Department of Natural Resources

MARYLAND GEOLOGICAL SURVEY

Emery T. Cleaves, Director

QUADRANGLE ATLAS NO. 24

SYKESVILLE QUADRANGLE

By

Mark T. Duigon

Prepared in cooperation with the
Howard County Department of Public Works

1994

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Emery T. Cleaves, Director

QUADRANGLE ATLAS NO. 24
SYKESVILLE QUADRANGLE: HYDROGEOLOGY

By Mark T. Duigon, Barbara F. Cooper, and Michael D. Tompkins

INTRODUCTION

This atlas presents hydrogeologic information for the Sykesville 7½-minute quadrangle located in northern Howard County and southeastern Carroll County, Maryland (fig. 1). The information contained herein is intended for use by planners, developers, environmental consultants, and other persons interested in hydrogeologic factors pertaining to land use in this area.

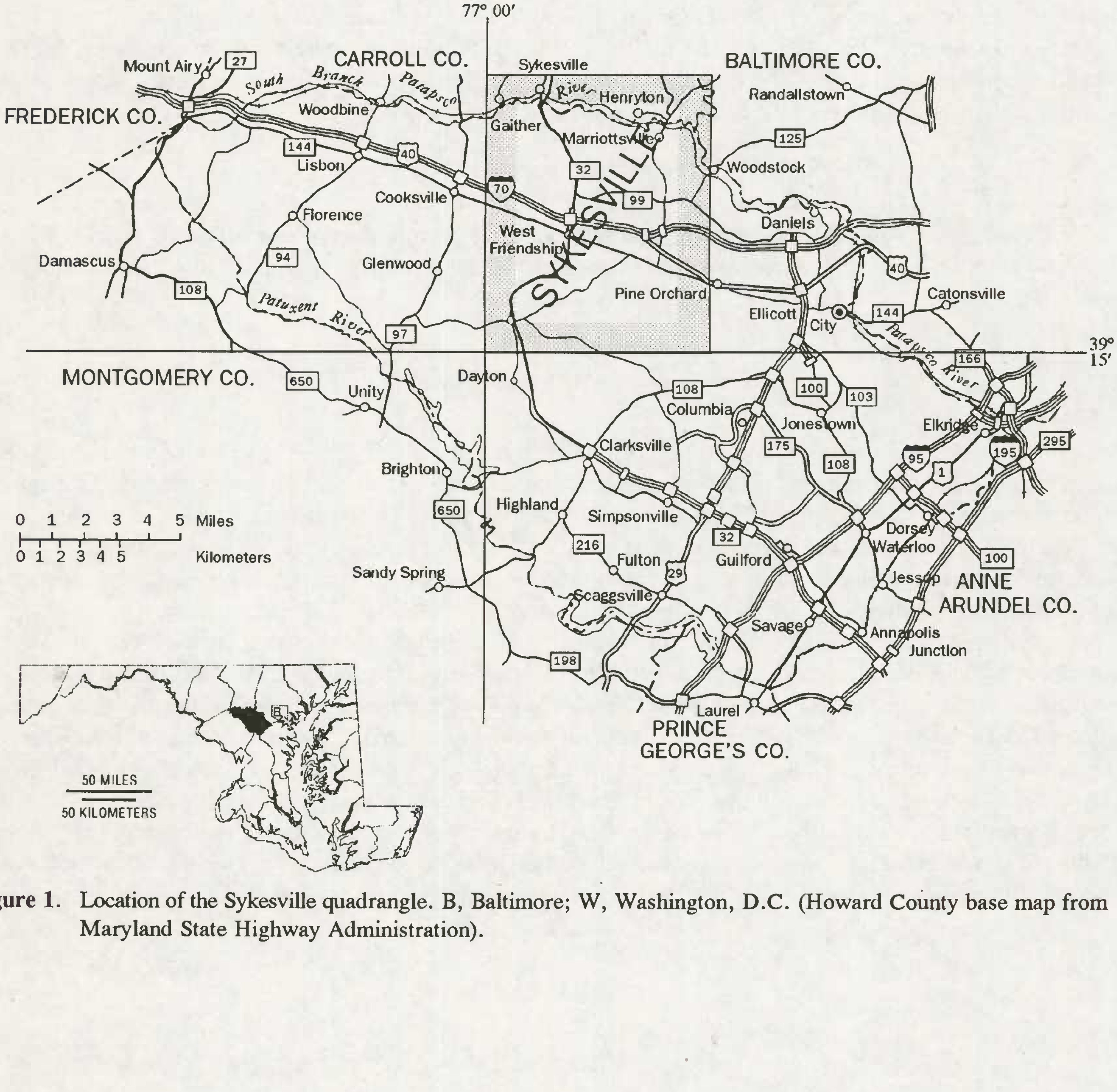

Figure 1. Location of the Sykesville quadrangle. B, Baltimore; W, Washington, D.C. (Howard County base map from Maryland State Highway Administration).

The Sykesville quadrangle lies within the eastern division of the Piedmont physiographic province, about 10 miles west of Baltimore and about 20 miles north of Washington, D.C. The area is characterized by rolling hills, although the North and South Branches of the Patapsco River have cut steep valleys with over 100 feet of local relief in the northern part of the quadrangle. Old Frederick Road (Maryland Route 99) approximately follows a drainage divide which separates the Patapsco River watershed on the north and the Patuxent River watershed on the south.

The climate of this area is humid-temperate, with an annual precipitation of approximately 42 inches. Monthly precipitation is slightly greater during May-September than during the rest of the year (Dine and others, 1995, p. 7-9).

Major roads passing through the Sykesville quadrangle include Interstate 70 (east-west) and Maryland Route 32 (north-south). Sykesville is the only incorporated town in the quadrangle; numerous residential developments are scattered around the quadrangle, and the Patapsco Valley State Park occupies a large area in the north. Some land remains in agricultural use.

Atlases for the adjacent quadrangles (except for the Savage quadrangle to the southeast) have also been published (Duigon and Crowley, 1983; Otton and Hilleary, 1980; Williams and others, 1981; Duigon, 1983; Duigon and others, 1995a, 1995b). The hydrologic analyses presented herein are largely based on data compiled by Dine and others (1992); additional discussions of the hydrogeology of Howard County may be found in Dingman and Meyer (1954) and Dine and others (1995).

ACKNOWLEDGMENTS

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GEOLOGY AND SOILS

The rocks underlying the Sykesville quadrangle (fig. 2; Edwards, 1993) have undergone a good deal of deformation, displacement, and metamorphism as a consequence of the location of the quadrangle near an orogenic continental margin. Precambrian (Proterozoic Y) Baltimore Gneiss is the basement rock underlying the Sykesville quadrangle, and is exposed in the cores of a set of domes. Clastic and carbonate rocks of the Glenarm Supergroup lie unconformably upon the Baltimore Gneiss and are exposed in more or less concentric bands around the domes. The Glenarm Supergroup comprises the Setters Formation (chiefly quartzite), the Cockeysville Marble, and the Wissahickon Group (schists, which include the Loch Raven and Oella Formations). In the western part of the quadrangle, the Morgan Run Formation (mostly schist) and Sykesville Formation (mostly gneiss) make up the Liberty Complex, a polygenetic mélange that was thrust into its present location (Muller and others, 1989). The northern tip of a younger (Silurian) granite pluton (Guilford Granite) is exposed in the southeastern edge of the Sykesville quadrangle; in approximately the same area, the Ellicott City Granite occurs as an injection complex of small dikes and sills making up as much as 25 percent of the rock. Pegmatite injections also occur in the southeastern corner of the quadrangle (making up to 50 percent of the rock) and occur as mappable pods and dikes elsewhere in the quadrangle. Unconsolidated alluvium underlies floodplains of some of the streams and may interfinger with colluvium at the bases of hillslopes.

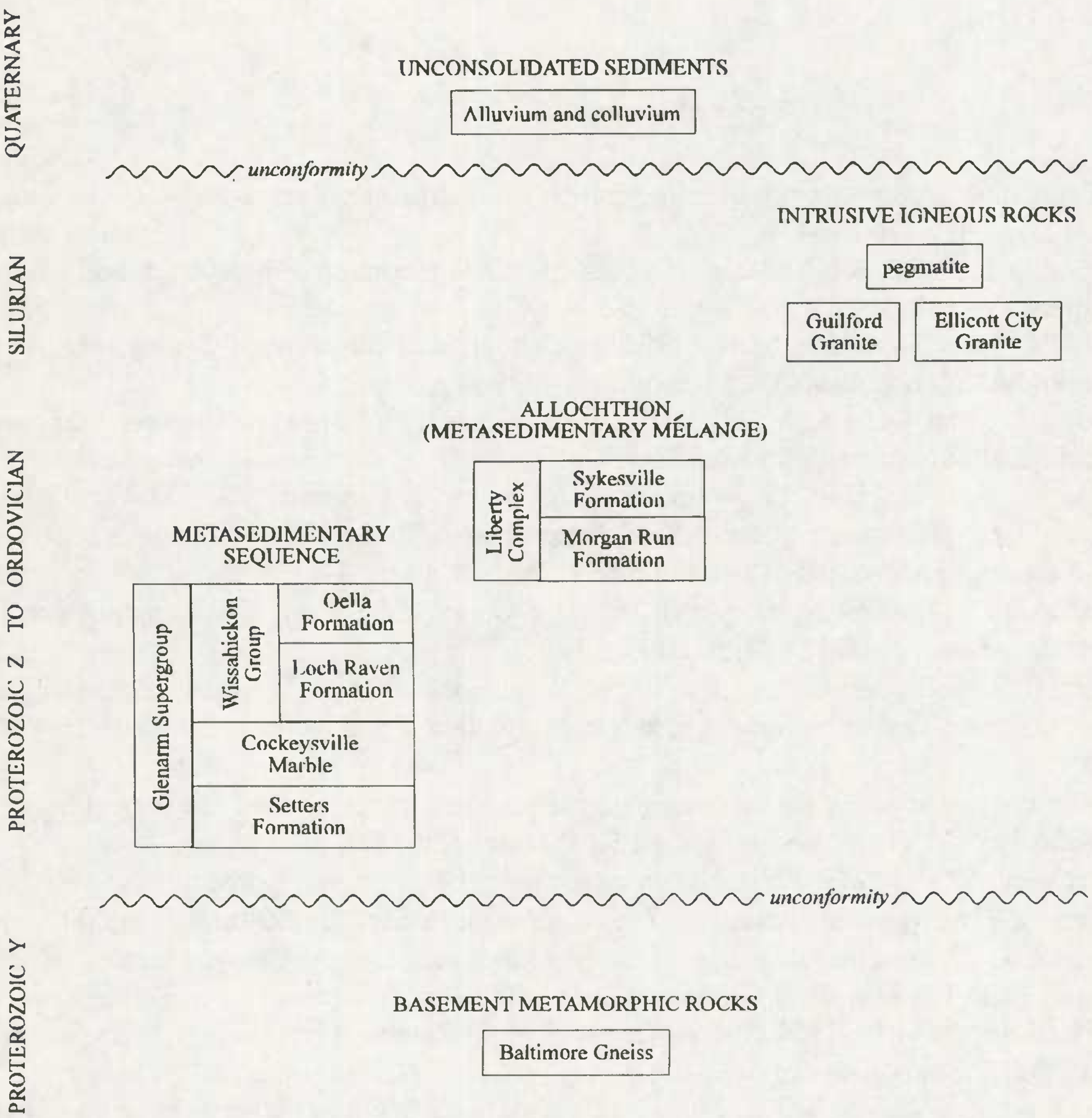

Figure 2. Generalized geologic column for the Sykesville quadrangle (based on Edwards, 1993).

