STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

HYDROGEOLOGIC QUADRANGLE ATLAS NO. 21

ELLICOTT CITY QUADRANGLE MARYLAND

by Mark T. Duigon

INTRODUCTION

This altas describes the hydrogeology of the Ellicott City 7 1/2-minute quadrangle in southwestern Baltimore County and northeastern Howard County, Maryland (fig. 1). The information contained herein is intended for use by planners, health officials, developers, environmental consultants, and anyone else concerned with baseline hydrogeologic data and the effects of hydrogeologic factors on development.

The Ellicott City quadrangle lies within the eastern division of the Piedmont physiographic province. The land surface is generally undulating. Stream valleys vary from steep to gentle.

The climate of this area is humid temperate, with an average annual temperature of 54°F and an average annual precipitation of 41 in. (Vokes and Edwards, 1974).

The Patapsco River which divides Baltimore and Howard Counties drains most of the quadrangle area. The Patuxent River drains the southwest corner of the quadrangle. Gwynns Falls, which empties into the Middle Branch of the Patapsco River drains a narrow portion of the eastern edge and the northeastern part of the quadrangle.

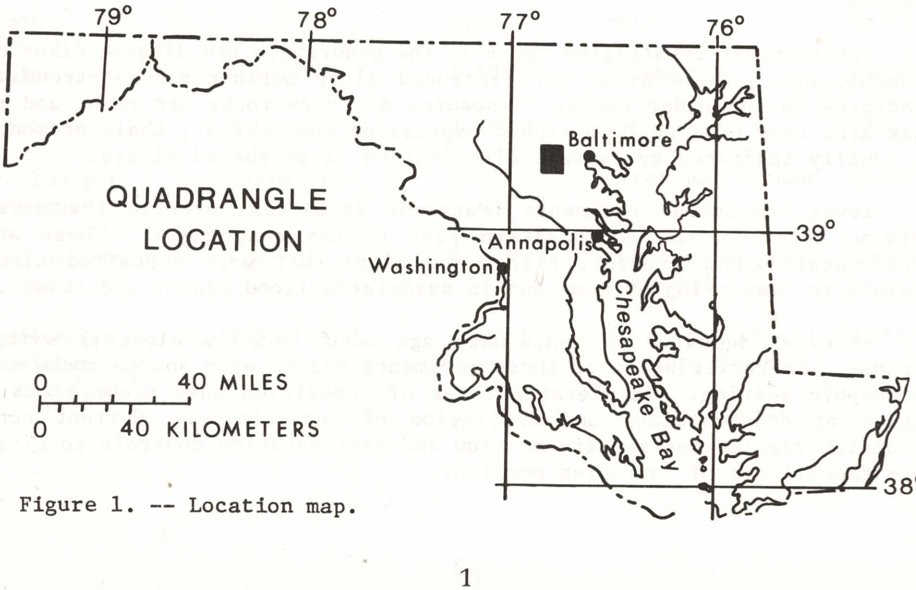

Figure 1. -- Location map.

A permanent gaging station, located on the Patapsco River about 0.3 mi south of Hollofield, has monitored daily flow since 1944. Low flow has been estimated for a site on the Little Patuxent River 0.4 mi east of Pine Orchard by correlation with a downstream station (Walker, 1971, p. 153).

Interstate 70 and U.S. 40 are major highways leading west from Baltimore City. U.S. 29, leading from Washington, D.C., presently terminates near the center of the quadrangle. Liberty Road (Md. 26), leading northwest from Baltimore, provides a corridor along which extensive suburban residential and commercial development has occurred. Residential development has also occurred in the south and east portions of the quadrangle.

GEOLOGY and SOILS

The stratigraphic nomenclature used in this report is that proposed by Crowley (1976) and does not necessarily follow the usage of the USGS.

The oldest rocks in the Ellicott City quadrangle belong to the Baltimore Gneiss, of Precambrian age. This unit formed a shelf in Paleozoic time upon which various clastic and carbonate sediments were deposited. Downwarping and uplift of this continental edge were controlled by plate-tectonic activity and sedimentation. The sediments that accumulated belong to the Glenarm Supergroup. Continued convergent plate motion resulted in the development of large thrust faults that stacked mafic and ultramafic rocks (Baltimore Mafic Complex) upon one another. Compressive forces relaxed, and erosion followed. The stacked thrust sheets were subsequently emplaced northwestward onto the former shelf, and the entire section was subjected to erosion and injection by granitic material, forming bodies such as the Ellicott City Granite and its associated injection complex.

