INTRODUCTION AND MAP 1. SLOPE OF LAND SURFACE

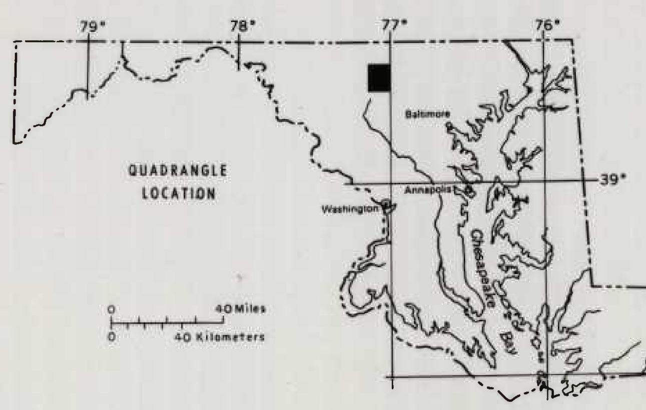
Quadrangle Atlas No. 11

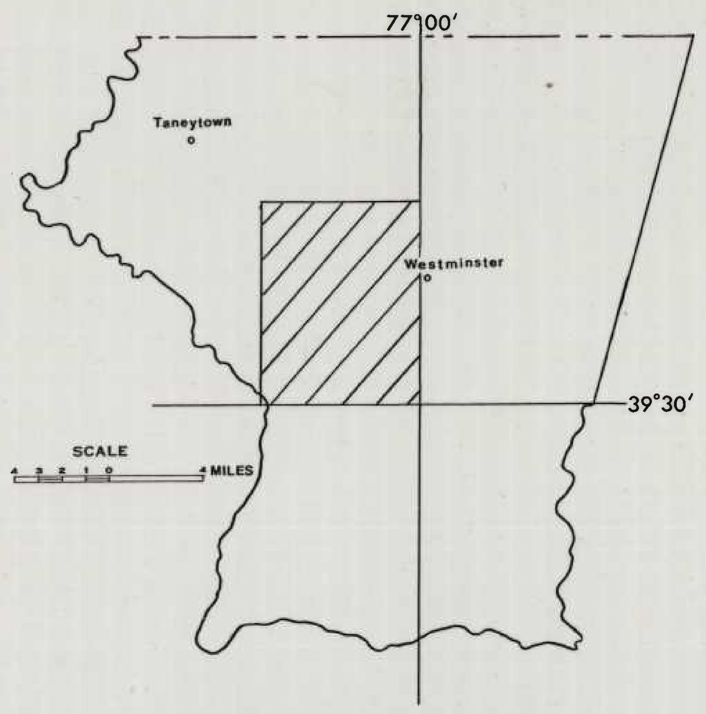
HYDROGEOLOGY

by Edmond G. Otton and others

INTRODUCTION

This atlas describes the hydrology and geology of the New Windsor 7½-minute quadrangle in central Carroll County, Maryland. It is for the use of County, State, and Federal officials as well as planners, engineers, health officers, and the public as a guide to water supply, waste disposal, and land-use planning and design. The quadrangle includes an area of 57 square miles lying entirely in Carroll County, except for 0.2 square mile in the southwest corner, which is in Frederick County. The town of Westminster lies partly within the quadrangle, and the town of New Windsor lies entirely within it. The area is traversed by Maryland Routes 97, 31, 27, and 407. The Western Maryland RR crosses the quadrangle from west to east. Land use in the area is largely agricultural and woodland, although considerable suburban development has taken place in the past decade, especially along the main roads southwest of Westminster. The area receives an average of 42 inches of rainfall annually, characteristic of the humid Piedmont region of central Maryland. West of Maryland Route 27, the quadrangle is drained chiefly by tributaries of the Monocacy River. East of Route 27, the drainage is mainly by tributaries of the Patapsco River. Topography is undulating to hilly, and the maximum relief is about 480 feet. The Wakefield Valley, in the center of the quadrangle, is a significant feature, characterized by gently sloping to flat terrain and rich, loamy soils.





LOCATION IN CARROLL COUNTY

HYDROLOGY

The source of all ground water in the area is local precipitation. Hydrologic studies show that 8 to 10 inches of the 42 inches of annual precipitation becomes recharge to the aquifers. Ground water occurs chiefly in the pores and voids in the weathered rock (saprolite) and in the fractures and joints in the unweathered rock. The top of the zone of saturation in these rocks is the water-table, or the potentiometric surface. The water-table fluctuates seasonally in response to changing patterns and amounts of precipitation and to changes in evapotranspiration.

Ground-water supplies are obtained from drilled wells and from a few springs. Some of the Piedmont aquifers are more productive than others; for example, average well yields in marble are substantially higher than those in schist or phyllite. In some localities, for example along Parrs Ridge, adequate domestic ground-water supplies are not everywhere available, due to the scarcity of fractures in the rocks.

The yield of individual wells depends on their topographic position (valley wells are most productive), the nature and thickness of the weathered zone, and the extent and degree of fracturing of the rocks penetrated by the well. Most of the water is of a suitable chemical quality for domestic use, although ground water from the areas underlain by marble may be hard. The flow of springs is variable--some of the smaller springs dry up during dry periods.

GEOLOGY

The New Windsor quadrangle is in the Piedmont physiographic province of Maryland. It is underlain chiefly by structurally complex, metamorphosed sedimentary rocks of early Paleozoic age. Two small areas, totalling about 1 square mile, along the north border of the quadrangle are underlain by sediments of Triassic age, chiefly shale, siltstone, and sandstone. A major structural feature, the Wakefield Valley syncline, occupies the center of the quadrangle (Fisher, 1978). Marble in the Wakefield valley near the town of Medford provides the material for an important quarry operation in Carroll County.

The crystalline phyllite, schist, and marble are commonly mantled by weathered rock (saprolite), which grades upward into true soil. The thickness of the saprolite is variable, ranging from zero to 100 feet or more; the saprolite may be relatively thin along some of the ridges of quartzitic phyllite and substantially thicker in the marble valleys.

MAPS INCLUDED IN THE ATLAS

Map 1. Slope of land surface, by Photo Science, Inc.

Map 2. Depth to the water table, by Edmond G. Otton.

Map 3. Availability of ground water, by Edmond G. Otton.

Map 4. Constraints on installation of septic systems, by Edmond G. Otton.

Map 5. Location of wells, springs, and test holes, by John T. Hilleary and Edmond G. Otton.

SLOPE OF LAND SURFACE

Prepared by

Photo Science, Inc.

EXPLANATION

Four slope-area categories are shown on this map by three types of shading and by the absence of shading for the terrain category having a slope of 0 to 5 percent. Terrain having the maximum slope (greater than 25 percent) currently (1978) exceeds the maximum land slope permitted for the installation of domestic sewage-disposal systems (septic tanks) by the Carroll County Health Department. Intermediate terrain categories are useful in planning certain construction activities involving local roads and drains.

This map was prepared using topographic-contour negatives by a process developed by the U.S. Geological Survey, Topographic Division. The process uses a semiautomated photomechanical process, which translates the distance between adjacent contours into slope data. The slope zones on the map are unedited. Proximity of the same contour or absence of adjacent contours may produce false slope information at small tops and depressions, on cuts and fills, in saddles and drains, along shores of open water, and at the edges of the map.

LIMITATIONS OF MAPS

All the maps of this Atlas represent some degree of judgment and interpretation of available data. The boundaries depicted on maps are not to be construed as being final, nor is the information shown intended to supplant a detailed site evaluation by a specialist in these fields.