Unweathered bedrock is exposed in limited areas in the Sykesville quadrangle. In most places it is covered by overburden, which includes an assortment of earth materials such as alluvium, colluvium, saprolite, loess, and artificial fill. Alluvium and colluvium are unconsolidated sediments deposited by streams and mass wasting; saprolite is soft, earthy material formed in place by chemical weathering of the crystalline bedrock. A discontinuous deposit of loess, or windblown silt, was deposited on saprolite. The loess eventually was incorporated in the Chester soil where the loess was thick (Darmody and Foss, 1982). Overburden thickness ranges from 0 to more than 100 feet, and is generally thicker beneath hilltops and thinner beneath large streams, as well as above certain lithologies, such as ultramafic rock. Roen and Froelich (1978) mapped overburden thickness in Howard County.

The geographic distribution of soils is due in part to the parent material that the soil formed in (alluvium along streams or saprolite in interfluvial areas) as well as topographic position and other, interrelated, factors. Most of the Sykesville quadrangle is underlain by the Glenelg-Chester-Manor and the Glenelg-Manor-Chester soil associations. The Soil Survey of Howard County, Maryland (Matthews and Hershberger, 1968) shows the soils, describes them, and tabulates their properties and the suitabilities of the soils for various purposes.

HYDROLOGY

The crystalline rocks that underlie the Sykesville quadrangle have negligible intergranular, or primary, porosity and permeability. Ground water is stored in and moves through fractures in the rocks, and ground-water flow rates depend upon the openness of the fractures and their degree of interconnection. Unconsolidated overburden above the crystalline rock frequently has much greater primary porosity and permeability than the rock has, allowing additional ground water to be stored (depending on the position of the water table).

The water table is the upper surface of the zone of saturation, and has a shape that approximately corresponds to the shape of the land surface, but with less relief. The water table is high (but deeper below land surface) under hilltops and low (but closer to land surface) along streams. Ground-water flow thus is directed along the hydrologic gradient, parallel to the land-surface gradient, and discharges to the streams. At some localities, rock fractures may have a preferred orientation and not be very well interconnected; in such cases ground water flows at an angle to the hydrologic gradient.

The generalized pattern of water circulation through the earth and atmosphere is known as the hydrologic cycle. The elements of the hydrologic cycle can be quantified for a particular region using a budget equation:

$$P = R_G + R_S + ET + \Delta S$$

where

P = Precipitation,
RG = Ground-water runoff,
RS = Surface or overland runoff,
ET = Combined evaporation and transpiration from plants (evapotranspiration), and
ΔS = Change in storage.

Precipitation is the source, or inflow, of water in the Piedmont. It is balanced by outflows as runoff and release back into the atmosphere as water vapor (evapotranspiration), and changes in the amount of water stored in or on the ground. Runoff, commonly measured at a stream-gaging station, is the total streamflow out of a basin. The total flow can be decomposed into contributions from ground-water discharge and overland flow. The amount of water in storage changes considerably seasonally, but net changes generally are smaller over longer periods, and this factor can often be assumed to be negligible. Evapotranspiration can then be estimated as the residual of the equation, or it can be estimated empirically (Thornthwaite and Mather, 1957), from climatological energy budget equations, or from hydrograph separation techniques (Daniel, 1976; this estimates evapotranspiration from the saturated zone, not total evapotranspiration). For the basin measured on the South Branch Patapsco River at Henryton, the average hydrologic budget for the period 1949-80 is (Dine and others, 1995):

$$41 \text{ in.} = 10 \text{ in.} + 4 \text{ in.} + 27 \text{ in.} + 0 \text{ in.}$$

(Change in storage was assumed negligible and evapotranspiration was calculated as the residual).

The chemical characteristics of ground water affect its suitability for various uses, and these characteristics are determined by geologic controls such as aquifer mineralogy and flow rates, as well as by certain human activities such as agriculture and road salting. Ground-water quality in the Sykesville quadrangle is generally good, notwithstanding the water is commonly somewhat acidic (except in areas underlain by Cockeysville Marble, where the water is somewhat alkaline and hard). Ground-water quality in Howard County is discussed in more detail by Dine and others (1995).

MAPS INCLUDED IN THIS ATLAS

The information in this atlas is presented on six maps, each with a standard U.S. Geological Survey topographic quadrangle base:

1. Slope of the Land Surface
2. Locations of Wells and Springs
3. Depth to the Water Table
4. Availability of Ground Water
5. Ground-Water Quality
6. Geohydrologic Constraints on Septic Systems

All of the maps were prepared at a scale of 1:24,000; Maps 2—6 have been reduced to a scale of 1:36,000. Computer-automated methods were used to some extent to prepare each map; artifacts of the procedures are most evident in Map 1, owing to the manner in which irregularly spaced elevation-data points were transformed into a regularly-spaced orthogonal grid, from which a lattice of land-slope values was computed.

These maps are designed for broad planning purposes and general hydrologic evaluations, and are not intended to substitute for detailed onsite investigations where required.

CONVERSION FACTORS, ABBREVIATIONS, AND WATER-QUALITY UNITS

Multiply	By	To obtain
inch (in.)	25.40	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
gallon (gal)	3.785	liter (L)
foot squared per day (ft^2/d)	0.09290	meter squared per day (m^2/d)
gallon per minute (gal/min)	0.06309	liter per second (L/s)
gallon per minute per foot [(gal/min)/ft]	0.2070	liter per second per meter [(L/s)/m]
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
picocurie per liter (pCi/L)	0.03700	Becquerel per liter (Bq/L)

Chemical concentration is expressed in milligrams per liter (mg/L) or micrograms per liter (μg/L). Radionuclide concentration is expressed in picocuries per liter, regardless of radionuclide species [1 picocurie per liter (pCi/L) = 3.7×10^{-2} disintegrations per second per liter]. Specific electrical conductance of water is expressed in microsiemens per centimeter at 25°C (μS/cm). Water temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) using the following equation:

$$°F = 1.8(°C) + 32.$$

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GEOHYDROLOGIC CONSTRAINTS ON SEPTIC SYSTEMS

By Mark T. Duigon and Barbara F. Cooper

INTRODUCTION

The septic-tank–soil-absorption system ("septic system") is an effective means of disposing of wastewater and sewage in many areas not served by public treatment systems. General descriptions of designs and principles of waste-disposal systems are provided by Bernhart, 1975; Leich, 1977; Johnson, 1978; American Society of Agricultural Engineers, 1978; Purdin, 1979; and Warshall, 1979. Site evaluation is discussed by Huddleston and Olson, 1967; Bouma, 1971 and 1974; Healy and Laak, 1973 and 1974; American Society of Agricultural Engineers, 1978; and Baker, 1978. Romero (1970), Allen and Morrison (1973), Keswick and Gerba (1980), Yates and Yates (1989), Pell, Nyberg, and Ljunggren (1990), and Gross and Mitchell (1990) describe movement of bacteria and viruses through soil and bedrock. Other water-quality aspects relating to septic systems are discussed by Viraraghavan and Warnock (1976), Scalf, Dunlap, and Kreissl (1977), DeWalle and Schaff (1980), Rea and Upchurch (1980), Hagedorn, McCoy, and Rahe (1981), Yates (1985), Alhajjar, Chesters, and Harkin (1990), Tinker (1991), Foster and Alexander (1992), Hantzsche and Finnemore (1992), and Wilhelm, Schiff, and Cherry (1994).

Materials in the household waste stream include excrement, food scraps, laundry detergents, bleach, and cleaning compounds and usually are mixed with large quantities of water for transport out of the house. Inside the septic tank, solids are separated from the waste slurry by settling and are broken down by anaerobic decomposition. Liquids flow out of the septic tank and are piped to a distribution field or seepage pit for distribution into the soil. As the water used to transport the wastes percolates through the soil it is depurated by the processes of filtration, adsorption on minerals (particularly clays), microbial action, and dilution. The cleansed water may subsequently recharge the local ground water.

Septic systems must be properly sited, constructed, and maintained to be efficacious. This map identifies areas where geohydrologic features impose maximum, moderate, and minimum constraints on the installation of typical septic systems consisting of septic tank and seepage field. Certain geohydrologic limitations can be overcome through alternative system designs such as mounding of the seepage field, aerobic tanks, sand filters, and other methods; some of these require more intensive maintenance, although some, such as mounding, have come into routine use (mound systems are now included under conventional systems—COMAR 26.04.02.05.Q). Various alternatives to the septic tank and drainfield disposal system are described by Duff (1979), Plews and Lenning (1979), and Bernhart (1979).

CONSTRAINT FACTORS

Certain geohydrologic conditions must be considered in order to determine the suitability of a site for installation of a septic system. The Code of Maryland Regulations (COMAR) specifies values for the following factors (as well as for some additional factors that cannot be shown at the scale of this map—see pamphlet for summary of regulations); however, peculiarities of individual sites may lead the approving authority to deny issuance of a permit, grant a variance, or increase required distances. The dimensions of the absorption field (and, in some cases, other system design aspects) are determined from the results of a percolation test. The percolation test consists of digging a number of holes deep enough to determine whether there is a sufficient thickness of unsaturated, unconsolidated material for effluent treatment, and an indication of the rate at which the soil can accept effluent (percolation rate). A small hole dug at the intended level of the disposal trenches is filled with water to a measured depth; the water level is allowed to drop one inch (pre-wetting), and then timed as it drops another inch. For conventional systems, the percolation rate must be within 2 to 30 minutes per inch after pre-wetting.

1. ***Flood hazard:*** Soil-absorption systems do not drain properly when flooded, and may be damaged. Flood waters can mix with sewage, spreading contamination to surface water and ground water. Areas prone to flooding were obtained from the Soil Surveys (Matthews, 1969; Matthews and Hershberger, 1968).

