GROUND WATER FOR SOUTHERN MARYLAND AND THE EASTERN SHORE

By Bill Klepczynski & Al Tucker

The Maryland Geological Survey (MGS) team of Andrew Staley and David Andreasen along with Stephen Curtin of the US Geological Survey (USGS) [Ref. 1] has recently added another sequel to their papers presenting potentiometric-surface maps and water-level difference maps that they wrote in 2014 and 2013. Their current paper analyzes water levels measured from 1975-2015. *These papers are a critical tool in helping communities to evaluate and meet their future needs for potable water*. In fact, the MGS, since the 1940's, has maintained a groundwater-level monitoring network to observe changes in groundwater levels and its staff have written many papers on this critical topic.

A main purpose of these papers is to assess the **regional effects of groundwater withdrawals** on the water levels in Southern Maryland and Maryland's Eastern Shore. The withdrawals are for, among other things, the operation of power plants, wells used for private residences and public suppliers of water, and the extensive use for irrigation in Kent and Queen Anne's Counties.

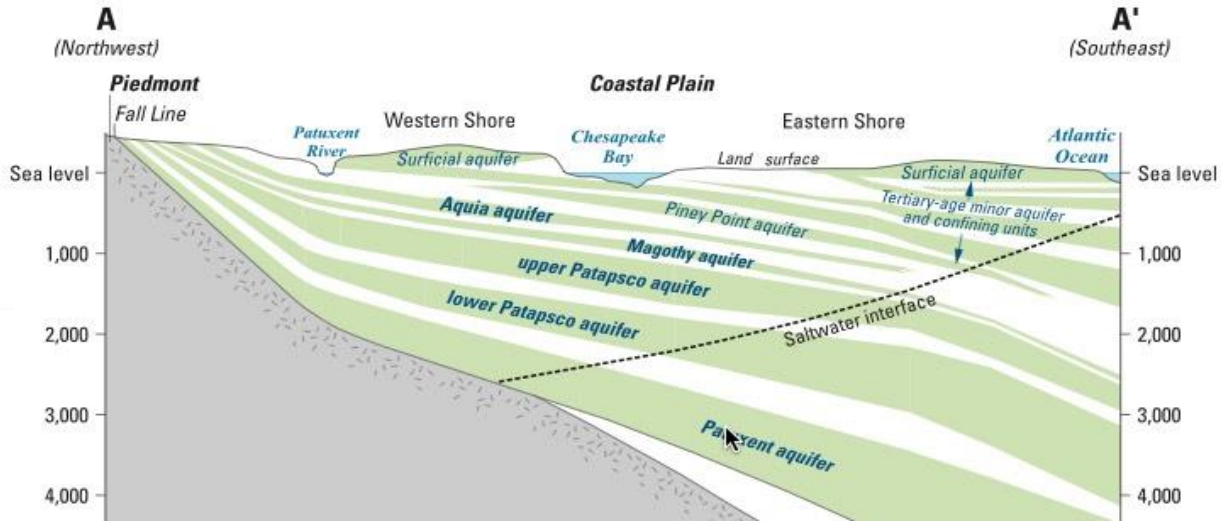

Figure 1. Schematic of the Aquifers which supply water for Southern Maryland and the Eastern Shore along with their distances below sea level.

The current report presents ***potentiometric surface maps*** for the five aquifers supplying water for this region: the Aquia, the Magothy, the Upper Patapsco, the Lower Patapsco and the Patuxent (Fig. 1).

A "***potentiometric surface***" is an imaginary surface that defines the level to which water in a tube placed in a confined aquifer would rise. A **potentiometric surface map** is an important tool for visualizing the directions of groundwater flow and changes in hydraulic gradients in an aquifer. Wells or sampling tubes at different depths at the same location enable vertical gradients to be computed. These quantities are important because they form the basis for permitted withdrawals from Maryland's confined aquifers. If future permitted withdrawals will cause the water level to decline to a point which exceeds a water management level referred to as the 80-percent management level then the confined aquifer may start to **dewater**.

So, these potentiometric surface maps define, at a point in time, the levels of the aquifers. And, when we make estimates for future use due to growth, we can see if the water usage will drop below the critical 80-percent management level as shown in Fig. 2.

In 2007, David Drummond (Ref. 4) published a paper which computed and showed the 80-percent management surfaces for the Aquia, Magothy, Upper Patapsco and Lower Patapsco aquifers. Water-supply providers are restricted from letting the water level decline below this level.

The 80-percent management levels are shown in Figures 3 and 4 for the Aquia and Magothy Aquifers. Compare each with Figure 1 to visualize how the aquifers physically lie below the contours.

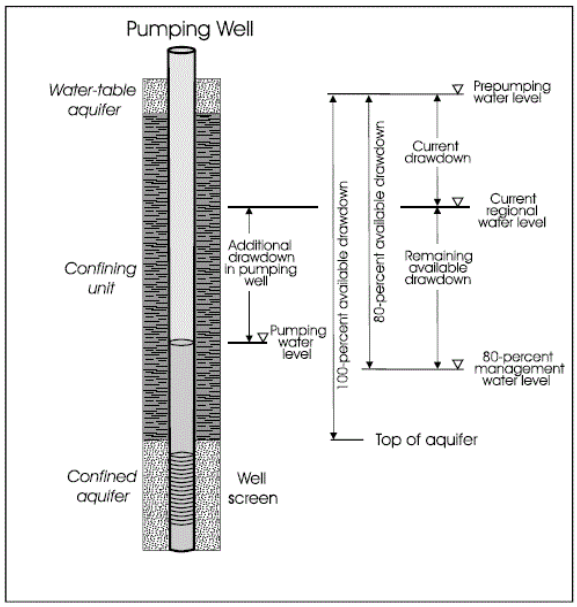

Figure 2. Schematic visualizing the 80% management level. From Ref. 4, page 91.

