf 78 were drilled between August 23 and August 30, 2010 at Church Hill Park. Well QA Cf 77 was drilled to a depth of 400 feet (ft) (into the top of the Monmouth Formation).

Ditch samples were collected at 10-ft intervals and lithologic descriptions were made on washed samples. Split-spoon core samples were taken at selected intervals to provide high-quality lithologic samples, and for future biostratigraphic and geochemical analysis. Geophysical logs (gamma radiation, 16- and 64-inch resistivity, single-point resistivity, self-potential, and 6-ft lateral) were run in the open hole.

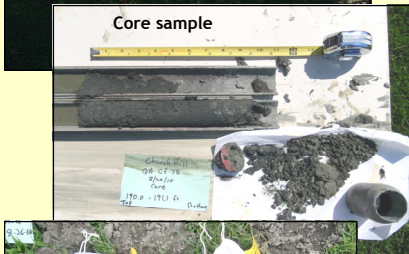
Well screen (4.5-inch diameter SDR-17 PVC; 0.02-inch slot) was installed from 315 to 355 ft. Test well QA Cf 78 was screened from 190 to 220 ft. The wells were cased to a few feet above land surface with 4.5-inch SDR PVC pipe, gravel-packed and grouted, and completed with steel protective casings and locking caps. Each completed well was developed using compressed air to remove drilling mud from the screen and gravel pack.

Well QA Cf 77 penetrated the Surficial aquifer, the Calvert confining unit, the Aquia aquifer (Aquia and Hornerstown Formations), the Severn confining unit, and the top of the Monmouth aquifer. The Aquia aquifer at the test site consists of fine to coarse, highly glauconitic, shelly quartz sand.

A 24-hour pumping test was conducted on each test well, followed by a 24-hour recovery test. Water levels were measured in both wells during each test using hand-held electric tapes and pressure transducers. Well QA Cf 77 was pumped at a constant rate of 80 gallons per minute



Aquifer test



Core sample



Glauconitic sand



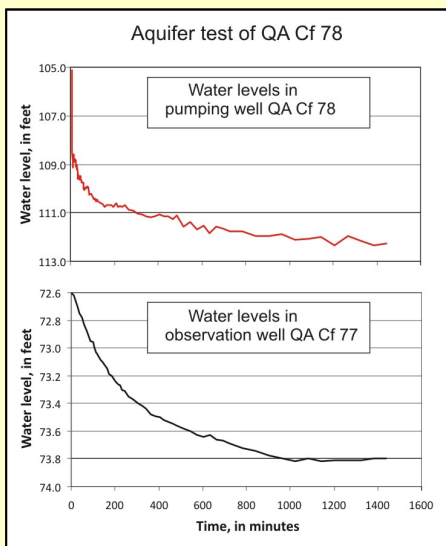
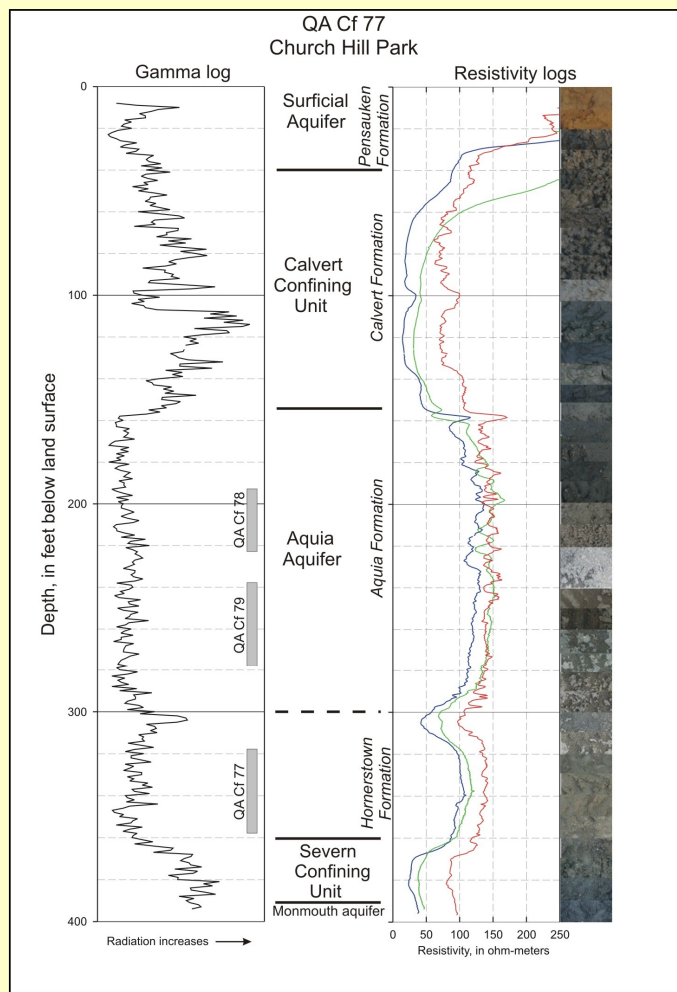
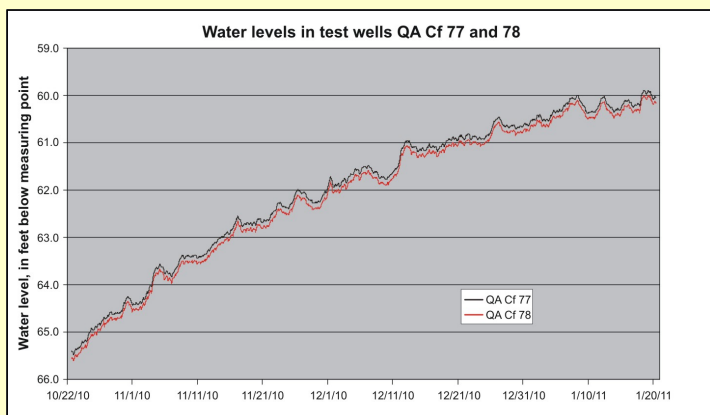
(gpm) with a specific capacity of 1.1 gpm per foot of drawdown (gpm/ft) and QA Cf 78 was pumped at a rate of 89.3 gpm, with a specific capacity of 2.3 gpm/ft. In each aquifer test, the observation well showed a rapid drawdown response caused by the pumping well, indicating significant hydraulic connection between the Aquia and Hornerstown sands.

