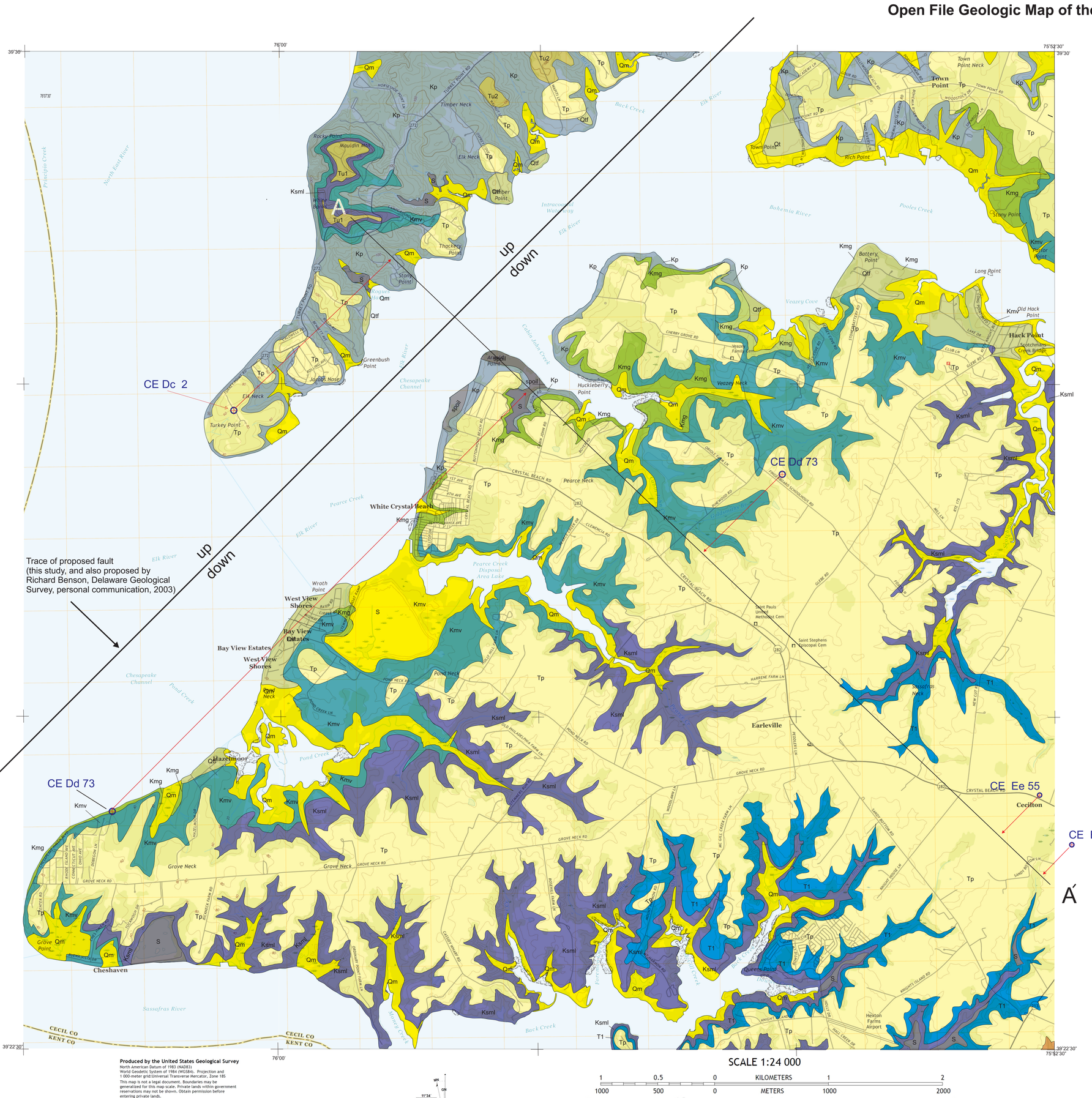
Open File Geologic Map of the Earleville and Eastern Spesutie Quadrangles, Maryland



SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2

1000 500 0 METERS 1000 2000

1 0.5 0 1 MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 FEET

CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 18S
This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, August 2015 - September 2015
Roads.....U.S. Census Bureau, 2016
Names.....GNIS, 1979 - 2019
Hydrography.....National Hydrography Dataset, 2003 - 2018
Contours.....National Elevation Dataset, 2007 - 2016
Boundaries.....Multiple sources; see metadata file 2017 - 2018
Wetlands.....FWS National Wetlands Inventory 2008 - 2013

MN GN
11°34' 204 MILS
0°36' 11 MILS
UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

OPEN FILE MAP
Subject to Revision

Description of Map Units

Quarternary

S – **Spoil -** Unconsolidated soil, sand, silt, clay, mud, and in places shells. May contain significant water content in area adjacent to Elk River and the Chesapeake Bay. Much is dredge spoil from the Chesapeake & Delaware Canal.

