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# FUTURE OF WATER SUPPLY FROM THE AQUIA AND MAGOTHY AQUIFERS IN SOUTHERN ANNE ARUNDEL COUNTY, MARYLAND

by
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Ground water is the only source of potable water in Southern Anne Arundel County, Maryland (fig. 1). Ground water pumped from individual wells tapping the Aquia aquifer supplied approximately 1.6 million gallons per day (Mgal/d) to an estimated population of 26,400 in 2000 (fig. 2). An additional 0.18 Mgal/d was withdrawn from the Aquia aquifer for mobile home parks and irrigation. Withdrawals from the Magothy aquifer totaled approximately 0.22 Mgal/d in 2000. Total water demand in Southern Anne Arundel County may increase from about 2 Mgal/d in 2000 to 2.8 Mgal/d by 2020 to support a population of 32,750. The Aquia and Magothy aquifers are the most likely sources for future withdrawals given their relatively shallow depths, although deeper aquifers in the Potomac Group are also available. The natural water quality of both aquifers is generally acceptable for self-supplied domestic use; however, the Magothy aquifer contains iron concentrations at levels requiring treatment.

## The Aquia and Magothy Aquifers

The Aquia aquifer is a medium to coarse sand with shell beds and iron or calcite-cemented layers. The Magothy aquifer consists of medium to coarse sand interbedded with black and gray clay. The top of the Aquia aquifer occurs from about 100 feet above sea level in its outcrop area northwest of the study area to 140 feet below sea level at Deale (fig. 3). At those same locations, the top of the Magothy aquifer is about 150 and 420 feet below sea level, respectively. Transmissivity (a measure of an aquifer's ability to transmit water) of the Aquia and Magothy aquifers ranges from 930 to 2,680 feet squared per day and 450 to 4,570 feet squared per day, respectively.

*Figure 1. Location of study and model areas.*

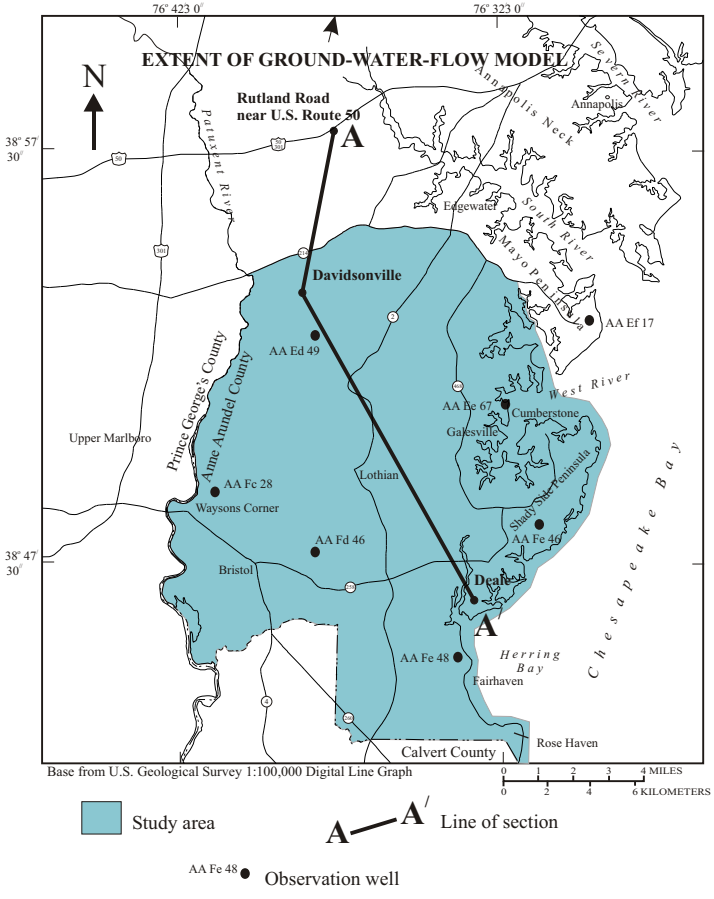
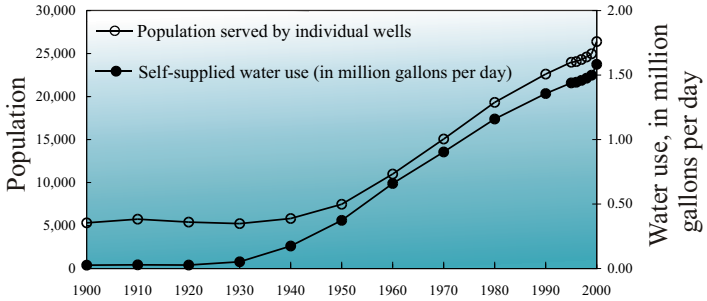