2. ***Depth to water table*:** Water flows more slowly under unsaturated than under saturated conditions, thereby allowing longer contact with soil and more thorough purification. Unsaturated soil is also better suited for the growth of the aerobic soil bacteria that break down wastes. Schwartz and Bendixen (1970) noted that nearly all removal of chemical oxygen demand (COD) and methylene-blue active substances (MBAS, which are surfactants contained in detergents) occurred within 2 ft of unsaturated soil, and nearly all ammonia was removed within 4 ft. The actual unsaturated thickness necessary for contaminant removal depends on the particular contaminant, as well as the soil environment. Areas of shallow depth to the water table were obtained from the Soil Surveys and from Map 3 of this atlas.

3. ***Depth to bedrock:*** Bedrock in the area mapped consists of crystalline metamorphic rocks having negligible primary, or intergranular, permeability. Ground water flows through fractures which are variably spaced throughout the rock and which have variable apertures; the fractured rock does not treat wastewater as effectively as soil, which has a much greater mineral surface area (per unit volume) than does the bedrock. Areas of very shallow depth to bedrock were obtained from the Soil Surveys.

4. ***Slope of the land surface:*** There may be a lateral component to the movement of septic-system effluent, resulting in surface discharge in steep areas having shallow soils. Land slopes were obtained from Map 1 of this atlas.

5. ***Distance to surface-water bodies:*** Streams and lakes are commonly areas of ground-water discharge. A septic system should be located at a sufficient distance from surface water to allow adequate treatment underground. Buffers were determined automatically from digital hydrography.

6. ***Geologic unit:*** Ground water in the marble aquifers tends to be more susceptible to contamination than ground water in the other rock units, owing to the solutional enlargement of fractures, which allows rapid ground-water flow. Ground-water availability is a problem in some of the other geologic units, and the presence of septic systems in a neighborhood could preclude installation or replacement of an on-site potable water supply. Geologic units were obtained from Edwards (1993).

MAP UNITS

UNIT I: Septic-tank–soil-adsorption systems constructed in this unit face a high probability of failure. This unit mostly occurs adjacent to streams, where flooding is an occasional hazard, the water table comes within 4 ft of land surface (at least seasonally), and the slope of valley walls exceeds 25 percent in some areas. Unit I includes 100-ft-wide buffer zones along streams tributary to Triadelphia Reservoir (located about 2.5 miles southwest of the Sykesville Quadrangle). It also includes areas where bedrock is less than 3 ft from land surface, mostly in the northern part of the quadrangle (characterized by Mt. Airy soils).

UNIT II: Conditions in this unit are less severe or more variable than in Unit I. A large part of Unit II comprises areas not served by public water (Howard County Master Plan for Water and Sewerage, 1985) that are underlain by marble (in which ground water may be more susceptible to contamination) or by rocks included in Geohydrologic Unit 4 (Map 4 of this atlas) (where obtaining an adequate water supply could be problematic). This unit also includes areas where the high water table is between 3 and 10 ft below land surface, and areas underlain by soils having a fragipan (a low-permeability horizon that impedes percolation). The Alpha Ridge landfill is included in this unit.

UNIT III: Conditions in Unit III, which comprises those areas not included in Unit I or Unit II, generally pose only slight limitations on the operation of septic systems. Onsite inspection is still required to verify site suitability and to estimate drainfield size.

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Maryland Geological Survey

MAP 6. GEOHYDROLOGIC CONSTRAINTS ON SEPTIC SYSTEMS

Quadrangle Atlas No. 24

Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

1995

Prepared in cooperation with the
Howard County Department of Public Works

AVAILABILITY OF GROUND WATER

By Mark T. Duigon

INTRODUCTION

Ground water in the Piedmont physiographic province occupies and moves through rock fractures. These fractures are not uniformly distributed throughout the rocks, and individual water-bearing fractures cannot be detected without drilling. Consequently, well yields in this region are highly variable across short distances and cannot be predicted with much certainty. The extent of fracturing varies somewhat among geologic formations owing to lithologic differences and differences in the stresses to which they have been subjected, and this allows them to be assigned to three geohydrologic units based on well-yield and construction data (fig. 1). This map was developed from a statistical analysis (multiway analysis of variance) of specific-capacity data with wells grouped by geologic unit and topographic setting. (Topographic setting was not a significant factor affecting specific capacity.) The geologic units are those of Edwards (1993, written communication).

Domestic water demand is typically 50 to 75 gallons per day per resident of single-family homes (Whitsell, 1982, p. 15), but minimum acceptable well yield is specified by the State. Most domestic well sites are chosen to meet regulations dealing with property lines, septic systems, and structures, as well as for convenience. If greater yields are required, more consideration should be given to site selection and well construction and development. Location of fracture traces (linear zones of concentrated rock fractures), which can be seen on aerial photographs, is a suitable technique for well-site selection in fractured-rock terrane. Fractures may also be more numerous beneath stream valleys and upland draws, making these sites more favorable than hilltop sites.

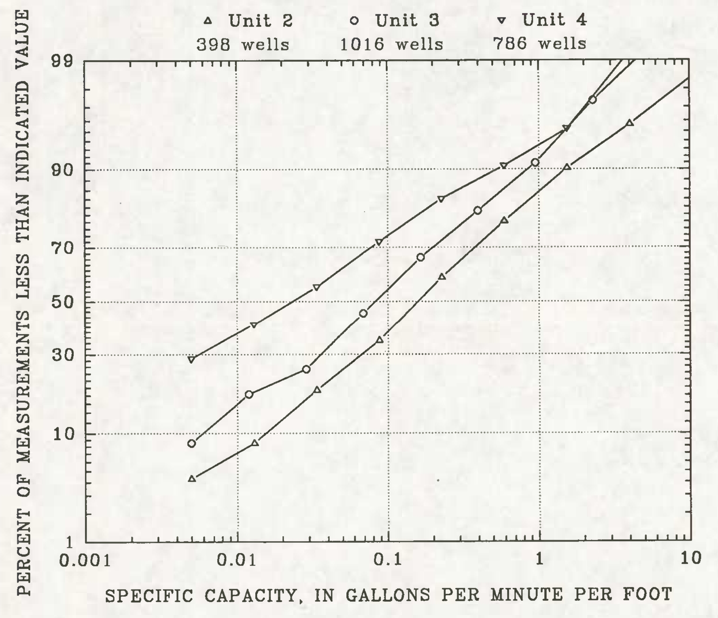


Figure 1.—Cumulative-frequency distributions of specific capacities of wells in the three geohydrologic units.

EXPLANATION

○ Well having reported yield less than 2 gallons per minute

● Well having reported yield greater than 15 gallons per minute

GEOHYDROLOGIC UNIT 1, not present in this quadrangle, is underlain by Coastal Plain sediments and is located elsewhere in Maryland.

GEOHYDROLOGIC UNIT 2: Geohydrologic Unit 2 comprises areas underlain by the Sykesville Formation, a fine- to medium-grained gneiss or fels, and by the Cockeysville Formation, a marble interlayered with calc-schist. Reported yields of 148 wells in the Sykesville quadrangle range from 0 ("dry hole") to 100 gallons per minute, with a median yield of 10 gallons per minute. Mean yield is 15.1 gallons per minute. The distribution of well yields among four yield classes related to adequacy for various uses is shown in figure 2. Specific capacities of 133 wells range from 0.000 to 20 gallons per minute per foot of drawdown, with a median of 0.25 (gal/min)/ft. Mean specific capacity is 1.1 (gal/min)/ft.

Well depths range from 32 to 400 feet for 155 wells, with a median of 125 ft and a mean of 147.7 ft. Water levels measured in 149 wells range from 5 to 90 ft below land surface, with a median of 36 ft and a mean of 37.8 ft.

Wells drilled in Geohydrologic Unit 2 will be adequate for domestic use in most cases, and in many cases, can meet the needs of limited commercial, municipal, and industrial uses.

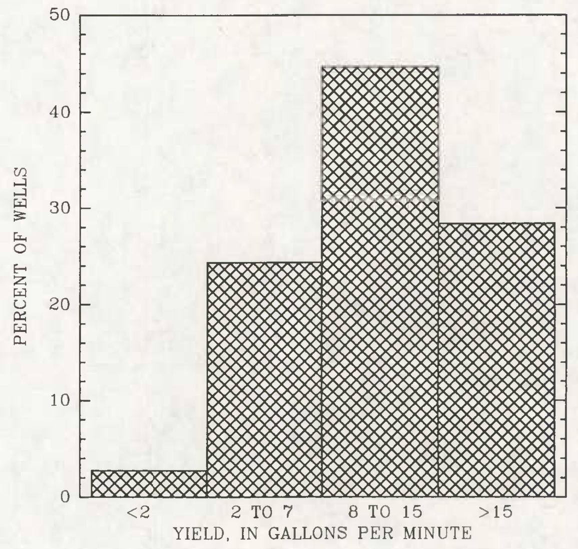


Figure 2.—Distribution of well yields, Geohydrologic Unit 2 (148 wells).

GEOHYDROLOGIC UNIT 3: In the Sykesville quadrangle this unit includes areas underlain by Baltimore Gneiss, Morgan Run Formation, Setters Formation, and some narrow pegmatite bodies. These rocks consist predominantly of gneiss and schist, and include quartzite and mafic and ultramafic schists and fels as well. Reported yields of 253 wells in the Sykesville quadrangle range from 0 to 60 gal/min; the median is 8 gal/min and the mean is 9.9 gal/min. Specific capacities of 225 wells range from 0.000 to 15 (gal/min)/ft, with a median of 0.08 (gal/min)/ft and a mean of 0.508 (gal/min)/ft. Depths of 257 wells range from 40 to 480 ft. Median well depth is 200 ft and mean depth is 207.6 ft. Water levels measured in 241 wells range from 5 to 215 ft below land surface, with a median of 36 ft and a mean of 38.0 ft.

About 5 percent of the wells in Geohydrologic Unit 3 were dry holes, and more than 10 percent yield less than 2 gal/min (fig. 3). Household demands can generally be met, as can some other uses if the demand is not very high.