Near the end of the pumping phase of each test, water samples were collected from wells QA Cf 77 and QA Cf 78. The park supply well (QA Cf 79, screened in an interval between QA Cf 77 and 78) was also sampled. Samples were analyzed for field parameters (pH, alkalinity, specific conductance, dissolved oxygen), major ions, nutrients, metals, and radionuclides. Water quality in the three wells is similar, and indicates a calcium-bicarbonate water type. No Primary Drinking-Water Standards were exceeded.

SUMMARY INFORMATION

Well number	Permit number	Screened interval (feet below land surface)	Aquifer	Pumping rate (gallons per minute)	Specific capacity (gallons per minute per foot)	pH	Total dissolved solids (residue on evaporation @ 180° C.) (milligrams per liter)
QA Cf 77	QA-95-2124	315 - 355	Aquia	80	1.1	7.9	151
QA Cf 78	QA-95-2125	190 - 220	Aquia	89.3	2.3	7.8	191

After the aquifer tests were completed, pressure transducers were installed in both test wells to continuously record water levels. Water levels were recorded at 15-minute intervals, between October 22, 2010 and January 20, 2011. Water-levels in the two wells show very similar trends, with an overall increase of about 5.5 ft over the three-month period. This is probably caused by recovery after the irrigation season. A barometric fluctuation is also displayed in the hydrograph, indicating confined conditions in the Aquia aquifer. The similarity in water level trends in the two wells is further evidence that sands in the Aquia and Hornerstown Formations function as a single aquifer in this area.



References

Drummond, D.D., 2001, Hydrogeology of the Coastal Plain Aquifer System in Queen Anne's and Talbot Counties, Maryland, with emphasis on water-supply potential and brackish-water intrusion in the Aquia aquifer: Maryland Geological Survey Report of Investigations No. 72, 141 p.
 Hansen, H.J., 1992, Stratigraphy of Upper Cretaceous and Tertiary sediments in a core-hole drilled near Chesterville, Kent County, Maryland: Maryland Geological Survey Open-file Report No. 93-02-7, 38 p.

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