*Figure 2. Population and water use, 1900-2000.*



## Water-Level Trends

Water levels have declined at rates ranging from 0.2 to 1.4 feet per year in the Aquia aquifer and 0.7 to 0.9 feet per year in the Magothy aquifer since the 1970's. Water levels are generally higher in the Magothy aquifer, especially in the southern part of the study area (fig. 4).

## Available Drawdown

The available drawdown at any point in time and location is the difference between the 80-percent management level and the water level measured at that time (fig. 5). The available drawdown in the Aquia aquifer in 2000 ranged from 0 feet through the central part of Southern Anne Arundel County to 150 feet at Rose Haven. Water levels exceeded the management level within a 2-mile-wide band located in the central part of Southern Anne Arundel County. By comparison, available drawdown in the Magothy aquifer in 2000 ranged from approximately 125 feet in the Davidsonville area to 360 feet at Rose Haven.

## The Natural Water Quality of the Aquia and Magothy Aquifers

Water produced from the Aquia and Magothy aquifers is a calcium bicarbonate type. The pH of the Aquia aquifer ranges from 7.3 to 8.0, while the pH of the Magothy water is about neutral (pH = 7). Iron concentrations in the Aquia and Magothy aquifers range from 0.15 to 4.5 and 3.6 to 7.6 milligrams per liter, respectively. Iron concentrations greater than about 0.3 milligrams per liter may require treatment to increase potability.