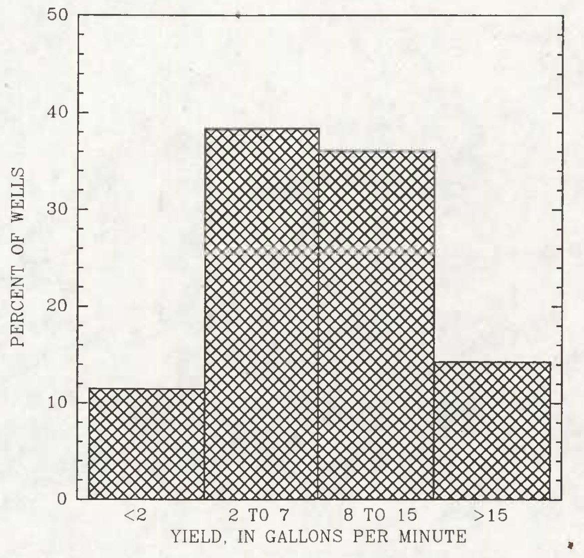


Figure 3.—Distribution of well yields, Geohydrologic Unit 3 (253 wells).

GEOHYDROLOGIC UNIT 4: Geohydrologic Unit 4 is underlain by the Loch Raven and Oella Formations in the Sykesville quadrangle. In places these formations are interlayered and not mapped separately; they were, therefore, treated as one entity for ground-water availability considerations. Both formations consist of schist with gneiss (more gneiss in the Oella Formation, which also includes minor quartzite locally). Reported yields of 240 wells range from 0 to 50 gal/min, and have a median yield of 3 gal/min and a mean yield of 5.0 gal/min. Specific capacities of 230 wells range from 0.000 to 10 (gal/min)/ft, with a median of 0.02 (gal/min)/ft and a mean of 0.27 (gal/min)/ft. Depths of 227 wells range from 18 to 600 ft, with a median of 260 ft and a mean of 256.7 ft. Water levels measured in 195 wells range from above land surface (flowing) to 240 ft below land surface. Median water level is 40 ft and mean water level is 43.0 ft below land surface.

Obtaining an adequate well yield in this unit can be a serious problem (fig. 4). Almost 20 percent of the wells were dry holes, and about 33 percent yield less than 2 gal/min. The chances of obtaining a yield sufficient for municipal or certain industrial or commercial uses are quite low, as only about 2 percent of inventoried wells yield more than 15 gal/min.

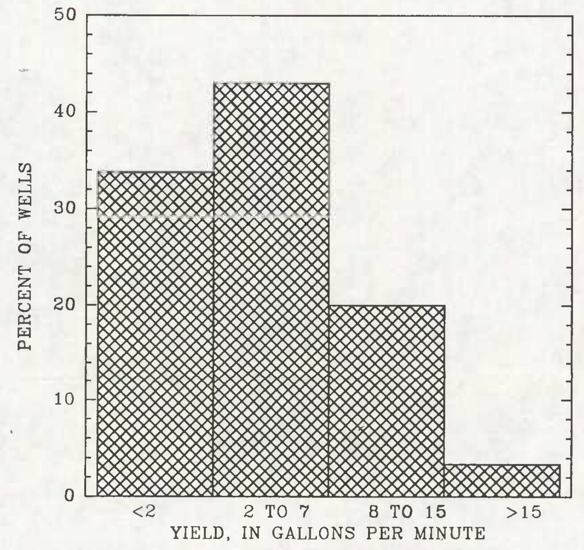


Figure 4.—Distribution of well yields, Geohydrologic Unit 4 (227 wells).

SUMMARY

Reported yields of 647 wells in the Sykesville quadrangle range from 0 to 100 gal/min, with a median of 6 gal/min. Mean yield is 9.2 gal/min. Nearly 10 percent of the wells inventoried in the Sykesville quadrangle were dry holes, and about 18 percent yield less than 2 gal/min. Approximately 13 percent of the wells yield more than 15 gal/min. Specific capacities of 594 wells range from 0.000 to 20 (gal/min)/ft, have a median of 0.07 (gal/min)/ft and a mean of 0.56 (gal/min)/ft. Depths of 646 wells range from 18 to 600 ft, with a median of 200 ft and a mean of 210.5 ft. Water levels measured in 591 wells range from above land surface (a flowing well) to 240 ft below land surface, with a median of 38 ft and a mean of 39.6 ft.

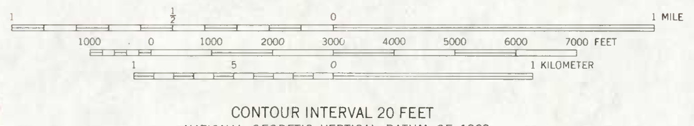
REFERENCE

Whitsell, W.J. (Committee Chairman), 1982, Manual of individual water supply systems: U.S. Environmental Protection Agency, EPA-570/9-82-004, 155 p.

MAP 4. AVAILABILITY OF GROUND WATER

Maryland Geological Survey Quadrangle Atlas No. 24

Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.



CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

1994

Prepared in cooperation with the Howard County Department of Public Works

GROUND-WATER QUALITY

by Mark T. Duigon

INTRODUCTION

Ground-water quality data for Howard County were compiled by Dine, Adamski, and Tompkins (1992) and discussed by Dine, Adamski, and Duigon (1995). Geographic variation of basic ground-water chemistry in the Sykesville quadrangle is shown on this map using Stiff diagrams (Stiff, 1951). A diagram is included for one stream-sampling station, Middle Patuxent River near West Friendship (site 01593600; the diagram is based on the median values of three samples). The stream site is included because samples were collected under base-flow conditions, when all of the streamflow consisted of ground-water discharge, and the quality indicative of ground water in the basin. Ground-water chemistry varies considerably and non-systematically in the Sykesville quadrangle. Some of the variation is due to the mineralogy of the aquifer, but anthropogenic sources, perhaps including road-deicing salt, likely affect the chemistry of about half of the samples. The shapes representing wells HO Bd 3 and HO Be 33, both completed in the Cockeysville Marble, are characteristic of ground water from carbonate rocks. Shapes wide at the top, such as for HO Bd 390, may indicate movement of road-deicing salt into the ground (sewage effluent, from treatment plants or from septic systems, and other wastes are possible sources of chloride and sodium). Deicing salt may be in the form of calcium chloride as well as sodium chloride. Many sources provide nitrogen in a variety of forms. Much of the nitrogen is converted to nitrate (the most common, oxidized form of nitrogen in ground water) before entering ground water. Concentrations of more than a few milligrams per liter (nitrate plus nitrite, as N) are likely due to contamination; septic systems are the most significant sources of nitrate in ground water in unsewered areas.

Most of the samples may be classified either as calcium-sodium—chloride-sulfate-bicarbonate or as calcium-sodium—bicarbonate-chloride-sulfate water types (fig. 1). Chloride makes up less than about 40 percent of the total anion content in 40 percent of the samples, and more than about 60 milliequivalents per liter in 60 percent of the samples.

Basic chemical data for the wells are shown in table 1. Some trace metals were detected at all sites (table 2), although chromium, cobalt, molybdenum, and vanadium were undetected at all sites. Radon concentrations in ground water in the Sykesville quadrangle range from 170 to 25,000 picocuries per liter (pCi/L). The U.S. Environmental Protection Agency had proposed a Maximum Contaminant Level (MCL) for radon of 300 pCi/L (1991); uncertainties involved in assessing health risks of waterborne radon have delayed implementation of a MCL (Stone, 1993), and a value of 3,000 pCi/L has been proposed (reauthorization of the Safe Drinking Water Act, S. 1316, 1995). Prometone was the only pesticide detected (table 3).

REFERENCES

Dine, J.R., Adamski, J.C., and Duigon, M.T., 1995, Water resources of Howard County, Maryland: Maryland Geological Survey, Bulletin 38, 128 p.

Dine, J.R., Adamski, J.C., and Tompkins, M.D., 1992, Hydrologic data for Howard County, Maryland: Maryland Geological Survey, Basic Data Report No. 19, 240 p.

S. 1316, 104th Congress, § 8 (1995).

Stiff, H.A., 1951, The interpretation of chemical water analysis by means of patterns: Journal of Petroleum Technology, vol. 3, no. 10, section 1,p. 15-16; section 2,p. 3.

Stone, Richard, 1993, EPA analysis of radon in water is hard to swallow: Science, vol. 261, no. 5128, p. 1514-1516.

U.S. Environmental Protection Agency, 1991, Notice of proposed rulemaking, national primary drinking water regulation—radionuclides: U.S. Federal Register, vol. 56, no. 13 (July 18, 1991), p. 33,050-33,124.

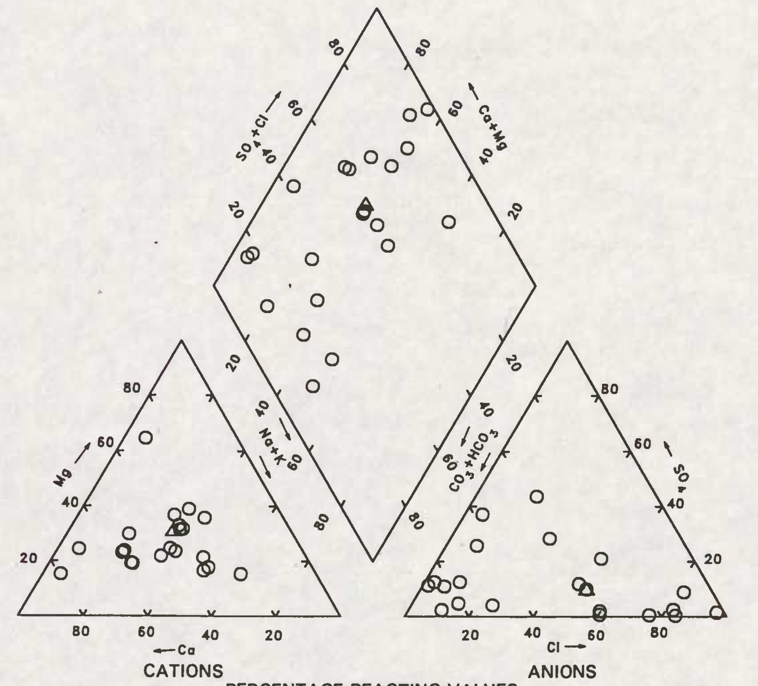


Figure 1.—Major-ion percentages in ground water in the Sykesville quadrangle (22 samples). Samples from wells are shown by circles; the triangles are based on the median values of three base-flow samples from Middle Patuxent River near West Friendship. Percentages are computed from concentrations expressed in milliequivalents per liter.

