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Fact Sheet 18e: Calvert Aquifer System Test Wells Located at Martinak State Park, Caroline 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 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 (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 (MDE).

Preliminary Results

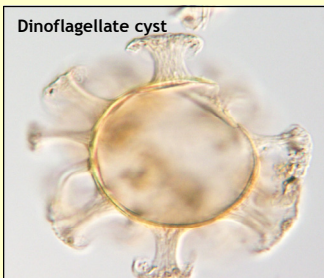
- Water levels in all test wells at the Martinak site show tidal fluctuations induced by tides in the Choptank River, which complicate analysis of aquifer-test data and assessment of inter-aquifer connectivity.
- Biostratigraphic and strontium isotope analysis of core materials are being used to correlate sediments at Martinak with other core sites in Maryland, Delaware, and Virginia.
- Water quality from the wells is generally good, with none of the U.S. Environmental Protection Agency's Primary Drinking-Water Standards exceeded in the analysis.

Introduction

The Miocene-age Calvert aquifer system is an important water supply in the central Eastern Shore counties of Dorchester, Caroline, and Talbot, Maryland, as well as central Delaware. The Calvert aquifer system includes (from shallow to deep) the Frederica, Federalsburg, and Cheswold aquifers. These aquifers, more prevalent in Delaware, were described and mapped in Maryland by Cushing, Kantrowitz, and Taylor (1973); however, the borehole correlations and hydraulic properties were not thoroughly documented. No subsequent studies of the Calvert aquifer system have been conducted in Maryland. It is uncertain whether these units act as independent aquifers or as a single hydraulic unit, and whether they correlate with units mapped in Delaware. These considerations are important in determining whether the MDE groundwater appropriations should be issued for three individual aquifers or for a single composite aquifer. Test wells were drilled to assess the hydraulic characteristics of the Calvert aquifer system, and to determine the connectivity of the individual units. A continuous core hole was drilled at Martinak State Park to collect high-quality sediment samples for biostratigraphic analysis. Observation wells were used to determine hydraulic continuity of individual aquifer units, monitor water-level trends, and estimate available drawdown. The Martinak test site is one of five drilled in the central Eastern Shore of Maryland as part of a systematic investigation of the Calvert aquifer system.

Core Drilling, Well Construction and Testing

A continuous core hole (CO Dc 152) was drilled between May 19 and 26, 2010 by USGS Geologic Division. The core hole was drilled through the Pensauken, Choptank, and Calvert Formations, some possible Oligocene sediments, and the top of the Piney Point Formation, to a depth of 400 feet (ft), with a core recovery rate of 76 percent. Cores were described in detail on site, and subsamples were collected for biostratigraphic analysis of dinoflagellate cysts and calcareous nannofossils. Samples of shell material were analyzed in the laboratory for strontium isotopes. Geophysical logs (gamma radiation, 16- and 64-inch resistivity, single-point resistivity, self-potential, and 6-ft lateral) were run in the open hole by the Delaware Geological Survey.



Test wells CO Dc 153, 154, 155, and 156 were drilled between August 2 and August 11, 2010 to depths of 310, 249, 215, and 156 ft, respectively. Drill cuttings were collected at 10-ft intervals, and three split-spoon core samples were collected at intervals where continuous core was not

recovered. The wells were screened with 4.5 -inch diameter SDR-17 PVC; with 0.02-inch slot and were cased to the surface with 4.5-inch SDR-17 PVC pipe and completed with steel protective casings and locking caps.

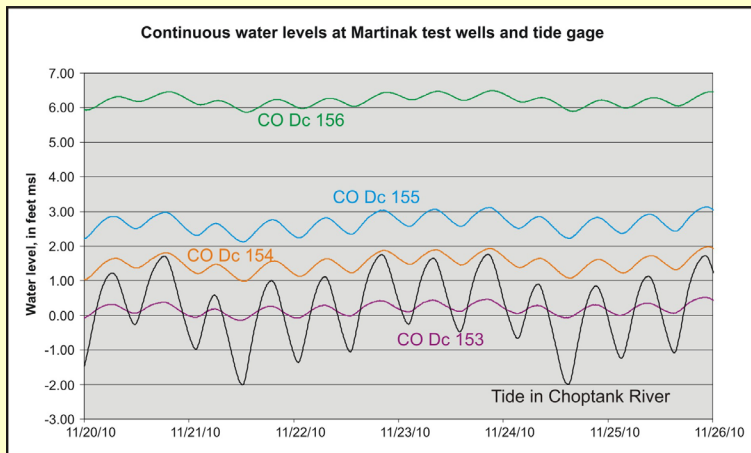
The test wells penetrated (from top to bottom) the Surficial aquifer, the Choptank aquifer/confining unit, and the Calvert aquifer system. CO Dc 156 was screened in the Choptank aquifer, which at the test site consists of fine to medium, silty sand with varying amounts of shell material, interbedded with clay/silt intervals. Wells CO Dc 153, 154, and 155 were screened in several sands of the Calvert aquifer system, which consisted of greenish-gray fine to medium-grained gray silty sand with shell fragments, and interbedded clay intervals.