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

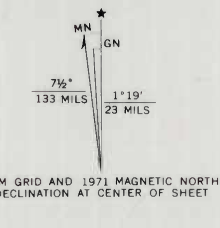
CONVERSION FACTORS

In this Atlas, figures for measurements are given in U.S. customary units. The following table contains the factors for converting customary units to metric (System International or SI) units:

U.S. Customary Unit	Symbol	Multiply by	For Metric Unit	Symbol
inch	(in)	25.4	millimeter	(mm)
foot	(ft)	0.3048	meter	(m)
mile	(mi)	1.609	kilometer	(km)
square mile	(mi^2)	2.590	square kilometer	(km^2)
U.S. gallon	(gal)	3.785	liter	(L)
U.S. gallon per minute	(gal/min)	0.06309	liter per second	(L/s)
U.S. gallon per minute per foot	[(gal/min)/ft]	0.207	liter per second	[(L/s)/m]

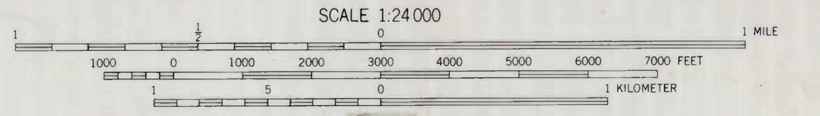
Topography from aerial photographs by stereophotogrammetric methods
Photographs taken 1943-44 (photo-revised by U.S. Geological Survey 1971).

Prepared by Photo Science, Inc., Gaithersburg Maryland, utilizing contour negatives furnished by United States Geological Survey.



UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

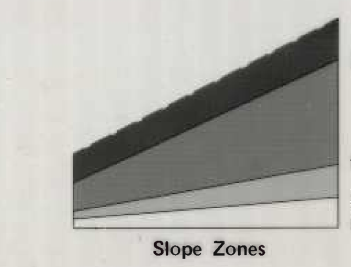


1980

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

Slope zones photomechanically generated from 20-foot contour lines.

QUADRANGLE LOCATION



Slope Zones

MAP 2. DEPTH TO THE WATER TABLE

Maryland Geological Survey

Quadrangle Atlas No. 11

DEPTH TO THE WATER TABLE

by Edmond G. Otton

EXPLANATION

This map shows the approximate depth to the top of the permanent zone of saturation (water table), as indicated by published well and spring records (Meyer, 1958), and by additional unpublished records. However, in large part, control for the areas underlain by a shallow water table (0 to 10 feet) was based on an analysis of the drainage network on the topographic quadrangles. Control for areas having depths to the water table of 35 feet or greater was based largely on well records and on an analysis of topographic features as they reflect variations in the position of the water table. In some places, temporary, perched zones of saturation may occur above the levels indicated on the map.

Ground-water levels, as measured in wells, fluctuate both seasonally and over longer periods in response to changes in frequency and amounts of infiltrating precipitation. Ground-water levels also fluctuate in response to withdrawal from wells. However, in the New Windsor and adjacent quadrangles, the effect of pumping from domestic wells is not widespread, such effects normally being confined to a few tens of feet from each well.

The greatest fluctuation in the water table occurs beneath hills and uplands and the smallest, in valleys and swales.

In general, ground-water levels are lowest in the fall and early winter and highest in the spring, but in some years may deviate from this pattern. Long-term fluctuations also occur, related chiefly to annual variations of precipitation. Average seasonal fluctuations of the water table are shown by an analysis of the 26-year water-level record of well MO-BE 1, located in Montgomery County near Damascus, Maryland, about 15 miles south of the southern boundary of this quadrangle. This well is 58 feet deep and ends in phyllitic rocks. The mean water level in the well is 37.6 feet below land surface (fig. 1), but during September through February, the water level is generally below the mean--being at its lowest in January. From March to or into August, the water level is above the mean--being at the highest in May. As the water level is rising from February to May, this is generally a period of ground-water recharge. The period from June to November is an interval of ground-water discharge. December and January are not well defined; they may be a period of recharge or discharge. However, figure 1 is somewhat misleading, as the range in water levels during any one month over the period of 26 years may be substantial. For example, the April range in levels amounted to 29 feet during the period of record. During the entire period of record, the measured water level fluctuated over a range of 30.2 feet.

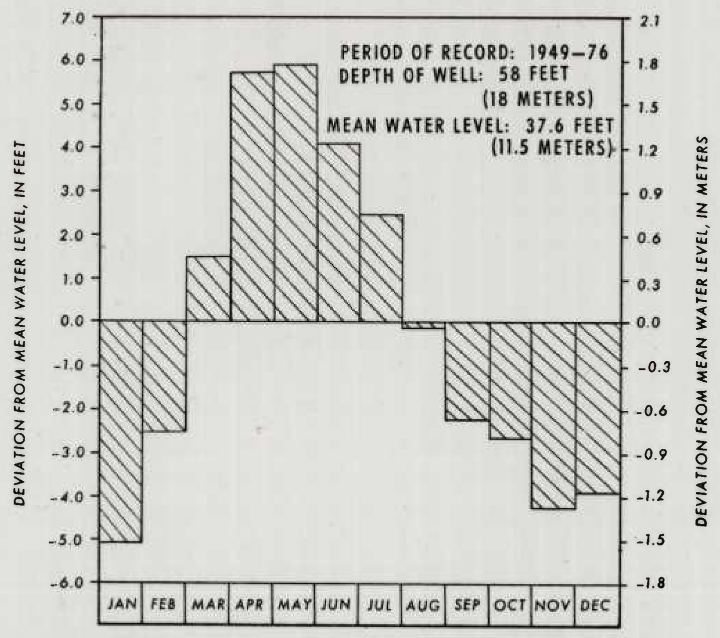


Figure 1.--Average monthly deviation from mean water level in well MO-BE 1 near Damascus, Md.

The magnitude of expected fluctuations in the water table at well MO-BE 1 is given in figure 2, which shows the percentage of time the water level was above a given stage. Thus, the figure shows that 60 percent of the time the water level in the well ranged between 32.0 and 43.3 feet below the land surface. This information indicates the range in water-table fluctuations that might occur under similar topographic and geologic conditions in the New Windsor quadrangle.

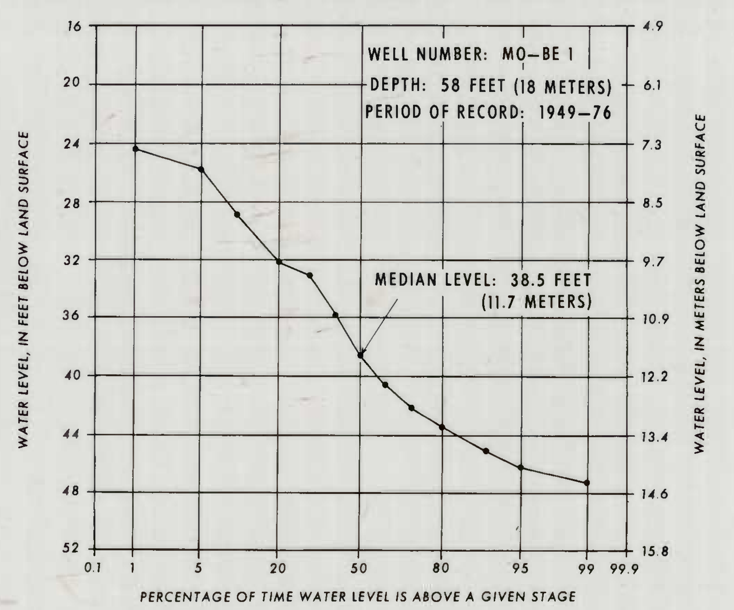


Figure 2.--Stage-duration graph of the water level in well MO-BE 1.

The range of water-level fluctuations in wells depends also on their location. Upland wells generally have greater fluctuations than lowland or valley wells.

The 23-year record of observation well CL-DD 2 at the Winfield Elementary School, 3 miles south of this quadrangle, is an example of long-term fluctuations of water levels that are somewhat smaller than those in MO-BE 1. This upland well is 310 feet deep and ends in schistose rocks. Nonpumping water levels in it during 1953-75 fluctuated throughout a range of 12.9 feet. The median water level is this well was 66.8 feet below the land surface, and during 60 percent of the time the water level fluctuated throughout a range of 5.9 feet. The following graph (fig. 3) is a stage-duration analysis of 247 water-level measurements made during the period of record.