TABLE 1. BASIC GROUND-WATER CHEMISTRY

[Concentrations are for dissolved forms; B, stream base flow; W, well; S, spring]

Site	Site type	Geologic unit	Open interval (ft below land surface)	Date sampled	Specific conductance (μS/cm at 25°C)	pH	Hardness (mg/L as $CaCO_3$)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Alkalinity (mg/L as $CaCO_3$)	Sulfate (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate + Nitrite (total, mg/L as N)	Silica (mg/L)	Total dissolved solids (residue at 180°C, mg/L)	Site
01593600	B	—	—	12-20-88	141	6.7	46	10	5.1	9.4	1.8	19	5.1	19	<0.1	—	11	95	01593600
				04-26-89	141	7.1	46	10	5.2	8.7	1.8	21	5.3	20	.1	—	6.7	100	
				10-16-89	182	7.2	48	11	4.9	9.1	2.9	24	4.0	30	.1	—	10	92	
CL Ee 145	W	SKVLG	unknown	08-11-83	283	5.5	—	—	—	—	—	—	—	—	—	—	—	—	CL Ee 145
HO Ad 26	W	SKVLG	20-345	05-23-89	186	6.9	67	20	4.2	9.5	2.4	55	21	5.7	.1	.70	17	119	HO Ad 26
HO Ad 34	W	SKVLG	31-120	05-10-90	48	5.0	11	1.8	1.6	3.0	.6	4	<1.0	3.8	<.1	2.9	7.9	34	HO Ad 34
HO Ad 83	W	UMFC	22-90	05-09-89	193	6.0	89	11	15	2.3	1.0	50	31	3.4	.1	1.9	19	116	HO Ad 83
HO Ae 3	W	BLMR	20-140	05-15-89	204	5.7	72	20	5.2	7.4	2.4	24	27	8.7	.1	7.2	18	139	HO Ae 3
HO Bd 3	W	CCKV	16-203	05-15-52	263	7.8	130	45	5.3	2.0	2.6	119	17	3.0	.1	—	15	166	HO Bd 3
HO Bd 4	W	BLMR	58-173	05-15-52	65	6.6	13	3.4	1.0	4.9	1.2	30	.8	2.5	.1	—	26	62	HO Bd 4
HO Bd 9	W	SKVLG	33-55	12-16-52	34	6.3	7	1.8	.60	2.7	.9	10	1.6	1.0	<.1	—	15	34	HO Bd 9
HO Bd 18	S	BLMR	—	08-14-81	280	7.1	120	31	11	4.6	1.8	—	1.9	5.3	<.1	—	24	166	HO Bd 18
HO Bd 77	W	SKVLG	21-80	03-28-89	156	5.2	45	7.4	6.3	9.3	1.7	7	<.2	16	.1	8.0	13	88	HO Bd 77
HO Bd 150	W	L-O	61-400	05-15-90	85	5.8	26	6.5	2.4	5.5	1.5	17	<1.0	4.3	<.1	4.6	16	66	HO Bd 150
HO Bd 246	W	L-O	66-128	03-28-89	151	5.2	35	8.4	3.4	13	1.9	10	<.2	11	.1	8.9	15	99	HO Bd 246
HO Bd 325	W	L-O	47-300	03-27-89	167	6.5	64	19	4.0	8.7	2.6	7	5.0	8.9	.1	.10	30	120	HO Bd 325
HO Bd 390	W	SKVLG	26-125	03-27-89	272	5.5	46	11	4.4	32	2.1	17	.6	65	.1	2.3	14	157	HO Bd 390
HO Bd 401	W	STRS	30-180	11-20-89	109	5.5	33	8.3	3.0	7.7	2.0	35	2.0	4.4	<.1	2.5	28	79	HO Bd 401
HO Bd 402	W	L-O	36-145	01-24-90	—	5.7	120	31	11	11	3.9	55	3.0	61	<.1	2.2	25	232	HO Bd 402
HO Bd 403	W	L-O	20-410	02-06-90	920	4.7	250	52	29	56	6.4	8	6.0	250	.1	1.2	16	554	HO Bd 403
HO Bd 404	W	SKVLG	43-105	02-06-90	82	5.6	23	4.7	2.8	4.5	1.4	12	8.0	6.4	.1	2.9	13	62	HO Bd 404
HO Bd 405	W	L-O	52-58	02-27-90	160	5.4	42	8.6	5.0	9.2	2.1	6	<1.0	23	.3	7.3	13	121	HO Bd 405
HO Bd 406	W	L-O	46-85	02-27-90	350	5.6	95	18	12	16	4.1	10	10	67	<.1	9.4	16	244	HO Bd 406
HO Be 21	W	BLMR	20-125	06-05-89	112	5.5	33	8.8	2.6	6.4	1.8	14	4.0	12	.1	3.2	22	88	HO Be 21
HO Be 33	W	CCKV	20-350	05-01-90	308	7.8	150	45	9.6	2.5	3.9	133	17	7.9	<.1	1.6	13	187	HO Be 33
HO Be 112	W	L-O	62-453	05-31-90	167	8.0	60	17	4.2	5.4	2.8	71	8.8	1.0	<.1	.40	16	101	HO Be 112

Geologic unit codes

BLMR	Baltimore Gneiss	SKVLG	Sykesville Formation
CCKV	Cockeysville Marble	STRS	Setters Formation
L-O	Loch Raven-Oella Formations (undifferentiated)	UMFC	Morgan Run Formation (undifferentiated ultramafic and mafic rock)

TABLE 2. DISSOLVED TRACE METALS AND RADON

[All concentrations in micrograms per liter except radon, which is in picocuries per liter]

Site	Date sampled	Aluminum	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Molybdenum	Nickel	Silver	Strontium	Vanadium	Zinc	Radon	Site
HO Ad 26	05-23-89	<10	5	<0.5	2	<5	<3	<10	5	<10	6	29	<10	10	<1.0	120	<6	9	2,500	HO Ad 26
HO Ad 34	05-10-90	<10	19	<.5	2	<5	<3	10	6	<10	4	4	<10	<10	<1.0	19	<6	6	2,600	HO Ad 34
HO Ad 83	05-09-89	<10	33	<.5	1	<5	<3	60	<3	<10	<4	5	<10	<10	<1.0	47	<6	13	170	HO Ad 83
HO Ae 3	05-15-89	<10	56	<.5	<1	<5	<3	40	12	<10	<4	<1	<10	<10	<1.0	120	<6	4	15,000	HO Ae 3
HO Bd 77	03-28-89	10	40	<.5	4	<5	<3	30	11	<10	<4	25	<10	<10	<1.0	90	<6	10	3,100	HO Bd 77
HO Bd 150	05-15-90	20	18	<.5	<1	<5	<3	40	<3	<10	9	8	<10	<10	<1.0	57	<6	4	4,800	HO Bd 150
HO Bd 246	03-28-89	30	49	<.5	3	<5	<3	30	14	<10	<4	180	<10	<10	1.0	91	<6	14	6,700	HO Bd 246
HO Bd 325	03-27-89	<10	8	<.5	2	<5	<3	10	27	<10	11	140	<10	<10	<1.0	81	<6	6	1,900	HO Bd 325
HO Bd 390	03-27-89	40	140	<.5	2	<5	<3	20	8	20	<4	49	<10	<10	2.0	140	<6	17	2,500	HO Bd 390
HO Bd 401	11-20-89	<10	55	<.5	<1	<5	<3	50	34	20	<4	200	<10	<10	4.0	87	<6	9	3,300	HO Bd 401
HO Bd 402	01-24-90	<10	55	<.5	2	<5	<3	40	49	<10	15	3	<10	20	<1.0	240	<6	<3	5,200	HO Bd 402
HO Bd 403	02-06-90	50	310	<.5	<1	<5	<3	70	36	10	4	74	<10	<10	<1.0	670	<6	18	—	HO Bd 403
HO Bd 404	02-06-90	20	24	<.5	1	<5	<3	20	16	<10	<4	3	<10	<10	<1.0	49	<6	8	—	HO Bd 404
HO Bd 405	02-27-90	30	88	.7	3	<5	<3	20	19	<10	<4	10	<10	10	<1.0	97	<6	20	15,000	HO Bd 405
HO Bd 406	02-27-90	20	130	<.5	<1	<5	<3	40	8	10	<4	16	<10	10	<1.0	250	<6	10	4,100	HO Bd 406
HO Be 21	06-05-89	20	46	<.5	<1	<5	<3	60	6	<10	<4	3	<10	<10	<1.0	120	<6	15	9,000	HO Be 21
HO Be 33	05-01-90	<10	64	<.5	4	<5	<3	<10	5	<10	4	<1	<10	<10	<1.0	220	<6	5	1,400	HO Be 33
HO Be 112	05-31-90	<10	10	<.5	<1	<5	<3	<10	<3	<10	12	4	<10	<10	<1.0	100	<6	<3	25,000	HO Be 112

TABLE 3. PESTICIDES

[ND, not detected]

Site	Date sampled	Triazine group	Carbamate group
CL Ee 145	08-11-83	ND[1]	—
HO Ad 26	05-23-89	ND	ND
HO Ad 34	05-10-90	ND	—
HO Ae 3	05-15-89	Prometone 0.2 μg/L	ND
HO Bd 150	05-15-90	ND	ND
HO Bd 246	03-28-89	—	ND
HO Bd 390	03-27-89	—	ND
HO Bd 402	01-24-90	ND	ND
HO Bd 403	02-06-90	ND	—
HO Bd 404	02-06-90	ND	—
HO Bd 405	02-27-90	ND	ND
HO Bd 406	02-27-90	ND	ND
HO Be 21	06-05-89	ND	ND
HO Be 33	05-01-90	ND	ND

[1] Analysis included Atratone, Cyprazine, and Simetone, but not Alachlor, Metolachlor, Metribuzin, or Trifluralin.

