INTRODUCTION

This atlas describes the hydrogeology of the New Freedom 7 1/2-minute quadrangle in northern Baltimore 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 climate of this area is humid temperate, with an average annual temperature of 52°F and an average annual precipitation of 44 in. (Vokes and Edwards, 1974, p. 20, 28).

The New Freedom quadrangle lies within the eastern division of the Piedmont physiographic province. The land surface is generally undulating, but some sections of stream valleys are deeply dissected. The drainage pattern shows some control by joints and fractures in the bedrock.

The entire Maryland portion of the area is drained by tributaries of Gunpowder Falls. A portion of Prettyboy Reservoir, formed by a dam on the Gunpowder Falls, is in the southwest corner of the area.

The northern portion, in Pennsylvania, drains into the Susquehanna River via several tributaries. These rivers ultimately empty into Chesapeake Bay.

Figure 1.-- Quadrangle location
A permanent gaging station, located approximately 1 1/2 mi southeast of Graystone, monitors discharge from Little Falls, the major tributary in the New Freedom quadrangle area. Low-flow measurements have been conducted on Beertree Run at Bentley Springs.

Interstate 83 (Harrisburg, Pa., to Baltimore, Md.) runs north-south through the quadrangle area. It runs parallel to York Road (Md. Rte. 45), but allows much more rapid transportation. For this reason, residential development serving the needs of commuters working in the Baltimore area has been rapidly increasing in northern Baltimore County. Farming remains important; corn is the chief crop, and dairy products are also important.

**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 U.S. Geological Survey. The chief difference between this terminology and previous usage (Higgins, 1972) is the manner in which the Wissahickon Formation has been subdivided.

Prettyboy Schist underlies most of the mapped area, except for a band of Pleasant Grove Schist and a wedge of the garnet facies of the Loch Raven Schist in the southeast corner. These rocks are of early Paleozoic age. Fine-grained sediments derived from the southeast accumulated in a down-warping basin, and were deformed and faulted by powerful forces that moved large areas, or plates, of crustal rock. This activity, known as plate tectonics, generated enormous quantities of heat and pressure, resulting in a seemingly jumbled assortment of metamorphic rocks.

Later earth movements uplifted these rocks, exposing them to the mechanisms of weathering and erosion. These processes began in Mesozoic time and continue to this day; in fact, the development of agriculture has accelerated erosion in some areas.

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, p. 16):

\[ s = f (c_l, o, r, p, t, ...) \]

This simply states that a particular soil's characteristics are a result of the interaction of climate, biological activity, topography, parent material, time, and other factors. Therefore, even though the bedrock in the area of the New Freedom quadrangle is quite uniform, minor differences in the other soil-forming factors have led to the development of different soils.

The soils in the New Freedom quadrangle belong to two soil associations (areas having distinctive soil patterns)---the Chester-Glenelg Association and the Manor-Glenelg Association (Reybold and Matthews, 1976). These are generally well-drained upland soils. Chester soils are found on
hilltops and ridgetops. Manor and Glenelg soils more frequently have steeper slopes than Chester soils, and where adjacent to Chester soils, are found downslope. Minor soils, such as Baile, Glenville, Codorus, and Hatboro, are found in upland draws and flood plains. Other minor soils, found on ridgetops or upper slopes, include the Elioak and Mt. Airy series. Differences in these soils affect the success and suitability of certain land uses.

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. 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 generalized Piedmont setting showing the hydrogeologic factors involved in well performance.

![Diagram of water circulation](image)

Figure 2.-- Wells in the Maryland Piedmont.

The generalized pattern of water circulation is known as the hydrologic cycle (fig. 3). The hydrologic cycle is the combination of "paths" that a quantity of water may move along 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,
- \( ET \) = combined evaporation and transpiration, and
- \( \Delta S \) = 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 such as steam boilers.

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.

2. Location of Wells and Springs, by Mark T. Duigon.
3. Depth to the Water Table, by Mark T. Duigon.

LIMITATIONS OF MAPS

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, geographical 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:

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\[1/\text{The name of this agency was changed to the Maryland Geological Survey in June 1964.}\]