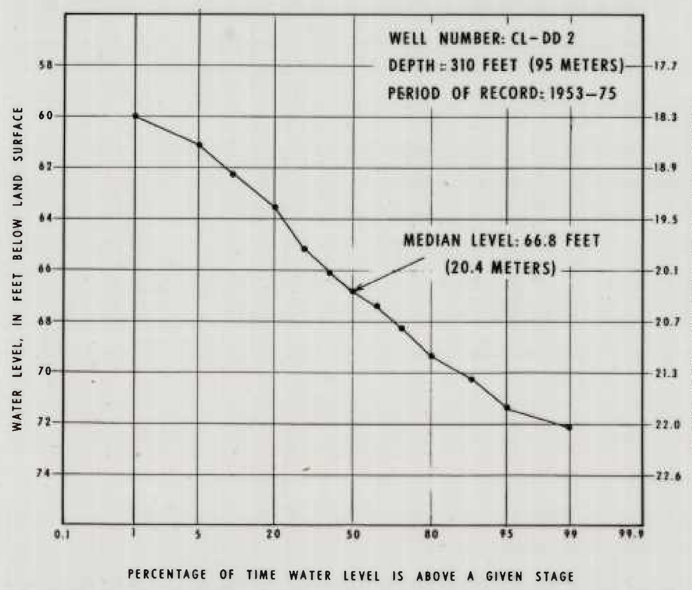


Figure 3.--Stage-duration graph of the water level in well CL-DD 2 at Winfield.

Fluctuations of ground-water levels in valleys and lowlands tend to be smaller than in uplands. Analysis of observation well BA-EC 43 along a stream valley near Pikesville in Baltimore County showed a range of the nonpumping water level of only 3.4 feet during 1956-73 (Otton, 1975, Atlas Map No. 6). Similar ranges in ground-water levels in valley and lowland areas may be expected in the New Windsor and adjacent quadrangles, although no observation-well records are available in the New Windsor quadrangle to show this.

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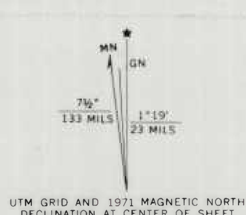
1/ The name of this agency was changed to the Maryland Geological Survey in June 1964.

APPROXIMATE DEPTH TO WATER, IN FEET BELOW LAND SURFACE

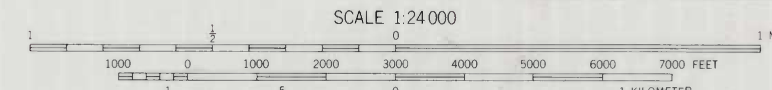
0 - 10 feet | 10 - 35 feet | Greater than 35 feet

Topography from aerial photographs by stereophotogrammetric methods Photographs taken 1943-44 (photo-revised by U.S. Geological Survey 1971).



UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000



1980

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

Prepared in cooperation with the United States Geological Survey and the Commissioners of Carroll County

Maryland Geological Survey Quadrangle Atlas No. 11

AVAILABILITY OF GROUND WATER

by Edmond G. Otton

NATURE OF OCCURRENCE

Ground water in Carroll County occurs in fractures and other voids in the crystalline rocks and in decomposed rock or saprolite, which forms a mantle of variable thickness over most of the bedrock. The source of all the water in the rocks is local precipitation amounting to about 42 inches per year. Of this amount, about 8 to 10 inches is estimated to be ground-water recharge.

Downward-moving water fills the voids and fractures in rocks and saprolite, forming a zone of saturation at variable depths beneath the land surface. The upper surface of the zone of saturation is the water table, or potentiometric surface. This irregular surface fluctuates with time in response to changes in the rate of replenishment of the saturated zone and to changes in the rate of removal of water from the zone. Ground water is removed from the saturated zone by gravity flow to nearby streams, by pumping from wells, and by evapotranspiration, where the root zone of vegetation is sufficiently close to the saturated zone. Water is added to the zone chiefly from infiltrating local precipitation.

Where the rocks in the saturated zone are capable of yielding water to wells and springs, they are termed aquifers. Aquifers differ widely in their ability to yield water. In the Piedmont region, some rocks are better aquifers than others, depending in part on the nature and extent of their interconnected fractures and voids. Figure 1 is a generalized sketch showing ground-water occurrence and movement in the Piedmont region.

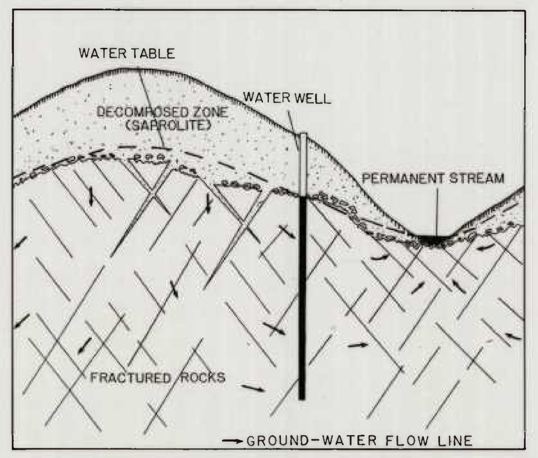


Figure 1.--Occurrence and movement of ground water in Piedmont terrain.

The yields of individual wells in the New Windsor quadrangle depend on factors such as topographic position of the well, nature and thickness of the saprolite, and intensity of fracturing of the rocks at the well site. In general, open fractures and voids in the rocks tend to decrease in size and frequency with increasing depth. An analysis of the depth of water-yielding fractures, as reported by drillers for 100 wells in the nearby Westminster and Winfield quadrangles, indicates that water-yielding fractures occurred at depths less than 100 feet in most of the wells. Figure 2 shows the occurrence of water-yielding fractures in depth intervals down to 425 feet, the greatest depth at which any fracture was reported. However, the sample is biased, as not all of the wells penetrated the maximum depth shown on the graph.

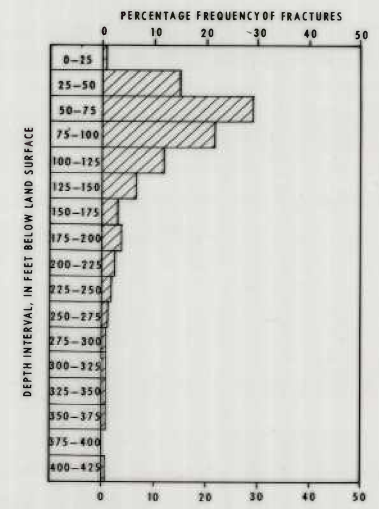


Figure 2.--Percentage frequency of water-yielding fractures in drilled wells in southern Carroll County.

Unfractured and unweathered metamorphic rocks are essentially impermeable. Crystalline rocks containing several intersecting fractures are more permeable than unfractured rocks and, accordingly, are more likely to yield relatively large supplies of water to wells. Therefore, the distribution of fractures is a major factor governing the availability of water in these rocks. An analysis of topography on maps and aerial photographs shows linear features, which may identify major zones of rock fracturing. The orientation of many valleys and stream channels seems to be controlled by the zones of rock fracturing. Wells drilled in such zones may be expected to have above-average yields. The presumed existence of such fracture zones, or lineaments, is shown on the accompanying map by straight lines, many of which follow the trend of watercourses.

One-fourth of the New Windsor quadrangle is estimated to be underlain by marble and interlayered marble and metabasalt. The marble, chiefly metamorphosed dolomitic limestone, is dissolved by mildly acidic circulating ground water resulting locally in entensive zones of interconnected channels and shafts. Such rocks may be good aquifers in many places, but areas of solutional development may be subject to ground collapse and the formation of sinkholes. Ground water in limestone regions is also readily subject to pollution from surface and subsurface sources.

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Stose, A. J., and Stose, G. W., 1946, Geology of Carroll and Frederick Counties, *in* The physical features of Carroll and Frederick Counties: Maryland Dept. of Geol., Mines and Water Res. 1/

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

EXPLANATION

The rocks of the New Windsor quadrangle are divided into four geohydrologic units according to their water-yielding characteristics. These units are part of a larger countywide classification scheme. The well statistics given are based on data from the New Windsor and adjacent quadrangles to the east and south. The geohydrologic units are numbered in the order of their decreasing productivity as a source of ground water, based on the mean specific capacities of drilled wells. Thus, wells in Geohdyrologic Unit 2 are generally more productive than wells in Unit 3.