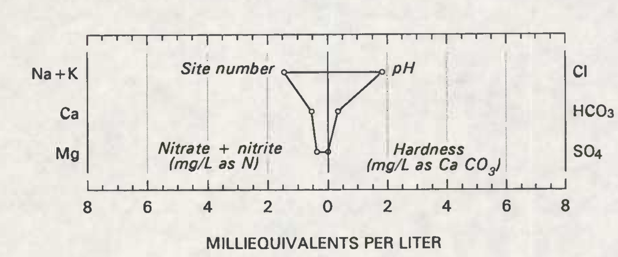
Triazine group	*Carbamate group*
Alachlor	Aldicarb
Ametryne	Aldicarb sulfone
Atrazine	Aldicarb sulfoxide
Cyanazine	Carbofuran
Metolachlor	3-Hydroxy carbofuran
Metribuzin	Methomyl
Prometone	1-Naphthol
Prometryne	Oxamyl
Propazine	Propham
Simazine	Sevin
Simetryne	
Trifluralin	

EXPLANATION

△ Stream base-flow sampling site

○ Well

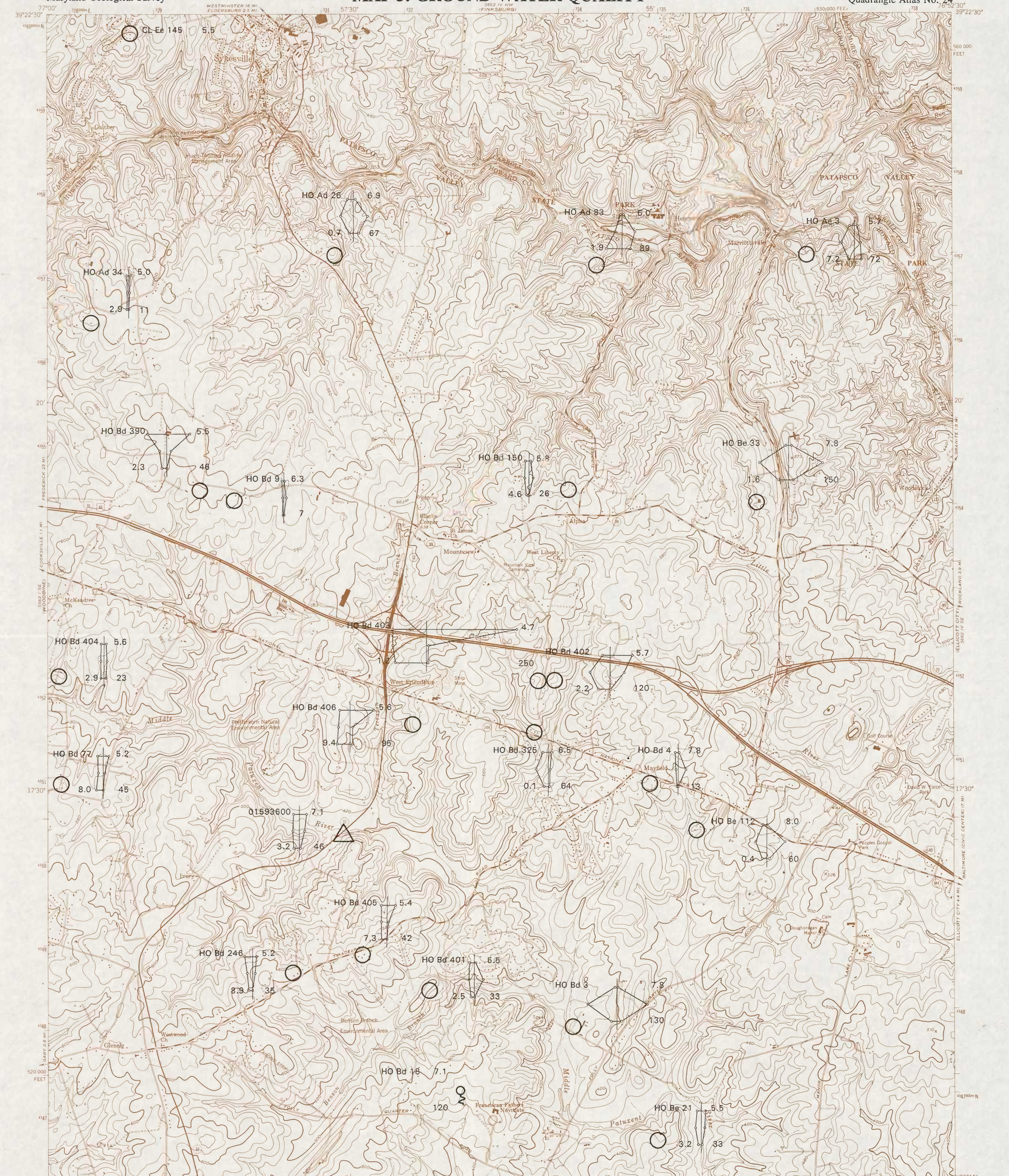
♀ Spring



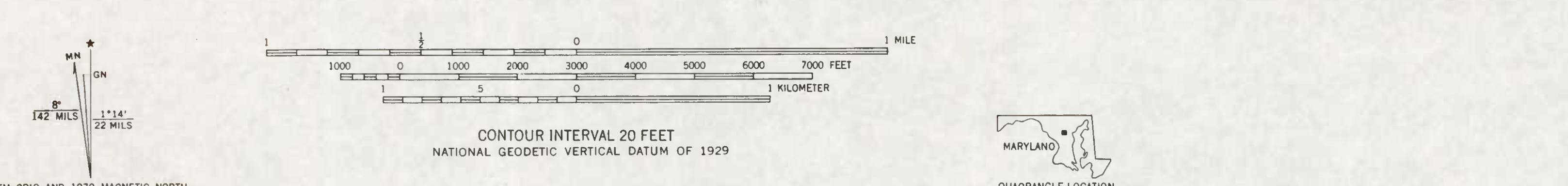
Maryland Geological Survey

MAP 5. GROUND-WATER QUALITY

Quadrangle Atlas No. 24



Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.



Prepared in cooperation with the
Howard County Department of Public Works

1995

LOCATIONS OF WELLS AND SPRINGS

By Michael D. Tompkins
and
Mark T. Duigon

Records of wells and springs inventoried in Howard County over the years were recently compiled and placed into a computer data base (Dine et al., 1992). Additional wells in the vicinity of Alpha were inventoried and data describing them are tabulated herein. Locations of wells and springs in the northern part of the quadrangle, in Carroll County (Hilleary and Weigle, 1981), were verified and the inventory supplemented; information for these wells was added to the data base and is also presented. The data base, known as the Ground-Water Site Inventory (GWSI) is operated by the U.S. Geological Survey and is part of a national hydrologic data base, the National Water Data Storage and Retrieval System (WATSTORE). Within WATSTORE, site-location, water-quality, and daily water-level-measurement data are related and indexed.

The State of Maryland has required a permit for drilling water wells since 1945. The permit requires that the driller furnish construction and yield information for each well completed. Wells drilled since 1973 have attached metal tags stamped with the permit numbers, which facilitates matching up completion reports and wells. These numbers are included in the well tables.

Wells and springs are identified using a State-wide numbering system. The first pair of letters of an identifying number is the county abbreviation. A grid is superimposed on each county, with a 5-minute by 5-minute spacing based on latitude and longitude. The second pair of letters in the identifier refers to the 5-minute quadrangle in which the well or spring is located; the first of these, upper-case, identifies the tier (with A being northernmost) and the second identifies the column (with a being westernmost). The remaining numbers are the sequential numbers assigned to sites in that quadrangle. Thus, for example, well HO Bd 151 is the 151st site inventoried in the second tier from the north, fourth column from the west, in Howard County.

REFERENCES

Dine, J.R., Adamski, J.C., and Tompkins, M.D., 1992, Hydrologic data for Howard County, Maryland: Maryland Geological Survey, Basic Data Report No. 19, 240 p.

Hilleary, J.T., and Weigle, J.M., 1981, Carroll County ground-water information: Well records, spring records, and chemical-quality data: Maryland Geological Survey, Basic Data Report No. 12, 251 p.