The youngest crystalline rocks in the quadrangle are diabase dikes of Mesozoic age. These dikes were intruded along north-northeast-trending fractures in the older rocks. Exposures of these rocks are rare, and in this area they have no topographic expression but, rather, their presence is usually indicated by surface distribution of weathered clasts.

Lower Cretaceous sediments (Patuxent Formation) overlie the crystalline rocks in the southeastern part of the quadrangle. These are continental sands, gravels, silts, and clays that were deposited along braided to meandering streams and in associated flood plains and swamps.

Alluvial deposits of Quaternary age occur chiefly along perennial streams. Characteristics of these sediments depend upon source rocks and geomorphic setting. Accelerated rates of deposition have occurred as a result of deforestation and initiation of agriculture. Current construction regulations require erosion and sedimentation controls to mitigate the effects of increased erosion.

Mechanical and chemical agents of weathering have been affecting the rocks of the Piedmont since Mesozoic time. The altered material formed at the surface of rock (or sediments) is known as soil. The nature of a soil at a particular location is a function of several parameters called factors of soil formation (Jenny, 1941):

$$s = f\,(cl, o, r, p, t, \ldots).$$

This simply states that a particular soil's characteristics (s) are a result of the interaction of climate (cl), biological activity (o), topography (r), parent material (p), time (t), and other factors. Therefore, even though the bedrock in the area of the Ellicott City quadrangle is quite uniform, minor differences in the other soil-forming factors have led to the development of different soils.

HYDROLOGY

Ground water stored in the intergranular pore spaces of unconsolidated soil material (overburden) is transmitted through the crystalline rocks of the Piedmont by means of fractures and joints. Most wells in the Piedmont are drilled through the overburden and into fresh rock. The amount of water produced by such a well depends, in part, on the number of fractures that the hole intersects and the extent of the network of intersecting fractures. Figure 2 is a diagram of ground-water occurrence in the Piedmont showing the hydrogeologic factors involved in well performance.

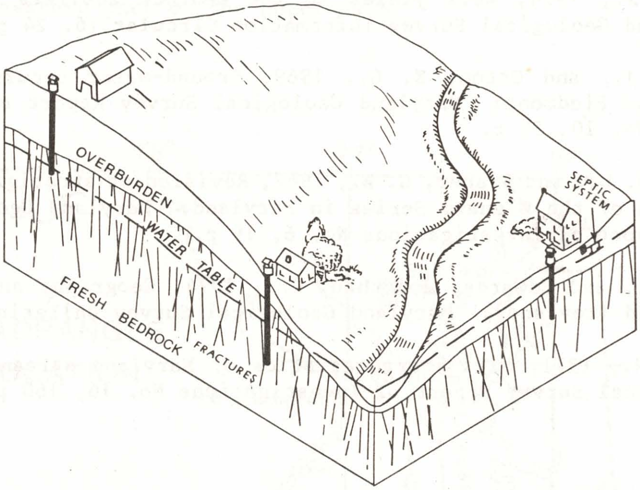

Figure 2. -- Wells in Maryland Piedmont. Well 'A' may go dry during a drought as the water table is lowered. Well 'B' intersects more interconnecting fractures and is assured a good supply, even if the water table is lowered. Well 'C' yields a sufficient amount of water but is subject to contamination from the septic system located up-gradient.

The generalized pattern of water circulation is known as the hydrologic cycle (fig. 3). The hydrologic cycle is the idealized movement of water as it is recycled through the earth and atmosphere. Water may be temporarily detained, but net losses or gains to the hydrologic cycle are negligible. A quantitative evaluation of the hydrologic cycle in a particular region can be made by use of the hydrologic budget:

$$P = R + ET + \Delta S$$

where

P = precipitation,

R = runoff,

ET = evapotranspiration, and

Δ S = change in storage.

Precipitation is the source of water in the Piedmont and is balanced by losses due to surface flow (runoff); release back into the atmosphere as water vapor (evapotranspiration); and changes (gain or loss) in the amount of water in storage in the ground.

Water quality is affected by the substances with which the water comes into contact. Ground water usually dissolves some of the minerals present in the rock and soil through which it passes. The intended use determines the suitability of water of a particular chemical nature: Water that is fit to drink may not be suitable for certain industrial applications. Steam boilers, for instance, require water that has a lower dissolved mineral content than potable water.