Geohydrologic Unit 1, underlain by Coastal Plain sediments, is absent from the New Windsor quadrangle, but is present beyond the Fall Line, about 30 miles east of the quadrangle. Geohydrologic Unit 4 includes areas underlain by diabase, gabbro, serpentinite, and related rocks. Unit 4 would be represented by a narrow band of diabase near Wakefield Mill and Bailes Mill, but, as no wells in the quadrangle are known to yield water from these rocks, this unit is not shown on the map. Unit 5 is underlain by shale, sandstone, and conglomerate of Triassic age. These sediments range widely in their water-yielding properties, but generally yield water to wells at somewhat greater depths than the older crystalline rocks. As unit 5 occupies only about 1 square mile, it is a relatively minor geohydrologic unit in the New Windsor quadrangle.

2

GEOHYDROLOGIC UNIT 2: Area underlain chiefly by the Wakefield Marble and the Sams Creek Formation (equivalent to the Bachman Valley Formation of Crowley in quadrangles to the north and east). These rocks are chiefly grayish-green to gray phyllite, locally interlayered with white, gray, pink, and blue marble, and in some places, consist of chloritic greenstone and green schists. Some of the schists contain vugs, resulting from the leaching of calcite. The rocks in unit 2 commonly form valleys, resulting from solutional weathering of the marble and associated rocks. The intersections of major fracture zones are especially favorable for high-yielding wells.

It is probable that some wells drilled in areas mapped as unit 2 may yield more than 60 gallons a minute, although the long-term sustained yield of such wells is dependent on local sources of ground-water recharge, such as nearby streams. The sustained yield of wells distant from recharging streams is dependent, during dry weather, on the storage capacity (or effective porosity) of the rocks. Where the effective porosity is low, the yields of wells may decline during periods of steady pumping.

WELL YIELDS AND DEPTHS: Because of the presence of thin bands and lenses of calcite and the development of vugs and other solution openings, Unit 2 locally may yield moderate water supplies. The reported yields 1/ of 45 wells range from 0 to 60 gal/min; the mean yield is 17 gal/min. The most productive well (CL-CD 93) is in a narrow valley at Spring Mills, approximately 1 mile south of Westminster. This well yielded 60 gal/min in 1972 in a 15-hour test. Figure 3 shows the distribution of wells by yield classes and adequacy categories.

The depths of 94 wells range from 47 to 1,033 feet and average 130 feet. The deepest well, CL-CC 14, was drilled in 1939 for the town of New Windsor, but was subsequently destroyed, as it yielded only 2 gal/min.

WELL SPECIFIC CAPACITIES: Reported specific capacities 2/ of 45 wells in the New Windsor quadrangle range from 0.0 to 2.0 (gal/min)/ft and average 0.3 (gal/min)/ft. Well CL-CD 93 had the maximum reported specific capacity of 2.0 (gal/min)/ft. About 40 percent of the wells had reported specific capacities of less than 0.1 (gal/min)/ft.

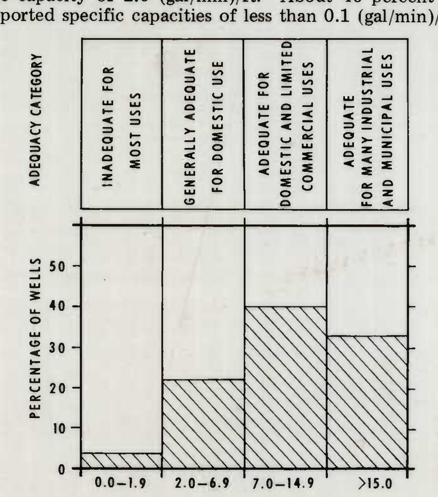


Figure 3.--Yield-class graph for Geohydrologic Unit 2 in the New Windsor quadrangle.

2A

GEOHYDROLOGIC UNIT 2A: Area underlain chiefly by white and blue to pink marble with some interlayered phyllite; also includes areas underlain by blue, thin-bedded limestone veined with calcite and quartz. These areas are shown on the geologic map of the New Windsor quadrangle (Fisher, 1978) as the Wakefield Marble and the Silver Run Limestone. Area also includes some valleys where calcareous rocks are inferred to be present, but have not been seen.

Wells in unit 2A are among the most productive in the Maryland Piedmont, but excessive pumping of water from large-capacity wells could result in nearby localized ground collapse, as some sinkholes, pinnacles, and other related karst features have been noted in the area. The reported yields 1/ of 9 wells in unit 2A range from 5 to 100 gal/min and average about 45 gal/min. Three of the nine wells yielded 100 gal/min each. Specific capacities of these wells range from 0.1 to 12.5 (gal/min)/ft and average 2.6 (gal/min)/ft. Several waterbearing crevices are commonly encountered in the uppermost 100 feet of well drilling. In some wells, muddy zones may be present. Because of the small number of well records available, no yield class graph was prepared for Geohydrologic Unit 2A.

3

GEOHYDROLOGIC UNIT 3: Area underlain by the Wissahickon Formation and the Ijamsville Phyllite (Fisher, 1978). In quadrangles to the north and east, Crowley has designated these rocks as the Prettyboy Schist and the Marburg Formation. The rocks consist of green to gray muscovite-chlorite schist and grayish-green to green chloritic phyllite and schist. Both units contain veins and ledges of quartzite and white to gray quartz.

The most productive wells occur where major fractures, faults, or joint planes exist, or where two or more of these features intersect. Indirect evidence suggests that these features are marked by stream valleys (Nutter and Otton, 1969, p. 21). A group of parallel stream valleys located on presumed fractures can be observed in the south-central part of the quadrangle near Bailes Mill.

WELL YIELDS AND DEPTHS: Wells in the rocks in this unit generally yield water supplies adequate for domestic purposes. The reported yields 1/ of 70 wells in the New Windsor quadrangle range from 0 to 80 gal/min; the mean yield of these wells is 11 gal/min. The most productive well (CL-BD 21) is at a diary plant in Frizzellburg in the northern part of the quadrangle. This well reportedly yielded 80 gal/min in 1949 during a 5-hour test. The well is 200 feet deep and may be yielding water from a solution zone in a thin marble layer.

Figure 4 shows that about 12 percent of the wells are inadequate for most purposes (yield less than 2 gal/min); about 24 percent of the wells yield 15 gal/min or more.

The depths of 111 wells range from 40 to 428 feet; the mean depth of these wells is 146 feet.

WELL SPECIFIC CAPACITIES: Reported specific capacities of 70 wells range from 0.0 to 1.4 (gal/min)/ft of drawdown and average 0.2 (gal/min)/ft 2/. The maximum specific capacity was from well CL-BD 21 at a dairy near Frizzellburg.

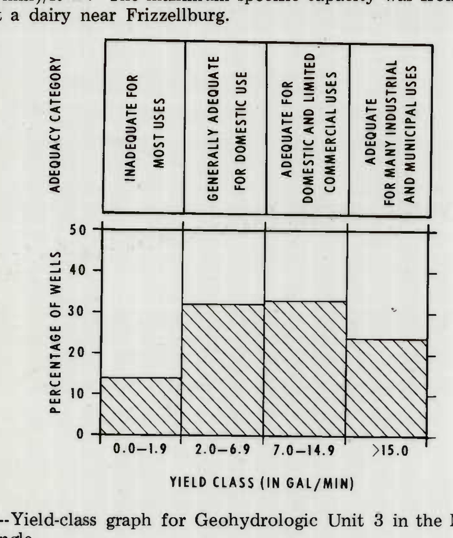


Figure 4.--Yield-class graph for Geohydrologic Unit 3 in the New Windsor quadrangle.

5

GEOHYDROLOGIC UNIT 5: Area underlain by red to purple arkosic sandstone, siltstone, and shale comprising the New Oxford Formation of Triassic age. In the New Windsor area, the basal section of the formation is a conglomerate containing quartz pebbles. The weathered zone is thin, commonly only a few feet thick. In places, the basal conglomerate forms ledges and boulders at the surface and the thin soil cover may locally be more permeable than in areas underlain by shale.