Qm – **Tidal Marsh deposits -** Interbedded sand, silt, and clay rich in organic matter. Thickness is generally less than 30 feet.

Qal – **Alluvium -** Stream deposits consisting of sand, silt and clay, gravel and organic matter. Locally contains boulders and other colluvial deposits. Generally grades and is poorly distinguished from tidal marsh deposits. Thickness generally less than 40 feet.

Qtf – **Talbot Formation -** Yellow-brown, thin-bedded, fine-grained sand and silt. Locally micaceous and glauconitic-rich. Origin as deltaic and flood-plain deposits. Range in thickness from 25 to 50 feet. Equivlaent to the fine-grained facies of Conant (1990).

Tertiary

Tp – **Pensauken Fm-** Light yellow to orange-tan, in places oxidized to deep reddish brown, feldspathic, fine- to coarse-grained, cross-bedded sand, with thin to thick beds of gravel. The base of the formation is characterized by gravelly channel-lag deposits; the upper part is generally a fine-to medium- grained sand and loam, but may include gravelly beds and stringers. Clasts include vein quartz, crystalline rocks, sandstones and siltstones. Thickness in the map generally ranges from 10 to 50 feet, but thicker channel deposits may be present in places. The altitude of the base of the unit is generally 40 to 50 above sea level in the map area but, is lower at the base of deeper paleo-channels. The Pensauken is a fluvial sand, possibly representing deposits of the ancestral Delaware River, and also possibly an ancestral Hudson River. The ae of the Pensauken is uncertain, but it is most likely late Pliocene to early Pleistocene. The unit is equivalent to the Columbia Formation in Delaware where it is assigned to the Pleistocene. Sands of the the Pensauken form the surficial, water-table aquifer in much of the map area.

Tu2 Tu1 – **Upland Gravels-** Quartz gravels and gravelly quartz sands. Includes cross-stratified quartz sands and lenses of light gray clay.

Tu2- Upland gravels on the eastern flank of Elk Neck peninsula at elevations between 100 and 150 feet are shown as Tu2, and are interpreted as a fluvial sand and gravel unit that is younger and distinct from the Upland gravels at higher elevations, and as older than the sands and gravels assigned to the Pensauken Formation by both Conant (1990) and Pazzaglia (1993). Pazzaglia (1993) assigned Upland gravels between 100 and 150 feet elevations to the informal Perryville formation. The thickness of Tu2 is about 20 feet.

Tu1- Gravels shown as Tu1 on the crest of Mauldin Mountain at elevations above 200 feet are deeply oxidized to reddish-brown and locally form iron-cemented conglomerates. The unit's thickness on Mauldin Mountain ranges from 10 to a maximum of about 45 feet. Pazzaglia (1993) assigned gravels at higher elevations to the Bryn Mawr Formation. The age of the upland gravel 1 is probably late Miocene to Pliocene.

T1 – **Tertiary Unit 1-** Fine- to medium-grained glauconitic quartz sand, clayey in places, dark to light green and yellow where fresh. Weathers to a yellow-brown and dusky dark-orange. Grades downward to olive-black, glauconite-bearing, fine-grained sand and sandy clay, and very dense olive-black clay. The upper part of the section possibly represents an Oligocene unit that has overlapped the older Paleocene unit (Aquia Formation). The Paleocene unit (T1) overlies and partially truncates the Severn Formation / Mount Laurel Sand undifferentiated and in the map area has apparently completely truncated the Paleocene-age Hornerstown Formation. This unit is about 50 feet thick in southeastern part of map area. Updip, to the northwest, the unit thins and is truncated by the Pensauken Formation.

Cretaceous

Ksml – **Severn Formation/Mount Laurel formation (undifferentiated)-** The Severn Formation is predominantly an olive-black to olive-brown highly glauconitic sand. Phosphate nodules are relatively common throughout. In the southeastern part of the map area, the upper part of the section mapped as Severn/Mount Laurel formation are undifferentiated and are correlated with the Severn Formation. The thickness of the unit is generally less than 10 feet in the map area.

The Mount Laurel Sand is a medium light gray to light olive gray, fine- to medium-grained, glauconitic, quartz sand, with shelly layers in places. The unit weathers yellow- to yellow-brown. The maximum thickness in the eastern part of the Earleville Quadrangle is about 70 feet. The unit thins updip by truncation. The Mount Laurel includes highly glauconitic sands similar to the basal part of the Severn Formation. Outliers of the Severn / Mount Laurel Sand may be present on the Elk Neck Peninsula at Mauldin Mountain. Fossils include *Belemnitella americana* and *Exogyra cancellata*. The Mount Laurel forms a good aquifer in the eastern part of the map area.