EXPLANATION

1○ Water well and number

13⊕ Spring and number

SUPPLEMENTAL RECORDS OF WELLS IN THE SYKESVILLE QUADRANGLE

Well number	Well permit number	Owner	Driller	Date of construction	Altitude of land surface (ft)	Topographic setting	Depth drilled (ft)	Use of water	Geologic unit	Casing Depth (ft)	Casing Diameter (in)	Finish	Water level (ft)	Date measured	Yield (gpm)	Pumping test Drawdown (ft)	Specific capacity (gpm/ft)	Hours pumped	Date	Other data available	Well number
CL Ee 1	CL-00-1108	Howard Co Farmers Coop.	Edward Brown	03-14-1947	455	S	90	U	300SKVL	38	6	X	10	03-14-1947	25	22	1.14	10	03-14-1947	-	CL Ee 1
CL Ee 2	--	MD State Highway Admin.	--	--	370	V	97.6	H	300SKVL	--	--	X	14.82 M	08-29-1955	--	--	--	--	--	-	CL Ee 2
CL Ee 25	CL-61-5935	Manahan, Neimar	L F Easterday	07-30-1954	560	H	75	H	300MRGR	40	6	X	42	07-30-1954	6	8	1.00	--	07-30-1954	-	CL Ee 25
CL Ee 28	CL-66-0224	Patapsco Valley St. Pk.	John Wells	11-13-1965	550	H	168	U	300MRGR	32	6	X	46	11-12-1965	.5	--	--	--	11-14-1965	C,L	CL Ee 28
CL Ee 29	CL-66-0224	Patapsco Valley St. Pk.	John Wells	11-- 1965	500	H	114	U	300MRGR	30	6	X	45	11-- 1965	--	--	--	--	11-- 1965	-	CL Ee 29
CL Ee 30	CL-66-0224	Patapsco Valley St. Pk.	John Wells	12-02-1965	480	H	159	U	300MRGR	59.6	6	X	43.70 M	12-02-1965	3	100	.02	8	12-02-1965	C,L	CL Ee 30
CL Ee 58	CL-67-0348	Kipke, Richard	W Edmondson	12-14-1966	480	S	57	H	300SKVL	57	6	X	17	12-14-1966	14	37	1.50	1	12-14-1966	-	CL Ee 58
CL Ee 62	CL-67-0523	Spates, James Jr	L F Easterday	04-07-1968	535	H	160	H	300MRGR	55	6	X	30	04-07-1968	1	130	.01	.5	04-07-1968	-	CL Ee 62
CL Ee 66	CL-72-0626	Foster, Bernard T	H Edmondson	07-28-1972	580	H	80	H	300MRGR	70	6	X	40	07-28-1972	8	5	1.60	1	07-28-1972	-	CL Ee 66
CL Ee 79	CL-68-0020	Pfeiffer, H Theodore	L F Easterday	08-22-1967	580	H	200	H	300MRGR	50	6	X	40	08-22-1967	1	160	.01	.5	08-22-1967	-	CL Ee 79
CL Ee 80	CL-73-0755	Burns, Leonard	Joseph Mayne	04-21-1973	540	H	180	H	300SKVL	40	6	X	60	04-21-1973	10	120	.08	2	04-21-1973	-	CL Ee 80
CL Ee 82	CL-70-0292	Johnson, Wesley L	Harry Green	04-07-1971	540	H	105	H	300SKVL	55.5	6	X	35	04-01-1971	10	65	.15	3	04-07-1971	-	CL Ee 82
CL Ee 84	CL-70-0239	Carpenter, Robert	L F Easterday	04-01-1970	500	H	99	H	300MRGR	60	6	X	30	04-01-1970	20	50	.40	1	04-01-1970	-	CL Ee 84
CL Ee 85	CL-73-2681	Seever, Lacy M	C A Criswell	01-22-1974	600	H	200	H	300MRGR	40	6	X	40	01-22-1974	3	105	.03	2	01-22-1974	-	CL Ee 85
CL Ee 86	CL-73-4167	[illegible]	R Dillon	04-24-1977	560	S	150	H	300MRGR	40	6	X	36	04-24-1977	15	20	.75	6	04-24-1977	-	CL Ee 86
CL Ee 90	--	Boller, Wilbur	J Edmondson	04 -- 1957	435	S	50	H	300SKVL	--	--	--	--	--	--	--	--	--	--	-	CL Ee 90
CL Ee 92	CL-03-4443	Volkert, Howard H	J Edmondson	05-05-1959	465	S	60	H	300MRGR	20	6	X	35	05-05-1959	12	4	2.40	1	05-05-1959	-	CL Ee 92
CL Ee 93	CL-03-0618	Strickland, Benjamin C	J Edmondson	05-02-1958	550	S	56	U	300SKVL	35	6	X	35	05-02-1958	12	8	1.50	1	05-02-1958	-	CL Ee 93
CL Ee 94	CL-03-0356	Watkins, Robert	Robert Stern	06-03-1958	480	S	76	H	300SKVL	40	6	X	26	06-03-1958	10	10	1.00	.5	06-03-1958	-	CL Ee 94
CL Ee 95	--	Franklin	Dewey Brown	1958	575	S	91	U	300MRGR	60	6	--	--	--	--	--	--	--	1958	-	CL Ee 95
CL Ee 96	CL-03-2685	Wimmer, Wilbur	Dewey Brown	11-01-1958	535	S	65	U	300SKVL	45	6	X	40	11-01-1958	10	10	1.00	.5	11-01-1958	-	CL Ee 96
CL Ee 97	CL-03-5858	Haines, Claude E	C Edmondson	08-18-1959	455	S	61	U	300SKVL	41	6	X	40	08-18-1959	6	5	1.40	4	08-18-1959	-	CL Ee 97
CL Ee 98	CL-03-4920	Rogers, Coman H	E E Thompson	06-08-1959	520	S	95	H	300MRGR	57	6	X	40	06-08-1959	15	--	--	--	06-08-1959	-	CL Ee 98
CL Ee 99	CL-65-0347	Stony Ridge Baptist Ch.	Westminster	03-10-1965	520	S	112	H	300MRGR	50	6	X	41	03-10-1965	5	64	.08	2	03-15-1965	-	CL Ee 99
CL Ee 103	CL-03-1007	Schneider, William	J Edmondson	06-22-1961	460	S	84	H	300MRGR	50	6	X	30	06-22-1961	5	10	.80	1	06-22-1961	-	CL Ee 103
CL Ee 104	CL-04-1118	Ford, Thomas M	Dewey Brown	01-05-1961	530	S	73	U	300SKVL	22	--	X	45	01-05-1961	10	--	--	--	01-05-1961	-	CL Ee 104
CL Ee 106	CL-04-1122	Schneider, William	J Edmondson	11-03-1961	555	S	90	H	300MRGR	35	6	X	40	11-03-1961	--	--	--	--	--	-	CL Ee 106
CL Ee 108	CL-03-1992	Rae, Melville C	Dewey Brown	09-02-1958	540	S	96	U	300SKVL	35	6	X	50	09-02-1958	4	30	.13	.5	09-02-1958	-	CL Ee 108
CL Ee 109	--	Jaeger, George	A Edmondson	04 -- 1960	555	S	70	H	300SKVL	35	6	X	30	04 -- 1960	10	--	--	--	04 -- 1960	-	CL Ee 109
CL Ee 113	CL-73-2328	Carroll Co Sanit Comm	G E Harr Sons	09-26-1974	410	V	250	H	300MRGR	20	6	X	8	09-26-1974	12	84	.14	24	09-26-1974	-	CL Ee 113
CL Ee 119	CL-04-3487	Spencer, Webster	Edward Brown	07-05-1961	400	S	80	H,S	300SKVL	20 / 32	8 / 6	X	36	07-05-1961	12	--	--	1	07-05-1961	-	CL Ee 119
CL Ee 145	CL-66-0184	Keefer, John	W Barnes	10-28-1965	600	H	--	P	300MRGR	--	--	-	33.06 M	08-11-1983	--	--	--	--	--	-	CL Ee 145
CL Ee 146	CL-81-5250	Duffy, James J	W W Reichart	01-20-1988	505	S	125	H	300SKVL	20	6	X	50	01-20-1988	9	7	1.29	4	01-20-1988	-	CL Ee 146
CL Ef 13	CL-02-2055	Patapsco Valley St. Pk.	G E Harr Sons	02-24-1956	485	H	178	H	400BLMR	56.8	6	X	58	02-24-1956	4	87	.05	8	02-24-1956	-	CL Ef 13
CL Ef 14	--	Patapsco Valley St. Pk.	L P Shultz	--	485	H	95	U	400BLMR	--	6	X	--	--	12	--	--	--	--	-	CL Ef 14
CL Ef 15	CL-66-0245	Westinghouse Corp.	G E Harr Sons	10-26-1965	660	H	178.5	H	300LCRV	23.5	6	X	90	10-27-1965	10	120	.08	24	10-26-1965	C,L	CL Ef 15
CL Ef 24	CL-03-8536	Patapsco Valley St. Pk.	G E Harr Sons	05-05-1960	400	W	200	H	400BLMR	34.1	6	X	20	05-05-1960	15	45	.33	24	05-05-1960	-	CL Ef 24
CL Ef 31	CL-67-0595	Kitchen, Clarence E	J Edmondson	08-05-1968	555	H	120	H	300SKVL	60	6	X	70	08-05-1968	10		--	1	08-05-1968	-	CL Ef 31
CL Ef 37	CL-73-1770	Brooks, Ross E	Tri County	01-07-1973	490	H	100	H	300LCRV	38	6	X	35	01-07-1973	7	35	.20	6	01-07-1973	-	CL Ef 37
CL Ef 42	CL-73-0546	Hurd, Harmie	G E Harr Sons	01-04-1973	440	S	300	H	300LCRV	24	6	X	-1	01-04-1973	.5	--	--	4	01-04-1973	-	CL Ef 42
CL Ef 43	CL-65-0025	Hadel, William E	J Edmondson	11-17-1964	480	S	110	H	300LCRV	44	6	X	20	11-17-1964	8	10	.80	1	11-17-1964	-	CL Ef 43
HO Bd 411	HO-81-0511	Wright, Danny	Westminster	04-26-1984	560	S	103	H	300STRS	85	6	F	30	04-26-1984	15	27	.56	3	04-26-1984	-	HO Bd 411
HO Bd 412	HO-81-1430	Palencar, Mike	G E Harr Sons	05-06-1986	562	S	300	H	400BLMR	60	6	X	28	05-06-1986	1.4	252	.006	6	05-06-1986	-	HO Bd 412
HO Bd 413	HO-81-1430	Palencar, Mike	G E Harr Sons	05-06-1986	562	S	300	H	400BLMR	--	--	-	dry	05-06-1986	0	--	.000	--	05-06-1986	-	HO Bd 413
HO Bd 414	HO-81-1430	Palencar, Mike	G E Harr Sons	05-06-1986	562	S	100	H	400BLMR	--	--	-	dry	05-06-1986	0	--	.000	--	05-06-1986	-	HO Bd 414
HO Bd 415	HO-81-1454	Douglas, Mark	L F Easterday	05-28-1986	565	S	280	H	L-O	52	6	X	31	05-28-1986	5	51	.10	3	05-28-1986	-	HO Bd 415
HO Bd 416	HO-73-3474	Howard County DPW	Frank's Well	11-15-1979	543	S	20	L	OVERBDN	15	4	G	6.3	11-15-1979	.5	8.7	.06	1	11-15-1979	-	HO Bd 416
HO Bd 417	HO-73-3475	Howard County DPW	Frank's Well	11-15-1979	584	S	17	L	OVERBDN	12	4	G	9.9	11-15-1979	1	4.1	.24	1	11-15-1979	-	HO Bd 417
HO Bd 418	HO-81-0015	Howard County DPW	Atec Assoc.	12-02-1982	590	S	28	L	--	18	4	G	5.4	12-02-1982	--	--	--	--	--		HO Bd 418
HO Bd 419	HO-73-3476	Howard County DPW	Frank's Well	11-15-1979	582	W	17	L	OVERBDN	12	4	G	8	11-15-1979	1	4	.25	1	11-15-1979	-	HO Bd 419
HO Bd 420	HO-81-0016	Howard County DPW	Atec Assoc.	11-30-1982	581	W	27	L	--	17	4	G	15	11-30-1982	--	--	--	--	--		HO Bd 420
HO Bd 421	HO-73-3467	Howard County DPW	Frank's Well	11-15-1979	542	W	17	L	OVERBDN	12	4	G	6	11-15-1979	1	8	.13	1	11-15-1979	-	HO Bd 421
HO Bd 422	HO-81-0744	Howard County DPW	L F Easterday	02-06-1985	522	W	17	L	OVERBDN	7	4	G	--	--	--	--	--	--	--		HO Bd 422
HO Bd 423	HO-81-0017	Howard County DPW	Atec Assoc.	11-30-1982	573	S	20	L	--	10	4	G	12	11-30-1982	--	--	--	--	--		HO Bd 423
HO Bd 424	HO-88-2127	Howard County DPW	G E Harr Sons	08-26-1992	585	S	77	L	L-O	60	8,4	G	--	--	1	--	--	1	08-26-1992		HO Bd 424
HO Be 141	HO-73-3468	Howard County DPW	Frank's Well	11-15-1979	523	C	22	L	OVERBDN	17	4	G	dry	11-15-1979	0	--	.000	--	11-15-1979		HO Be 141
HO Be 142	HO-73-3468	Howard County DPW	Frank's Well	11-15-1979	523	C	17	L	OVERBDN	7	4	G	4	11-15-1979	1	1	1.00	10	11-15-1979		HO Be 142
HO Be 143	HO-81-0018	Howard County DPW	Atec Assoc.	12-02-1982	523	C	21	L	--	11	4	G	5	12-02-1982	--	--	--	--	--		HO Be 143
HO Be 144	HO-73-3469	Howard County DPW	Frank's Well	11-15-1979	523	S	23	L	OVERBDN	18	4	G	7.6	11-15-1979	1	10.4	.10	1	11-15-1979		HO Be 144
HO Be 145	HO-73-3470	Howard County DPW	Frank's Well	11-15-1979	501	S	21	L	OVERBDN	16	4	G	4	11-15-1979	1	4	.25	1	11-15-1979		HO Be 145
HO Be 146	HO-73-3471	Howard County DPW	Frank's Well	11-15-1979	547	S	24	L	OVERBDN	19	4	G	18.4	11-15-1979	1	3.6	.28	1	11-15-1979		HO Be 146
HO Be 147	HO-81-0743	Howard County DPW	L F Easterday	02-06-1985	550	S	40.5	L	OVERBDN	30	4	G	--	--	--	--	--	--	--		HO Be 147
HO Be 148	HO-73-3472	Howard County DPW	Frank's Wall	11-15-1979	522	S	20	L	OVERBDN	15	4	G	8.3	11-15-1979	1.5	7.7	.19	1	11-15-1979		HO Be 148
HO Be 149	HO-73-3473	Howard County DPW	Frank's Well	11-15-1979	495	S	16	L	OVERBDN	11	4	G	10	11-15-1979	.5	4	.13	1	11-15-1979		HO Be 149
HO Be 150	HO-73-3560	Howard County DPW	Frank's Well	02-27-1980	533	S	25	L	OVERBDN	15	4	G	18	02-27-1980	1	7	.14	1	02-27-1980		HO Be 150
HO Be 151	HO-81-0019	Howard County DPW	Atec Assoc.	12-03-1982	536	S	38	L	--	28	4	G	30	12-03-1982	--	--	--	--	--		HO Be 151