WELL YIELDS AND DEPTHS: Because only a few wells have been drilled in unit 5 in the New Windsor quadrangle, it was not feasible to do a statistical analysis of these data. However, the records of 15 domestic wells in the adjacent Taneytown quadrangle to the northwest show that well yields range from 3 to 25 gal/min and average about 10 gal/min.

The depths of 63 wells in the Taneytown quadrangle range from 50 to 600 feet and average 154 feet, or slightly deeper than wells in Geohydrologic Unit 3.

WELL SPECIFIC CAPACITIES: The reported specific capacities of 15 domestic wells range from 0.1 to 2.3 (gal/min)/ft and average 0.3 (gal/min)/ft. The sparse well data available indicate that, on the average, wells in unit 5 might be somewhat more productive than wells in unit 3.

Linear features which may be related to zones of rock fracturing.

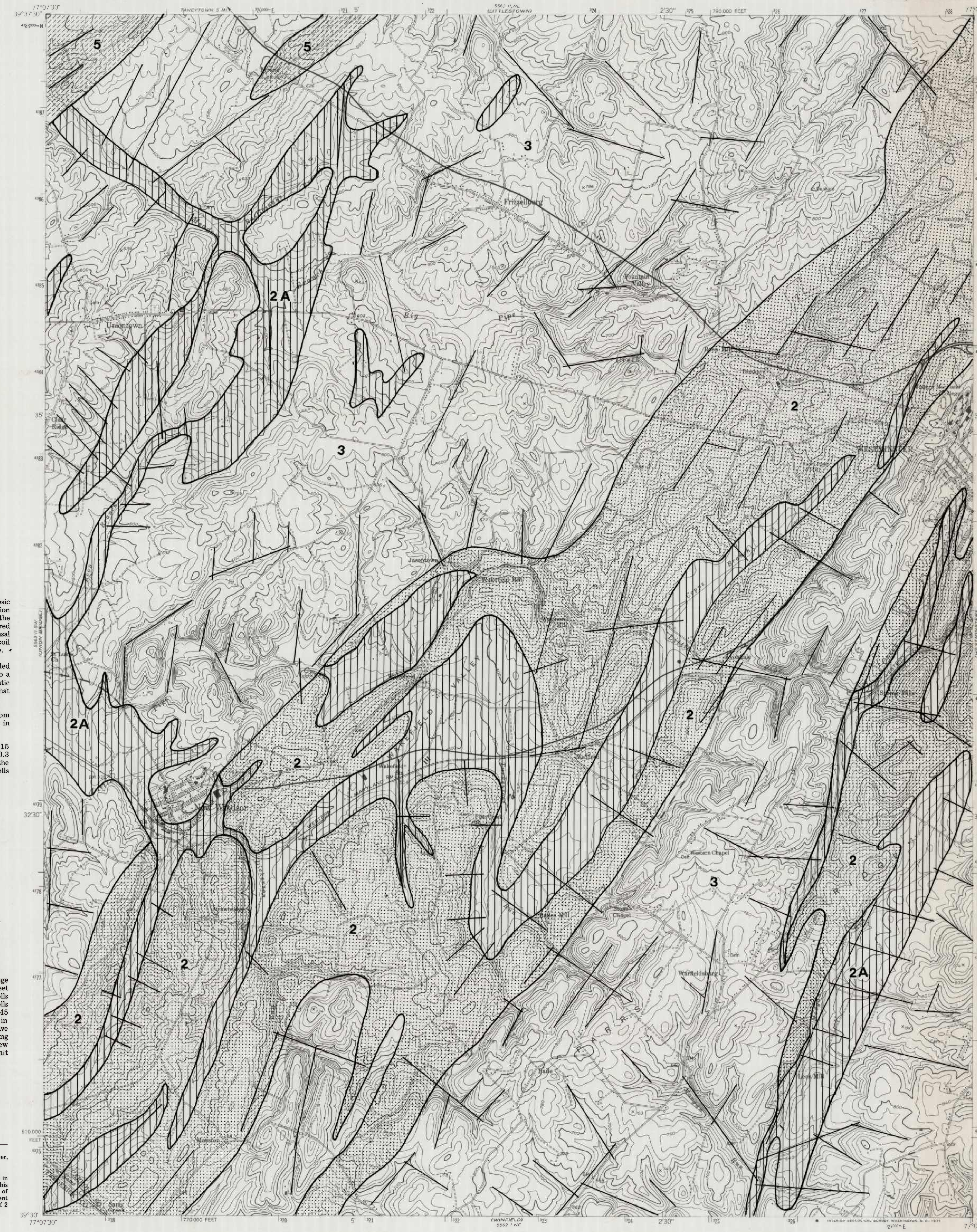
SUMMARY OF GEOHYDROLOGY

The reported yields of 124 wells in the New Windsor quadrangle range from 0 to 100 gal/min. The depths of 220 wells range from 40 to 1,033 feet and average about 140 feet. The reported specific capacities of 124 wells range from 0.0 (gal/min)/ft to 12.5 (gal/min)/ft. The most productive wells are in Geohydrologic Unit 2A, where the yields of nine wells average 45 gal/min. Wells in Geohydrologic Unit 3 are less productive than those in units 2 or 2A. Approximately 12 percent of the wells in unit 3 have yields inadequate for most uses. Little is known of the water-yielding characteristics of Geohydrologic Unit 5 (rocks of Triassic age) in the New Windsor quadrangle, but data from the Taneytown area suggest this unit may be somewhat more productive than unit 3.

1/ Only wells for which the driller reported a yield test of 2 hours duration, or longer, were used in this analysis.

2/ Specific capacity of a well is the yield per foot of drawdown of the water level in the well. No time period is, however, specified for the measurement of this variable, which is commonly expressed in gallons per minute per foot of drawdown [(gal/min)/ft]. For many domestic wells, the period of measurement ranges from 2 to 6 hours. Analysis includes only wells having a yield test of 2 hours duration, or longer.

MAP 3. AVAILABILITY OF GROUND WATER



Topography from aerial photographs by stereophotogrammetric methods Photographs taken 1943-44 (photo-revised by U.S. Geological Survey 1971).

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1980

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

MARYLAND
QUADRANGLE LOCATION

Prepared in cooperation with the United States Geological Survey and the Commissioners of Carroll County

MAP 4. CONSTRAINTS ON INSTALLATION OF SEPTIC SYSTEMS

Maryland Geological Survey Quadrangle Atlas No. 11

CONSTRAINTS ON INSTALLATION OF SEPTIC SYSTEMS

by Edmond G. Otton

EVALUATION OF UNITS

The units shown on this map differ in their suitability for domestic liquid-waste disposal systems because of difference in soil and subsoil infiltration characteristics, land slope, depth to water table, flood hazard, and the existence at various places of a thin or rocky soil mantle over bedrock.

The following shows the range in constraints (or suitability) of the various units for use as a disposal medium:

MAXIMUM CONSTRAINTS	MARGINAL TO VARIABLE CONSTRAINTS			MINIMUM CONSTRAINTS
I	II	III	III A	IV

FACTORS GOVERNING THE EVALUATION

1. Soil and subsoil infiltration rates were determined chiefly on the basis of several hundred percolation tests 1/ conducted by sanitarians of Carroll County, under standardized procedures established by the Maryland Department of Health, and by more than 100 tests conducted by the U.S. Geological Survey using modified test procedures.

2. Land slopes were obtained from a machine-generated slope map, prepared by Photo Science, Inc. Maryland Department of Health regulations (July 1964, Section 1, definitions, part 1.9) do not permit, as of 1978, the installation of underground domestic sewage disposal systems where the slope of the land surface is in excess of 25 percent. Steep slopes are considered to be a major contributing cause of failure of underground disposal systems (U.S. Public Health Service, 1967, p. 18 and U.S. Department of Agriculture, Soil Conservation Service, 1971, p. 8).