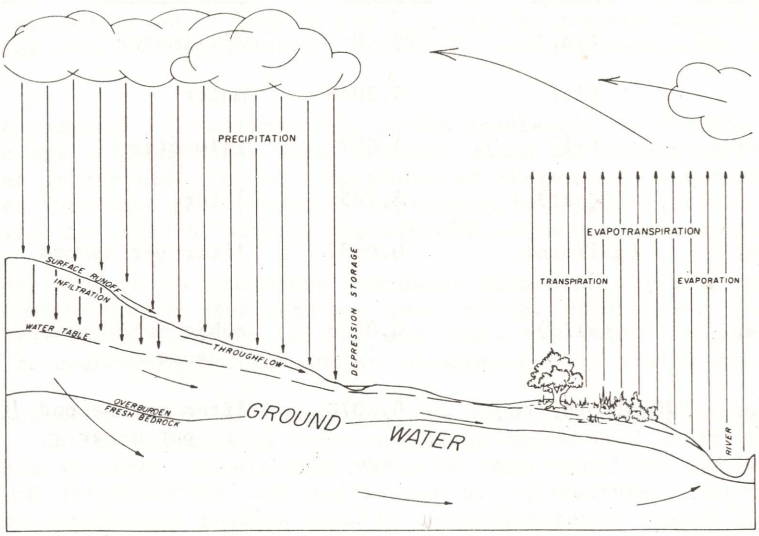

Figure 3. -- The hydrologic cycle.

MAPS INCLUDED IN THIS ATLAS

The information in this atlas is presented as five maps, each prepared on a standard 7 1/2-minute topographic quadrangle base:

1. Slope of the Land Surface, by Maryland Geological Survey.
2. Location of Wells and Springs, by Mark T. Duigon.
3. Depth to the Water Table, by Mark T. Duigon.
4. Availability of Ground Water, by Mark T. Duigon.
5. Geohydrologic Constraints on Septic Systems, by Mark T. Duigon.

These maps are designed for broad planning purposes and are not intended to substitute for detailed onsite investigations where required. Boundaries may not be exact because of map scale, data quality and distribution, and judgment required for interpolation.

CONVERSION OF MEASUREMENT UNITS

In this atlas, figures for measurements are given in inch-pound units. The following table contains the factors for converting these inch-pound units to metric (System International or SI) units:

Inch-pound Unit	Symbol	Multiply by	For Metric Unit	Symbol
inch	(in.)	25.40	millimeter	(mm)
foot	(ft)	0.3048	meter	(m)
mile	(mi)	1.609	kilometer	(km)
gallon	(gal)	3.785	liter	(L)
gallon per minute	(gal/min)	0.0631	liter per second	(L/s)
gallon per day	(gal/d)	0.0438	cubic meter per second	(m^3/s)
gallon per minute per foot	[(gal/min)/ft]	0.2070	liter per second per meter	[(L/s)/m]

SELECTED REFERENCES

Baltimore County Office of Planning and Zoning, 1970, Western Run Watershed, plan for 2020: Baltimore County Technical Report, 40 p.

Cloos, Ernst, 1964, Review of the Post-Triassic rocks, in The geology of Howard and Montgomery Counties: Maryland Geological Survey, p. 18-26.

Crowley, W. P., 1976, The geology of the crystalline rocks near Baltimore and its bearing on the evolution of the eastern Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 27, 40 p.

Crowley, W. P., and Reinhardt, Juergen, 1980, Geologic map of the Ellicott City quadrangle, Maryland: Maryland Geological Survey, scale 1:24,000, 1 sheet.

Dingman, R. J., Ferguson, H. F., and Martin, R. O. R., 1956, The water resources of Baltimore and Harford Counties: Maryland Department of Geology, Mines and Water Resources [1/] Bulletin 17, 233 p.

Fisher, G. W., 1964, The Triassic rocks of Montgomery County, in The geology of Howard and Montgomery Counties: Maryland Geological Survey, p. 10-17.

Hopson, C. A., 1964, The crystalline rocks of Howard and Montgomery Counties, in The geology of Howard and Montgomery Counties: Maryland Geological Survey, p. 27-215.

Jenny, Hans, 1941, Factors of soil formation: New York, McGraw-Hill Book Company, 281 p.

Nutter, L. J., 1974, Well yields in the bedrock aquifers of Maryland: Maryland Geological Survey Information Circular 16, 24 p.

Nutter, L. J., and Otton, E. G., 1969, Ground-water occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 10, 56 p.

Southwick, D. L., and Fisher, G. W., 1967, Revision of stratigraphic nomenclature of the Glenarm Series in Maryland: Maryland Geological Survey Report of Investigations No. 6, 19 p.

Vokes, H. E., and Edwards, Jonathan, Jr., 1974, Geography and geology of Maryland (revised): Maryland Geological Survey Bulletin 19, 242 p.

Walker, P. N., 1971, Flow characteristics of Maryland streams: Maryland Geological Survey Report of Investigations No. 16, 160 p.

1/ The name of this agency was changed to the Maryland Geological Survey in June 1964.

P42297/7-83