*Figure 5. Available drawdown and the 80-percent management water level.*

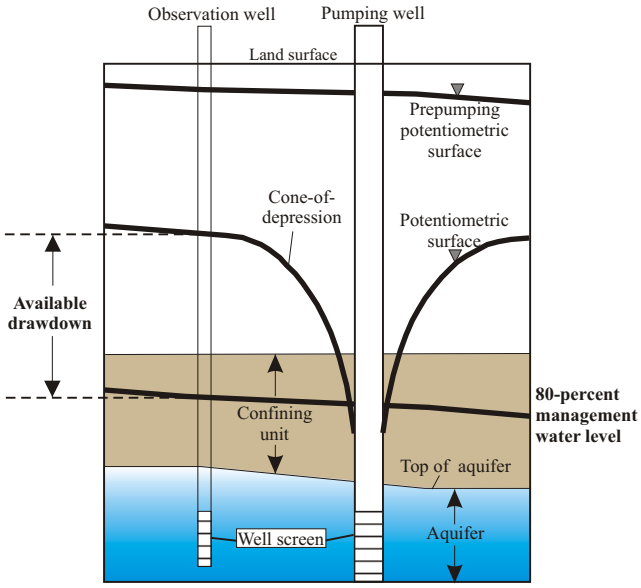



*Figure 3. Hydrogeologic cross section through Southern Anne Arundel County.*

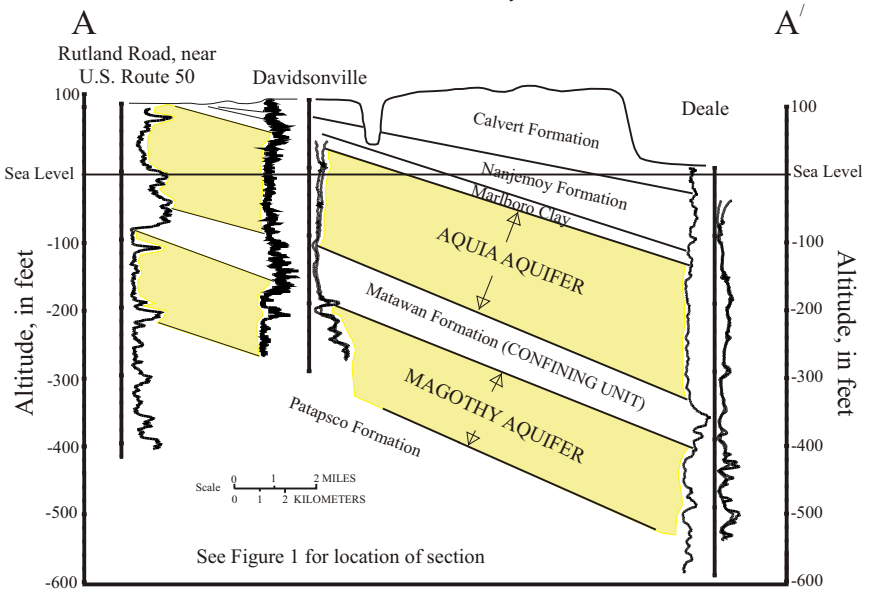
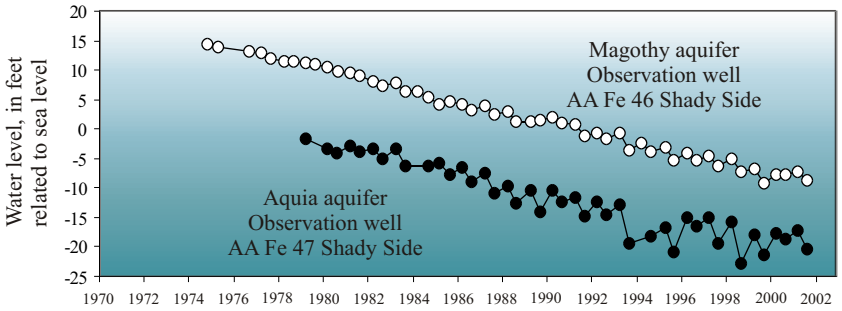



*Figure 4. Water-level trends in the Aquia and Magothy aquifers.*




## Will there be enough water to support the current and projected population?

### The ground-water flow model

An important issue facing water-resource managers, planning officials, and residents in Southern Anne Arundel County is whether there will be enough water to sustain current use, while allowing for future increases. To make this determination, a computer model of the Aquia and Magothy aquifers was developed (Andreasen, 2002). Specifically, the model determined: (1) the potential impact of supplying the projected 2020 population increase, (2) the impact if water use was to remain at levels withdrawn in 2000, (3) the total water available from both aquifers, and (4) the effect of regional pumpage on water levels in Southern Anne Arundel County.

## Model Predictions

### What is the simulated effect of pumping an additional 0.8 million gallons per day from the Aquia and Magothy aquifers to support a projected 2020 population of 32,750 in Southern Anne Arundel County?

If withdrawn from the Aquia aquifer, the increased withdrawals (combined with regional withdrawals) would cause water levels in the Aquia aquifer to decline by as much as 22 feet. The Aquia aquifer can supply the projected 2020 water demand without depleting the available drawdown in most of Southern Anne Arundel County. However, water levels exceed the management level in a band as much as 3.5 miles wide extending from Waysons Corner to Rhode River (fig. 6). Constraining the use of the Aquia aquifer in Southern Anne Arundel County and adjacent Calvert County would reduce drawdown in Southern Anne Arundel County.

If withdrawn from the Magothy aquifer, the increased withdrawals (combined with regional withdrawals) would cause water levels in the Magothy aquifer to decline about 20 feet by 2020. Available drawdown ranges from 100 to 350 feet. The Magothy aquifer can supply the projected increase in water demand through either individual residential wells or public-supply wells without a significant reduction in available drawdown. However, greater drilling depths, treatment costs for the removal of iron, and the practicality and expense of centralized public-water systems are important considerations related to its use.