3. The 10-foot depth to the water table used as a constraint in this report is the sum of three component factors. These are: (a) The recommended depth of drain tile fields is 3 feet below the land surface (U.S. Department of Agriculture, Soil Conservation Service, 1971, p. 3); (b) a minimum depth of 4 feet between the base of the tile field (absorption trench) and the underlying water table is recommended (U.S. Public Health service, 1967, p. 11); and (c) a 3-foot additional depth is suggested to allow for seasonal variations in position of the water table, which commonly fluctuates through at least a 3-foot range in Piedmont valleys.

4. Most valleys in the New Windsor quadrangle are subject to periodic flooding. Floods would cause uncontrollable dispersal of sewage and possible physical damage to the disposal system.

5. Where bedrock crops out or occurs near the land surface, the construction of underground disposal systems is not feasible. Hence, the presence of rock is an obvious terrain constraint.

REFERENCES

Fisher, G. W., 1978, Geologic map of the New Windsor quadrangle: U.S. Geological Survey Map I-1037.

Meyer, Gerald, 1958, The ground-water resources *in* The water resources of Carroll and Frederick Counties: Maryland Dept. Geology, Mines and Water Res. 2/ Bull. 22, p. 1-228.

University of Maryland, Maryland State Roads Commission, U.S. Bureau of Public Roads, 1963, Engineering soil map of Carroll County (1 sheet).

U.S. Department of Agriculture, Soil Conservation Service, 1969, Soil survey, Carroll County, Maryland, 92 pages, 55 photomaps, 1 index.

U.S. Department of Agriculture, Soil Conservation Service, 1971, Soils and septic tanks: 12 p.

U.S. Public Health Service, 1967 rev., Manual of septic-tank practice: 92 p.

1/ The standard percolation test in the Maryland Piedmont counties is done as follows: A 2- to 3-foot wide pit is dug to the depth to be tested, and a 1-foot-square hole is hand-excavated on the floor of the pit. The 1-foot hole is filled with water, and the time required for the water to drop the second inch of a 2-inch decline is measured. To be rated as "passing" or successful, the rate of drop of the water level must be between 2 and 30 minutes per inch (as of March 1978).

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

MAP UNITS

I — UNIT I. Includes low-lying valley-botton areas, where the depth to the water table ranges from 0-10 feet and areas where the slope of the land surface exceeds 25 percent. Unit I is underlain by stream alluvium, colluvium, and rocky, steeply sloping land consisting of the crystalline rock units, the Wissahickon Formation, Sams Creek Formation, Wakefield Marble, and the Ijamsville Phyllite. In quadrangles to the south and east, Crowley has designated these formations as the Prettyboy Schist, the Bachman Valley, and the Marburg Formations. Depth of overburden on the rocky slopes generally ranges from 0 to 5 feet.

Many of the valley bottoms are flat, poorly drained, and periodically flooded. Only a few percolation tests have been made in Unit I, but the valley soils and subsoils seem to have low infiltration characteristics. Unit I is underlain by Codorus, Hatboro, Lindside, and Glenville silt loams and by Mt. Airy channery loam and Linganore channery silt loam (U.S. Department of Agriculture, 1969). The Mt. Airy and Linganore soils occupy the steep hillsides.

Figure 1 shows the approximate mean percolation rates for the three depth categories in Unit I, based on 33 tests in various localities in central Carroll County. In only two tests (depth interval 6 to 9 feet) were the percolation test rates more rapid than 30 minutes per inch. However, the number of tests available is probably insufficient for a valid rating of the unit.

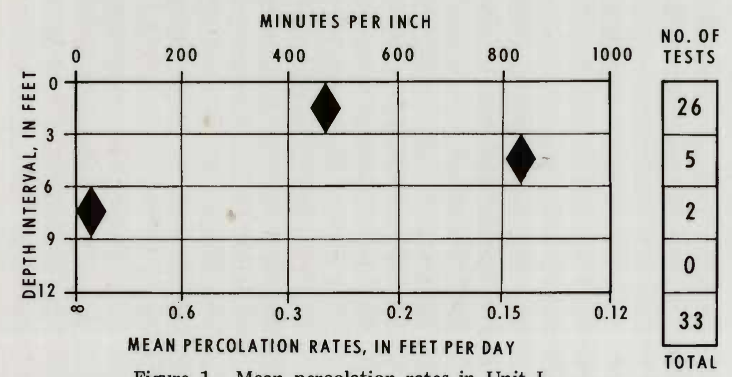


Figure 1. Mean percolation rates in Unit I.

II — UNIT II. Includes areas underlain by maroon to reddish-brown shale, siltstone, and sandstone, comprising the New Oxford Formation. This unit occupies a little less than 1 square mile in the northwest corner of the quadrangle.

The New Oxford Formation occurs extensively in the Union Bridge, Taneytown, and Littlestown quadrangles adjacent to the New Windsor quadrangle. The terrain in unit II is flat to gently undulating or rolling. Soils in unit II consist of the Penn loam, Penn shaley silt loam, and Penn silt loam. The water table is generally more than 10 feet below the land surface. Slopes of the land surface are less than 25 percent.

Within the soil and subsoil of unit II, percolation rates vary widely. Figure 2, based on 137 percolation tests in adjacent quadrangles to the north and west, shows that mean percolation rates range from 20 to 318 minutes per inch. Based on 80 tests in the depth interval 0 to 3 feet, the mean rate in it is 318 minutes per inch (or 0.4 feet per day). Based on 40 tests in the depth interval 3 to 6 feet, the mean rate is 187 minutes per inch (or 0.6 feet per day); from 6 to 9 feet, the mean rate is 20 minutes per inch (or 6 feet per day); in the interval 9 to 12 feet, the mean rate is 25 minutes per inch (or 4.8 feet per day). Percolation rates of this magnitude might be expected to allow downward movement of effluent into the underlying creviced-rock aquifers with relatively little renovation.

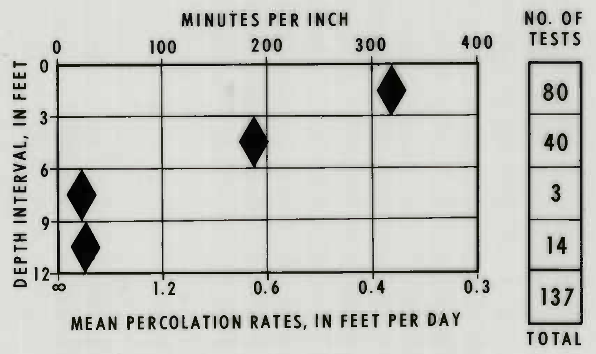


Figure 2. Mean percolation rates in Unit II.

III — UNIT III. Includes a large northeast-southeast trending belt of rocks extending through the quadrangle. These rocks comprise mainly the Sams Creek Formation (Fisher, 1978), which is also present in the southeast part of the quadrangle from Spring Mills to Lees Mill. Crowley designates these rocks as the Bachman Valley Formation in adjacent quadrangles to the north and east. The rocks consist of green to bluish-gray phyllite and phyllitic greenstone. Narrow bands and lenses of blue-white and reddish impure marble occur in the greenstone. In places, quartz-veins are common. The more calcareous zones form deeper soils and tend to form valleys, especially along zones of fracturing. Depths of weathering can locally be more than 100 feet. Depth to the water table is commonly between 10 and 35 feet and is subject to seasonal and long-term fluctuations. Slopes of the land surface are commonly less than 15 percent, resulting in a more subdued topography than in Unit IV.

Soils prevalent in the unit are the Mt. Airy and Linganore channery loams, the Manor loams, and the Glenville silt loam. These are moderately deep to deep, well-drained soils (U.S. Dept. of Agriculture, 1969). Figure 3 shows the mean percolation rates in four depth intervals. Percolation test rates from 2 to 30 minutes per inch (the passing range) are most prevalent in the depth intervals 6 to 9 and 9 to 12 feet. Therefore, many seepage pits are constructed in this interval. At some sites, effluent disposal at these depths can result in rapid movement of the relatively unfiltered effluent down to the underlying fractured-rock aquifer.