Kmv – **Merchantville Formation-** Medium gray to black, silty and fine clayey sand containing mica and glauconite-bearing layers. Grades into a dark gray, dense, mica bearing clayey silt in the lower part of the section. The Merchantville Formation has a sharp basal contact with the underlying Magothy Formation that in places is characterized by a burrowed surface, pyritized nodules, small pebbles and lignite. The maximum thickness is about 70 feet in the southeastern part of the Earleville Quadrangle. Updip, the unit thins by erosional truncation.

Kmg – **Magothy Formation-** White to light gray and buff, fine to medium quartz sand, lignitic in places with flattened carbonized logs present. Also, with black to dark gray clays and silty sands. Sands cross-stratified in places. Light gray to light pinkish-gray stiff plastic clay present just below contact with overlying Merchantville Formation. Thickness ranges from 0 to a maximum of 70 feet in southeastern part of the Earleville Quadrangle. The Magothy is a good aquifer in the central and eastern parts of the map area.

Kp – **Potomac Group (undifferentiated)-** Brown to yellow-brown, fine- to medium-grained, quartz sands. In places unit is silty and gravelly and multicolored, often with mottled, red, brown, purple, and gray, dense clays. Sands often show planar and cross stratification. In places dark gray clays may contain carbonized plant fossils, lignite and carbonized logs. Thickness ranges from about 800 feet at sea level along the Elk Neck Peninsula to about 1,300 feet in the southeastern part of the Earleville Quadrangle. Sands of the Potomac Group are major aquifers in the map area. The Potomac Group overlies the basement rocks in the map area (A - A')

Paleozoic

Pre-Cretaceous Basement Rocks (cross-section only)- Mica schists in borehole CE Dc 2 and CE Ec 17. Schist or gneisses in CE Ee 29 (Hansen and Edwards, 1979; 1986). These rocks are similar to the schists and gneiss that crop out to the west in the eastern Piedmont of Maryland. Well CE Ee 29 lies just outside the map area in the Town of Cecilton in the adjacent Cecilton Quadrangle.

Paleontology- The initial microfossil analyses of samples from corehole CE Ee 55 (G. Keller, Princeton Univ., written communication, 2004) indicate a late Maastrichtian age for the interval from the prominent gamma-log peak at 67 ft below lsd (land surface datum) in CE Ee 55 (cross-section A-A') to at least 136 ft below lsd. The assemblages found are high-stress, low-diversity species, and the initial sampled intervals contained no short-ranging species that would indicate precisely how late in the Maastrichtian the samples are. It is possible that the gamma-log peak at 67 ft below land surface is very late Maastrichtian. Sampled intervals above 67 feet were barren. An upper age limit is placed at 66 Ma (million years ago) for the 136-foot below land surface sample based on the presence of inoceramid prisms. The 142.5 - foot to 154-foot interval represented by a prominent gamma log peak consists of mostly glauconite, quartz and volcanics and is barren of forminifera. By correlation and log interpretation, the gamma-log peak at 150 feet and the thin lignitic sand below the gamma peak are assigned to the Maastrichtian-age Mount Laurel Formation. Additionally, a *B*elmnitella americana was retrieved from the core at 94 ft below lsd in the Severn / Mount Laurel section. The intervals sampled below 154 at depths of 222.4 and 224 feet. The 222.4 foot sample contained rare benthics, volcanic ash and charred wood, and the 224 foot interval consisted of volcanic ash with no foraminifera; these samples were from the top of the Magothy Formation.

Structural Geology- A northeast-trending fault is shown along the Elk River on the map and on section A-A'. The relative movement of the proposed fault is down-to-the-east and with about 200 feet of throw at basement between test holes CE Dc 2 and CE Ee 17. Movement appears to have initiated in the Cretaceous with recurrent movement through the Miocene. Pliocene to Pleistocene and younger movement is not indicated based on the similar elevations of the Pensauken on the Elk Neck Peninsula and eastward across the Elk River in the central and eastern parts of the Earleville quadrangle. Movement during the Miocene is suggested by the presence of the Upland Gravel unit Tu1 at eleveations up to 240 feet above sea level. Benson has also suggested that the Elk Neck Peninsula represents a faulted upthrown block based on the elevation of the gravels (Benson, R., Delaware Geological Survey, personal communication, 2003.)

References

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Pazzaglia, F.J., 1993, Stratigraphy, petrography, and correlation of late Cenozoic Middle Atlantic Coastal Plain deposits: Implications for late-stage passive-margin evolution: Geological Society of America Bulletin, v. 105, p. 1617-1634.

EXPLANATION

CE Ee 55 – Well or borehole number, site location and arrow showing site projected on to line of section.