*Figure 6. Simulated available drawdown in 2020 in the Aquia aquifer based on projected population growth.*

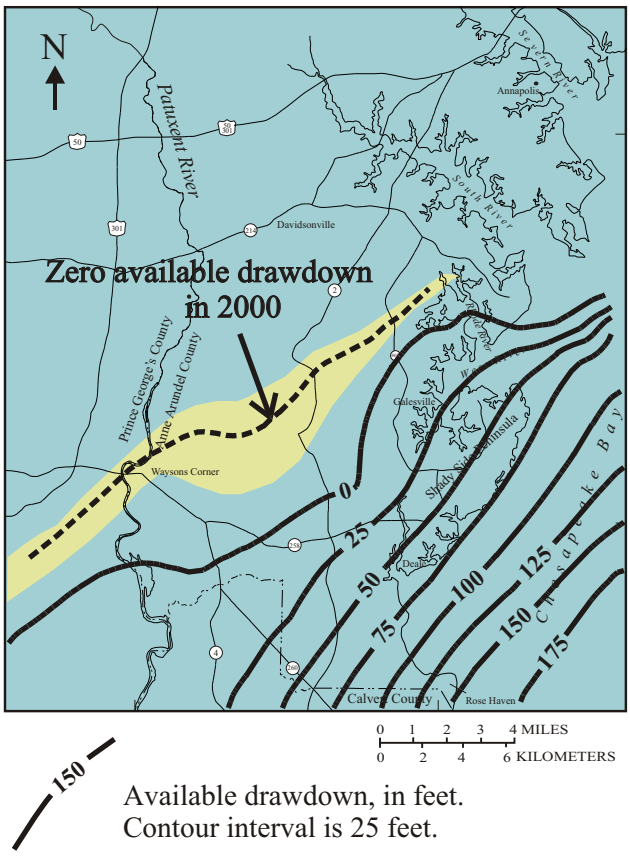
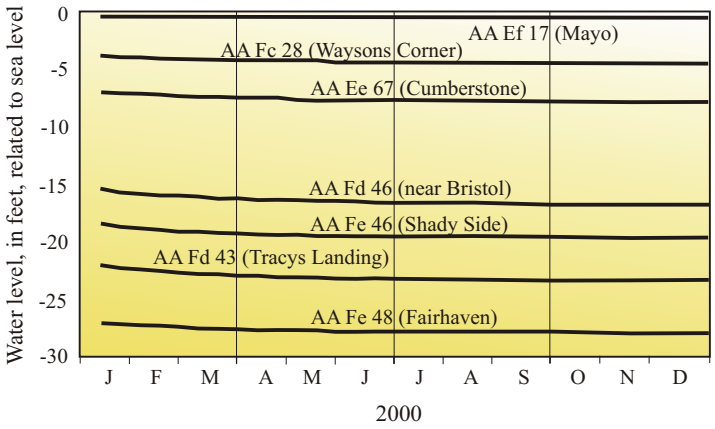



*Figure 7. Simulated water levels in the Aquia aquifer at selected observation wells when pumpage is held constant at 2000 levels.*




### Will water levels in the Aquia and Magothy aquifers in Southern Anne Arundel County stabilize if withdrawals in these aquifers are held constant at the 2000 amount?

When Aquia withdrawals in the model area (and adjacent areas) are held constant at the 2000 level (1.8 Mgal/d in Southern Anne Arundel County), simulated water levels in the Aquia aquifer stabilize in less than 1 year (fig. 7). Simulated water levels in the Magothy aquifer stabilize within about 3 months when withdrawals in the Magothy aquifer are held constant at the 2000 level (0.22 Mgal/d in Southern Anne Arundel County).

## What is the total simulated water-supply potential of the Aquia and Magothy aquifers in Southern Anne Arundel County?

As of 2000, water levels in the Aquia aquifer have exceeded the management level within a 2-mile-wide band located in the central part of Southern Anne Arundel County. Although there is sufficient available drawdown south of this area to sustain an increase in withdrawals, doing so will cause water levels to further exceed the management level in the central part of Southern Anne Arundel County. Therefore, as defined by the present management guideline, the Aquia aquifer has reached its maximum allowable yield.