The completed wells were developed using compressed air to remove drilling fluid and fine-grained sediment from the well bores and screens. Twenty-four hour aquifer tests were conducted on CO Dc 153, 154, and 155 at pumping rates of 86 gallons per minute (gpm), 18 gpm, and 80 gpm, respectively. During each test, there was a significant tidal fluctuation in the observation wells, caused by tides in the Choptank River, located about 200 ft from the test wells. The tidal fluctuation in the observation wells tended to mask any draw-down caused by the pumping well, complicating the analysis of aquifer connectivity. Data analysis is continuing.

Water samples were collected from CO Dc 153, 154, and 155 during the aquifer tests. Samples were analyzed for field parameters (pH, alkalinity, specific conductance, dissolved oxygen), major ions, nutrients, metals, and radionuclides. None of the U.S. Environmental Protection Agency's Primary Drinking Water Standards were exceeded.

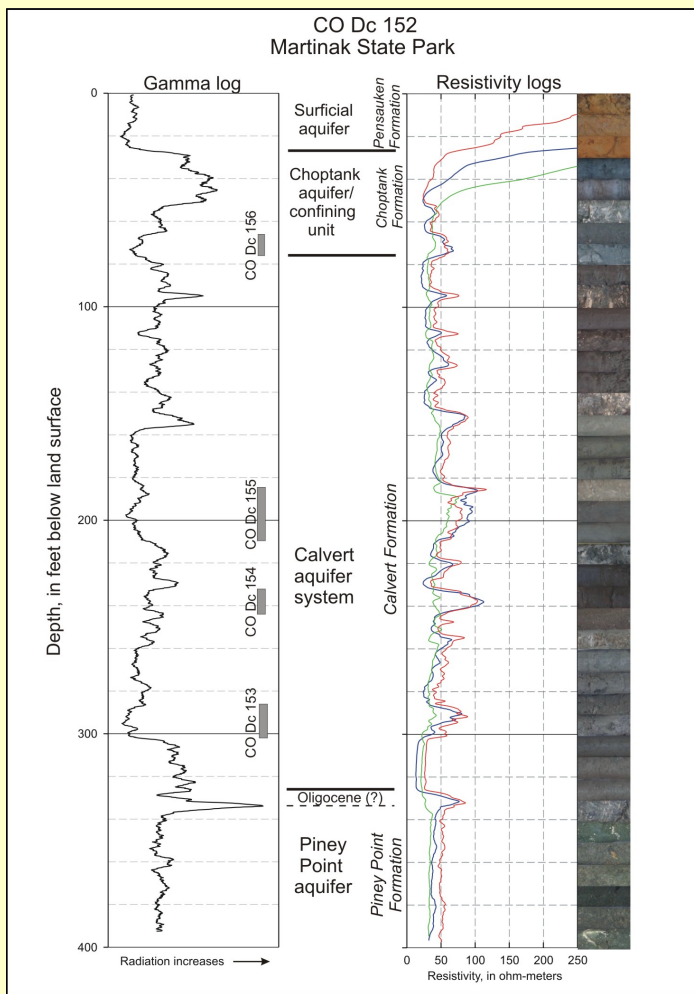
SUMMARY INFORMATION							
Well number	Permit number	Screened interval (feet below land surface)	Aquifer	Pumping rate (gallons per minute)	Transmissivity (feet squared per day)	pH	Total dissolved solids (residue on evaporation at 180° C.) (milligrams per liter)
CO Dc 153	CO-95-0860	286 - 302	Calvert	86	Not applicable	8.6	364
CO Dc 154	CO-95-0861	232 - 244	Calvert	18	Not applicable	8.4	321
CO Dc 155	CO-95-0862	184 - 209	Calvert	80	Not applicable	8.2	339
CO Dc 156	CO-95-0942	66 - 76	Choptank	(No pumping test performed)			

After testing was completed, pressure transducers were installed in all four test wells to continuously record water levels at 6-minute intervals, between October 18 and December 16, 2010. A tide gage was also installed on an unused pier on the Choptank River from October 13 to November 30, 2010 to correlate water-level fluctuations in the test wells with tides in the river.



Reference

Cushing, E.M., Kantrowitz, I.H., and Taylor, K.R., 1973, Water Resources of the Delmarva Peninsula: U.S. Geological Survey Professional Paper 822, 58 p.



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