A – A´ – Line of section A - A', Cross-section through map area with borehole data points projected onto section line.

up / down – Trace of fault showing relative movement.

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Geologic field mapping conducted by author in 2003-2004 built upon mapping of Conant (1990) 2004-2005. Map layout and corrections by D.K. Brezinski, 2020 utilizing USGS Earleville and Spesutie 2019 as topographic base.

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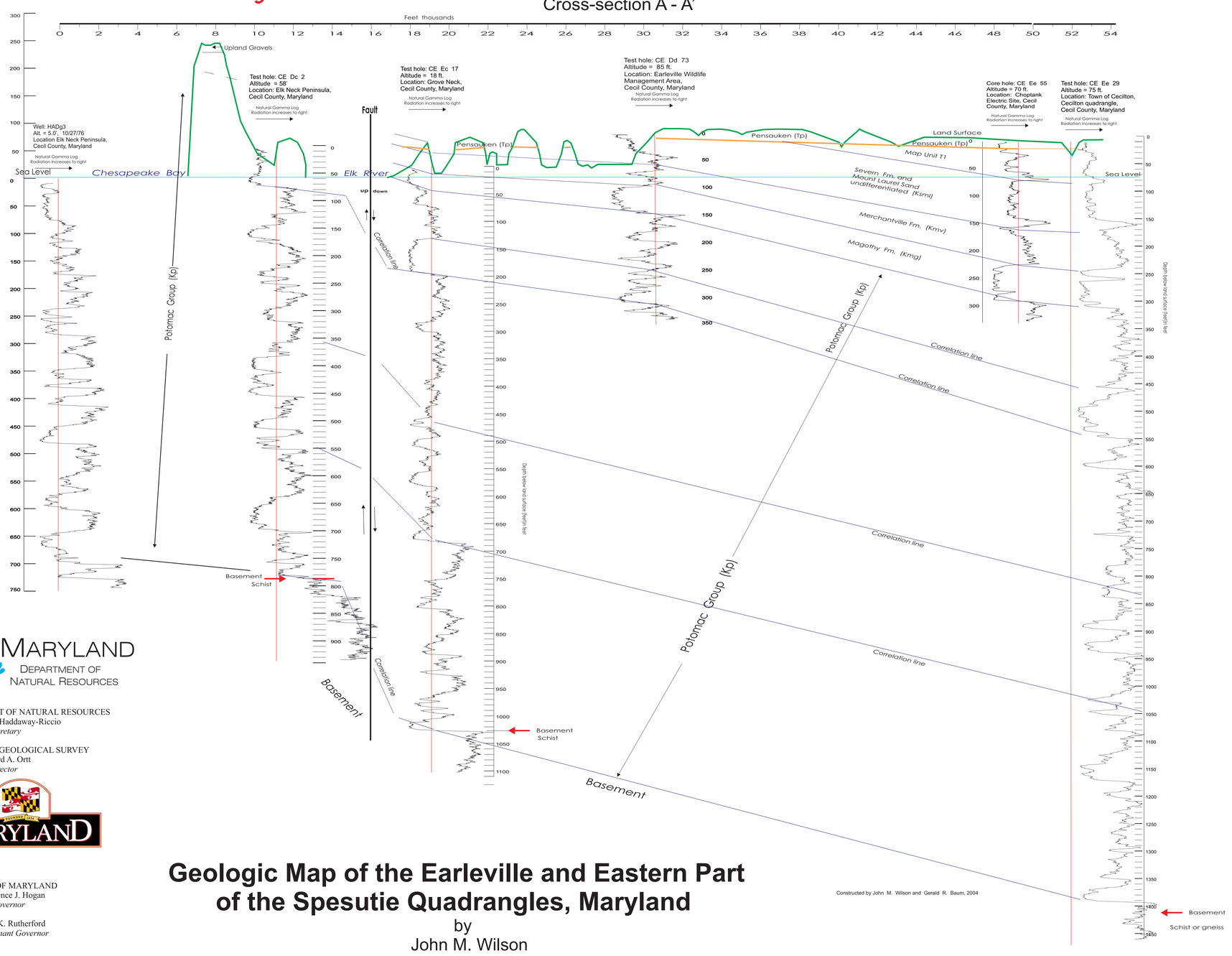
April 2021

Adjoining 7.5-minute quadrangles
(Earleville and Spesutie quadrangle shaded)

1	2	3	1 Havre De Grace
4		5	2 Northeast
6	7	8	3 Elkton
			4 Spesutie
			5 Cecilton
			6 Betterton
			7 Galena
			8 Millington

northwest — southeast

Cross-section A - A'



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Geologic Map of the Earleville and Eastern Part of the Spesutie Quadrangles, Maryland

by
John M. Wilson
2004

Constructed by John M. Wilson and Gerald R. Baum, 2004