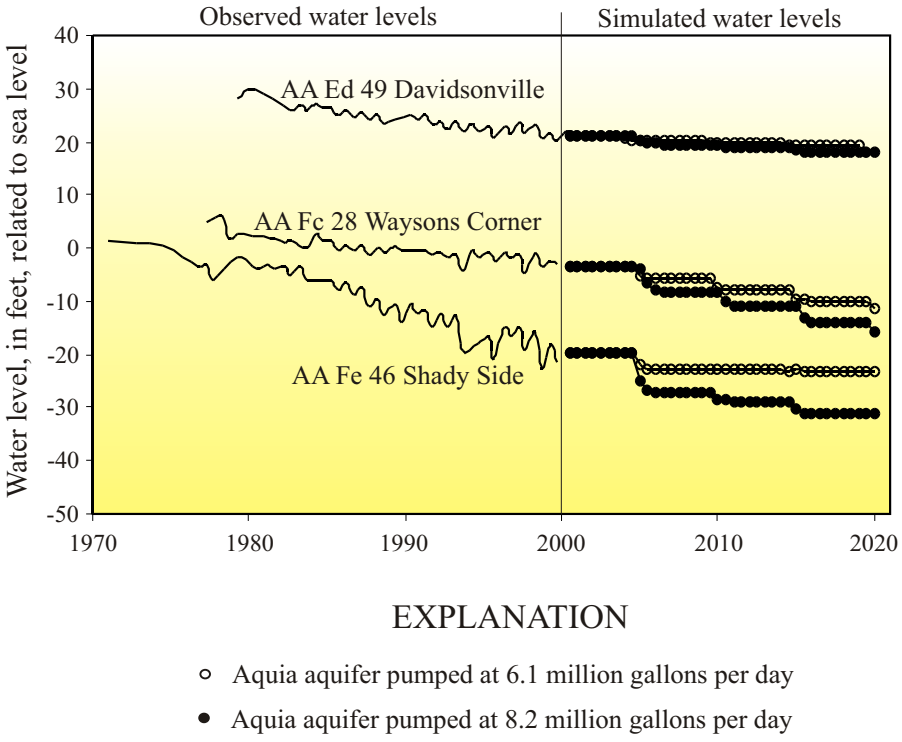
Approximately 7 Mgal/d can be safely withdrawn from the Magothy aquifer over the period 2000-2020. Available drawdown at the end of this period ranges from 100 to 350 feet. Drawdown in the Aquia aquifer resulting from the Magothy pumpage is less than 4 feet.

## What is the simulated effect of projected 2020 withdrawals from the Aquia aquifer in Calvert and St. Mary's Counties on water levels in Southern Anne Arundel County?

Withdrawals from the Aquia aquifer are projected to increase to 8.2 Mgal/d in Calvert County and 11.3 Mgal/d in St. Mary's County by 2020 (Achmad and Hansen, 2001). Simulated withdrawals in Calvert and St. Mary's Counties cause water levels in the Aquia aquifer to exceed the management level in a band as much as 3 miles wide, extending from Waysons Corner to Rhode River.

Constraining withdrawals in Calvert County could reduce the amount of future drawdown in Southern Anne Arundel County (fig. 8). For example, decreasing withdrawals in Calvert County to 6.1 Mgal/d, reduces the width of the area where the management level was exceeded by about 1 mile.

*Figure 8. Observed and simulated water levels in the Aquia aquifer when pumped at 6.1 and 8.2 million gallons per day in Calvert County (pumpage in Southern Anne Arundel County at the 2000 level).*




## References


Achmad, Grufron, and Hansen, H.J., 2001, Simulated changes in water levels of the Aquia aquifer using revised water-use projections to 2025 for Calvert and St. Mary's Counties, Maryland: Maryland Geological Survey Supplemental Report No. S1/RI 64, 58 p.

Andreasen, D.C., 2002, Hydrogeology, water quality, and water-supply potential of the Aquia and Magothy aquifers in Southern Anne Arundel County: Maryland Geological Survey Report of Investigations No. 74, in press.



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