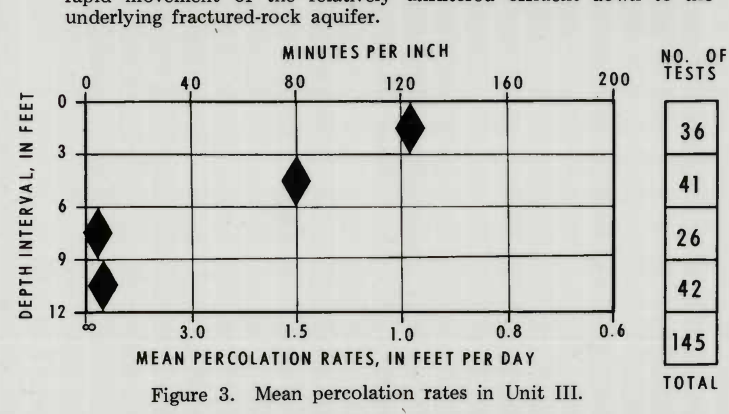


Figure 3. Mean percolation rates in Unit III.

III A — UNIT IIIA. Includes areas underlain chiefly by marble and designated as the Wakefield Marble on the geologic map of the New Windsor quadrangle (Fisher, 1978). The unit also includes four comparatively small areas east of Uniontown underlain by the Silver Run Formation, chiefly poorly exposed impure calcareous schistose and phyllitic rocks, and a small area in the southeast part of the quadrangle underlain by the Sams Creek Formation.

Depth of weathering is greater in Unit IIIA than in Unit III, and the marble forms low areas of slightly undulating or nearly level terrain. Depth to the water table commonly ranges from 10 to 25 feet.

Only a few percolation tests have been made in Unit IIIA, and these are insufficient for a statistical appraisal of its percolation characteristics. However, the marble valleys have soils with severe contraints for use as filter fields (U.S. Dept. of Agriculture, 1969, table 7). The soils are the Lindside silt loam, Linganore channery silt loam, Melvin silt loam, and Codorus and Wiltshire soils, Unit IIIA has moderately high constraints for underground sewage disposal.

IV — UNIT IV. Includes chiefly the upland well-dissected areas of the quadrangle underlain by the Wissahickon Formation and the Ijamsville Phyllite (Fisher, 1978). The Wissahickon is gray to greenish-gray phyllitic schist with bands and veins of quartz. The Ijamsville Phyllite is a green to silvery blue-green chlorite-rich phyllite with some quartz veins and stringers; the formation is intensely sheared and closely folded.

Depth of weathering, based on 50 well logs, ranges from 7 to 101 feet and averages 43 feet. In some upland and hillside localities, the formations weather to broken rocky, slabby fragments, and the true soil zone is only a few feet thick. Nearly everywhere the water table is more than 10 feet below the land surface.

Soils in Univ IV include the Glenelg loam, Manor gravelly loam, Mt. Airy channery loam, and the Linganore channery silt loam (U.S. Dept. of Agriculture, 1969). In some of the Linganore and Mt. Airy soils, the depth to the channers (flat, broken rock fragments) ranges from 1 to 3 feet. In these localities, domestic underground sewage disposal systems are generally not feasible, although on the scale of this map it is difficult to indicate these sites. It is generally necessary to conduct site-specific tests to determine their precise location and extent.

Figure 4 shows the mean percolation rates of the soils in Unit IV by depth intervals. Soils in the depth interval 0 to 3 feet average 83 minutes per inch (about 1.5 feet per day), a more rapid rate than in the other units in the same depth interval. However, in the depth interval 6 to 12 feet, the percolation rates in Unit IV are comparable to those in Units II and III.

Because most of the sewage disposal systems in the quadrangle are seepage pits ending in the depth interval 6 to 12 feet, the high percolation rates (18 to 25 feet per day) permit rapid passage of the effluent into the underlying rock aquifers with only marginal opportunity for renovation. This is especially true where the rocks are extensively creviced and jointed.

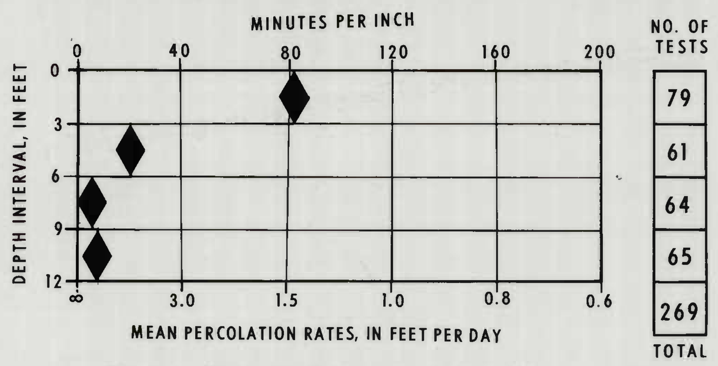
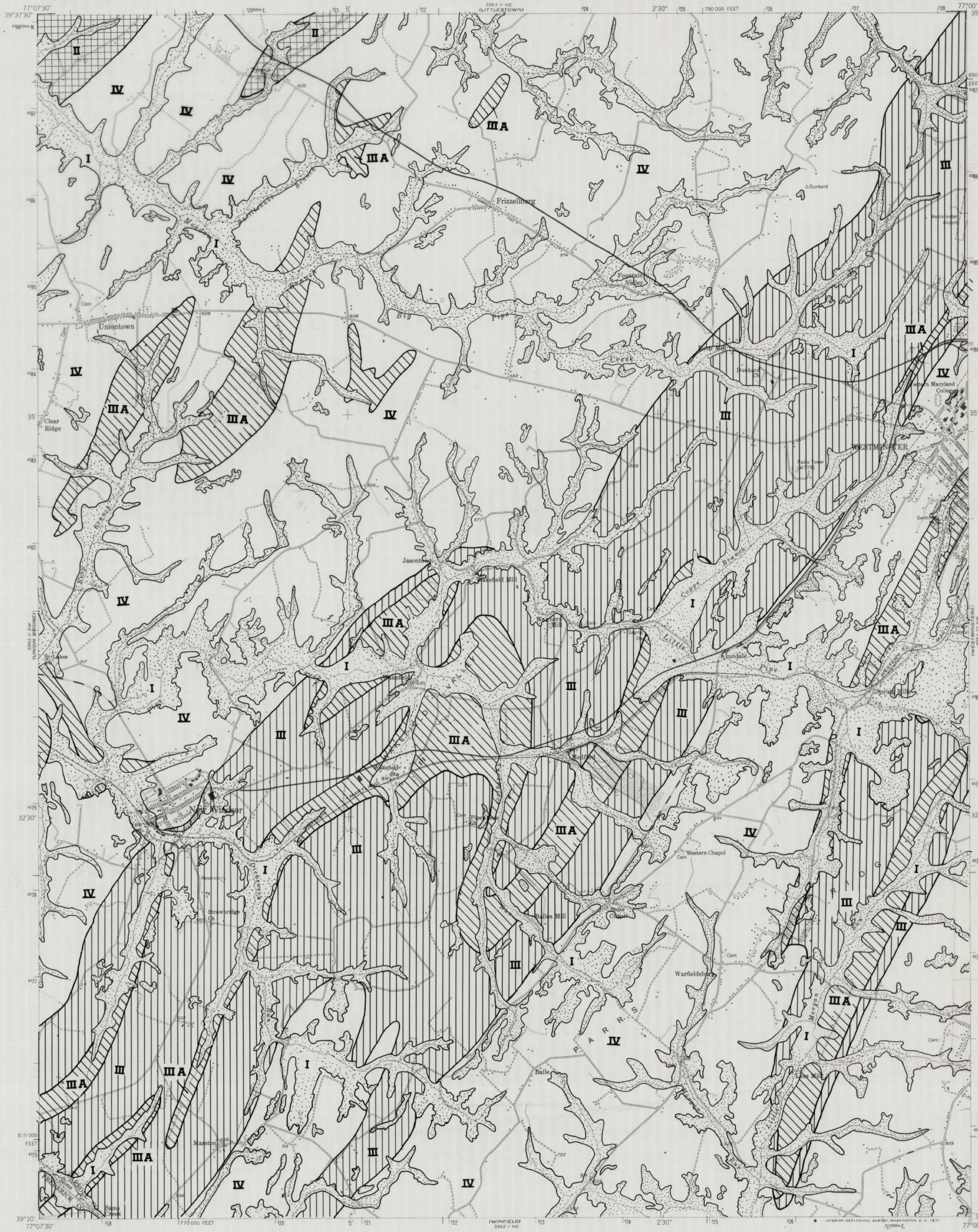


Figure 4. Mean percolation rates in Unit IV.