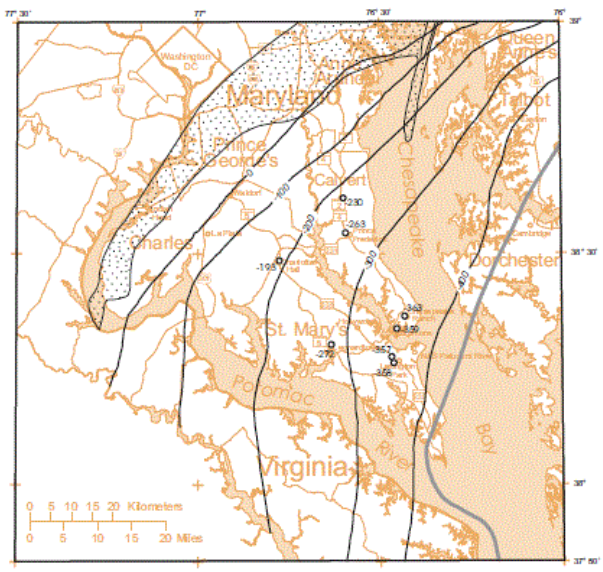

Figure 3 – Aquia Aquifer 80% contour levels.

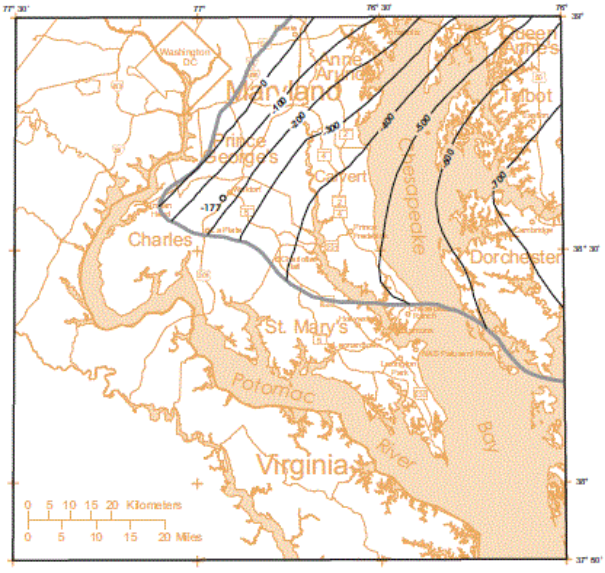

Figure 4 – Magothy Aquifer 80% contour levels.

In their current paper, the authors summarize the current water level differences in the 5 main aquifers for southern Maryland and its eastern shore as shown in Table 1.:

Table 1.

Aquifer	Deepest water level	Difference in level	Since
1) Aquia	-164 ft	-116 ft	1982
2) Magothy	-106 ft	-99 ft	1975
3) Upper Patapsco	-115 ft	-66 ft	1990
4) Lower Patapsco	-194 ft	-83 ft	1990
5) Patuxent	-171 ft	-80 ft	2007

As an example of how these data are used, consider the Aquia. We see from the table that the deepest water level is 164 ft. below sea level. That was in Lexington Park. We see from Figure 3, that the 80% management level at Lexington Park is -357 feet. So a drawdown of 193 more feet would put us at the 80% management level. The pre-pumping water level was 13 feet above sea level, so the total drawdown is now 177 feet total (38% level), and, from the table, 116 feet since 1982. This level will change depending on how much water is pumped from the area. A cone of depression is formed around wells as water is pumped, and it may be several miles across. When the cone of depression is too large and the water level approaches the 80% management level, water must be pumped from a well at a different location or from a different aquifer. Even though the drawdown at Lexington Park is not yet excessive, the 80% level of the Aquia was reached in the area of Wayson's Corner, so the amount of water pumped from the Aquia has been reduced, and future growth will most likely be supplied from other aquifers.

Data for Lexington Park is more complete than most places since it has had growth spurts in the past, and as a result the water supply was a concern. South county will experience more rapid growth, so we need to increase our ability to make the necessary adjustments to how we use our water supply. Years ago, it was recognized that we need more monitoring wells. That hasn't happened primarily due to restricted funding and the fact that right now there is not a crisis.

An additional complication is that as the water level falls in the aquifers, there is an increasing chance that salt water will intrude into the aquifer (see Figure 1).

REFERENCES:

1) Potentiometric Surface and Water-Level Difference Maps of Selected Confined Aquifers in Southern Maryland and Maryland's Eastern Shore, 1975-2015; *A. W. Staley, D. C. Andreason and S. E. Curtin*; Maryland Gelologic Survey; **2016**
2) Potentiometric surface and water-level difference maps of selected confined aquifers in Southern Maryland and Maryland's Eastern Shore, 1975–2013; *A. W. Staley,D. C. Andreasen, and S. E.Curtin*; Maryland Geological Survey; **2014**,
3) Potentiometric surface and water-level difference maps of selected confined aquifers in Southern Maryland and Maryland's Eastern Shore, 1975-2011; *A. W. Staley, D. C. Andreason and S. E. Curtin*; Maryland Gelologic Survey; **2013**
4) Optimization Of Ground-Water Withdrawals In Anne Arundel County, Maryland, From The Upper Patapsco, Lower Patapsco, And Patuxent Aquifers Projected Through 2044;*D. D. Drummond;* Maryland Gelologic Survey; **2007**