Topography from aerial photographs by stereophotogrammetric methods Photographs taken 1943-44 (photo-revised by U.S. Geological Survey 1971).

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

MARYLAND QUADRANGLE LOCATION

1980

Prepared in cooperation with the United States Geological Survey and the Commissioners of Carroll County

HYDROGEOLOGIC ATLAS NEW WINDSOR QUADRANGLE CARROLL COUNTY, MARYLAND

MAP 5. LOCATION OF WELLS, SPRINGS, AND TEST HOLES

Maryland Geological Survey

Quadrangle Atlas No. 11

LOCATION OF WELLS, SPRINGS, AND TEST HOLES

by John T. Hilleary and Edmond G. Otton

EXPLANATION

Information for wells and test holes shown on the map is on file with the U.S. Geological Survey, Towson, Maryland, and the Maryland Geological Survey, Baltimore, Maryland. Logs and well-construction records are available for most wells and test holes shown.

Well-numbering system: The wells and springs shown on the map are numbered according to a coordinate system in which Maryland counties are divided into 5-minute quadrangles of latitude and longitude. The first letter of the well number designates a 5-minute segment of latitude; the second letter designates a 5-minute segment of longitude. These letter designations are followed by a number assigned to wells chronologically. This letter-number sequence is the quadrangle designation, which is preceded by an abbreviation of the county name. Thus, well CL-CE 20 is the 20th well inventoried in quadrangle CE in Carroll County. In reports describing wells in only one county, the county prefix letters are frequently omitted from the well number. However, the numbering system currently in use (1978) differs slightly from that used in earlier published reports, such as Meyer (1958). In the 1958 report, well CL-CE 20 was designated as Car-Ce 20. The discontinuance of the use of lower-case letters in the well designation was necessitated by the change in 1970 to a computer storage and retrieval system for well information.

Miscellaneous shallow boreholes or auger test holes are designated by a number preceded by a "T". These holes are numbered chronologically within each 7½-minute quadrangle. Geologic and hydrologic records for them were obtained from various local concerns and agencies, chiefly county and State highway departments.

Water wells drilled in Maryland since 1945 also have a number (not shown on this map) assigned by the Maryland Water Resources Administration. This number consists of a two-letter county prefix (for example, CL for Carroll County) followed by a two-digit number indicating the State fiscal year in which the permit was issued (for example, -72 for the 1972 fiscal year). A four-digit chronologic sequence number follows the State fiscal year in which the permit was issued (for example, -72 for the fiscal year designation. Thus, well CL-72-0010 is the 10th well permit issued for Carroll County during the 1972 fiscal year. Since 1973, metal well tags showing the Water Resources Administration permit number are required to be affixed to the well casing. Beginning in 1973 the wells in Carroll County have been numbered chronologically through number CL-73-9999, regardless of the actual fiscal year.

Records of wells, springs, and boreholes shown on the map are in the Selected References, or are in the files of the District office of the U.S. Geological Survey at Towson, Maryland.

o 10

WATER WELL AND LOCATION NUMBER

o 3

SPRING AND LOCATION NUMBER

● T7

AUGER OR TEST HOLE AND NUMBER

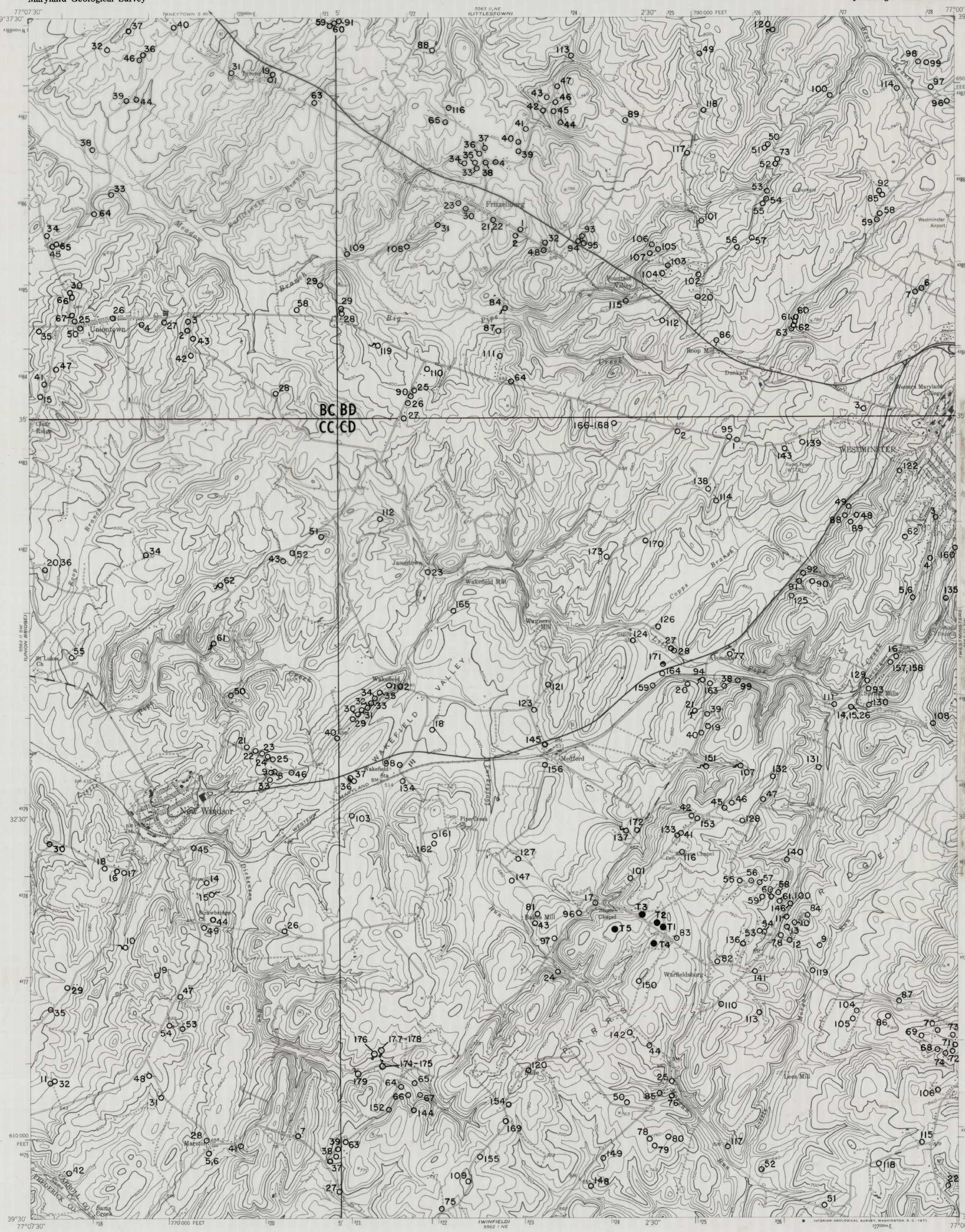
SELECTED REFERENCES

Cleaves, E. T., Edwards, Jonathan, Jr., and Glaser, J. D. (compilers and editors), 1968, Geologic Map of Maryland: Maryland Geol. Survey, scale 1:250,000.

Meyer, Gerald, 1958, The ground-water resources *in* The water resources of Carroll and Frederick Counties: Maryland Dept. of Geology, Mines and Water Resources 1/ Bull. 22, p. 1-228.

Stose, A. J., and Stose, G. W., 1944, Geology of the Hanover-York district Pennsylvania: U.S. Geol. Survey Prof. Paper 204, 84 p.

1/ Name of this agency changed to Maryland Geological Survey in 1964.



Topography from aerial photographs by stereophotogrammetric methods Photographs taken 1943-44 (photo-revised by U.S. Geological Survey 1971).

SCALE 1:24 000

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CONTOUR INTERVAL 20 FEET
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