SUPPLEMENTAL RECORDS OF SPRINGS IN THE SYKESVILLE QUADRANGLE

Spring number	Owner	Altitude of land surface (ft)	Topographic setting	Use of water	Geologic unit	Discharge (gpm)	Date discharge measured	Improvements	Other data available
CL Ef 50	Patapsco Valley State Park	430	S	U	300LCRV	2	03-24-1981	G	Z

EXPLANATION OF CODES

Topographic setting
- C Channel
- H Hilltop
- S Hillside
- V Valley
- W Draw

Use of water
- H Domestic
- L Monitoring
- P Public supply
- S Stock
- U Unused

Finish
- F Gravel filled
- G Gravel-packed screen
- X Open hole

Water level
- M Measured

Geologic unit
- OVERBDN Surficial material which may include alluvium, colluvium, saprolite, and artificial fill
- 300MRGR Morgan Run Formation
- 300SKVL Sykesville Formation
- L-O Loch Raven Schist—Oella Formation, undifferentiated
- 300LCRV Loch Raven Schist
- 300STRS Setters Formation
- 400BLMR Baltimore Gneiss

Improvements
- G Gallery

Other data available
- C Drill cuttings
- L Geophysical logs
- Z Additional data published in Md. Geol. Survey Rept. of Investigations No. 42.

MAP 2. LOCATIONS OF WELLS AND SPRINGS

Maryland Geological Survey

Quadrangle Atlas No. 24

Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

1993

Prepared in cooperation with the
Howard County Department of Public Works

DEPTH TO THE WATER TABLE

By Mark T. Duigon

EXPLANATION

This map shows the depth from land surface to the water table. It is generalized, showing three depth zones where the water table, on average, may be encountered. Water-level data were obtained mostly from completion reports submitted by drillers, and were supplemented by soil survey information (Matthews and Hershberger, 1968; Matthews, 1969), topographic analysis, and observation of springs, swamps, and other natural features. Water-level data from completion reports and from monitoring programs have been compiled by Dine *et al.* (1992). Statistical analysis of water-level data from long-term observation wells in Howard County indicate that extreme water levels occurred most commonly during January (highest levels) and May—June (lowest levels); consequently, water levels measured during these months were excluded from the set used to construct this map.

Ground-water levels undergo long-term fluctuations (fig. 1) in response to year-to-year climatic variation, as well as seasonal fluctuations (fig. 2). The water level in well HO Bd 1, seen in figure 1, varied between a depth of about 28 feet below land surface to about 47 feet during the period 1946-92; half of the time the water was at a depth of approximately 39 feet (fig. 3). Precipitation information at Woodstock provided in figures 1 and 2 was obtained from the U.S. Weather Bureau (subsequently an agency within the Environmental Science Services Administration, or ESSA, and the National Oceanic and Atmospheric Administration, or NOAA).

The water table is the surface of the zone of saturation where ground water is not confined by an overlying impermeable zone. This surface has a configuration similar to that of the land surface, although its relief is less. Because of this similarity, the shallowest zone shown on the map generally follows the drainage network and the deepest zone generally occurs beneath hills and interfluves. Certain soils contain low-permeability layers that can impede the downward percolation of water (such as rainfall infiltrating during a storm), thereby allowing an additional zone of saturation to grow, perched above the impermeable zone. These perched zones are generally shallow and of limited extent; they are not indicated on this map. Local areas where the water table is temporarily depressed because of pumping are likewise not indicated.

REFERENCES

Dine, J. R., Adamski, J. C., and Tompkins, M. D., 1992, Hydrologic data for Howard County, Maryland: Maryland Geological Survey, Basic Data Report No. 19, 240 p.

Matthews, E.D., 1969, Soil survey of Carroll County, Maryland: U.S. Department of Agriculture, Soil Conservation Service, 92 p.

Matthews, E.D., and Hershberger, M.F., 1968, Soil survey of Howard County, Maryland: U.S. Department of Agriculture, Soil Conservation Service, 104 p.

U.S. Environmental Science and Services Administration, 1965-69, Climatological data annual summary (published annually).

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U.S. Weather Bureau, 1946-64, Climatological data annual summary (published annually).

APPROXIMATE DEPTH TO WATER TABLE FEET BELOW LAND SURFACE

Less than 10 feet — 10 to 35 feet — Greater than 35 feet

HO Bd 1 ○ Observation well and number

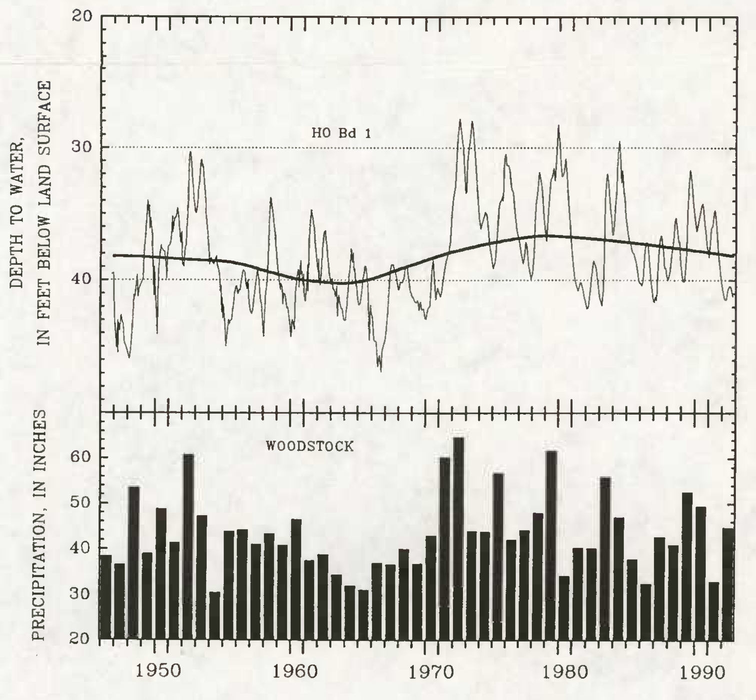


Figure 1.—Water-level fluctuations in well HO Bd 1 during the period 1946-92. Precipitation measured at Woodstock (Weather Bureau, ESSA, and NOAA).

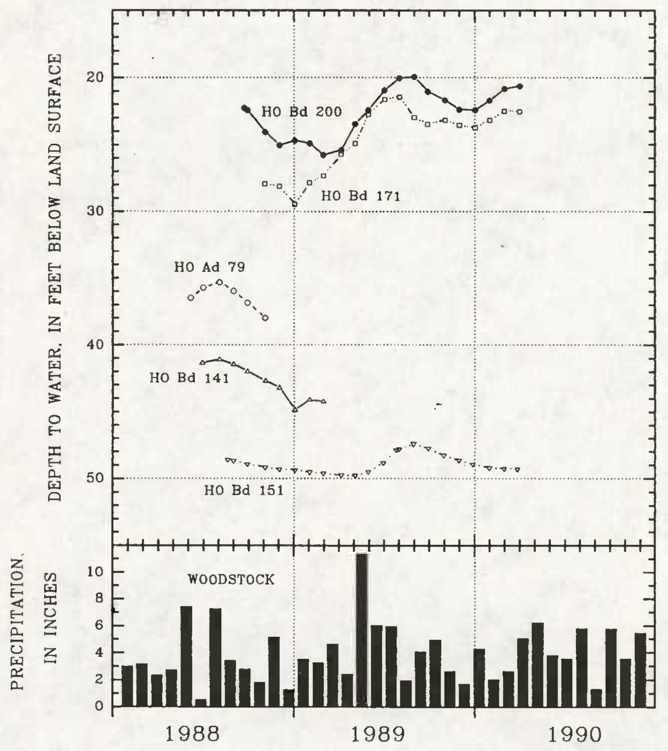


Figure 2.—Seasonal water-level fluctuations measured in five observation wells. Precipitation measured at Woodstock (Weather Bureau, ESSA, and NOAA).

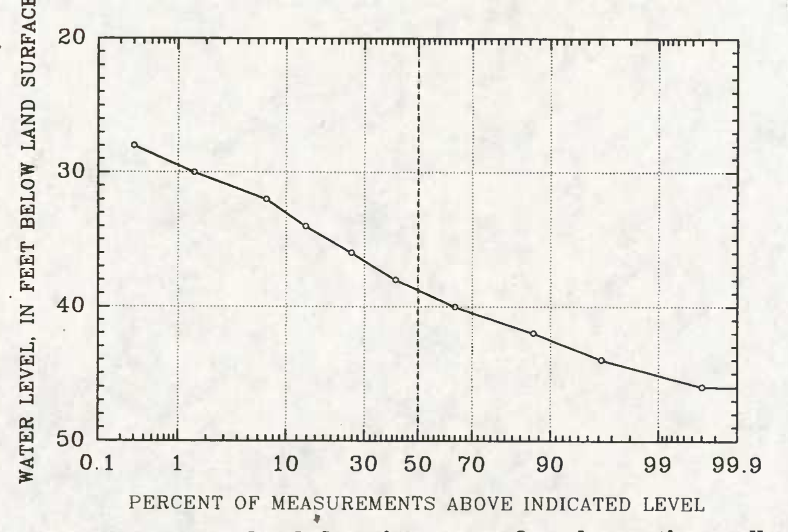


Figure 3.—Water-level duration curve for observation well HO Bd 1, based on the period 1946-92.

MAP 3. DEPTH TO THE WATER TABLE

Maryland Geological Survey — Quadrangle Atlas No. 24

Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

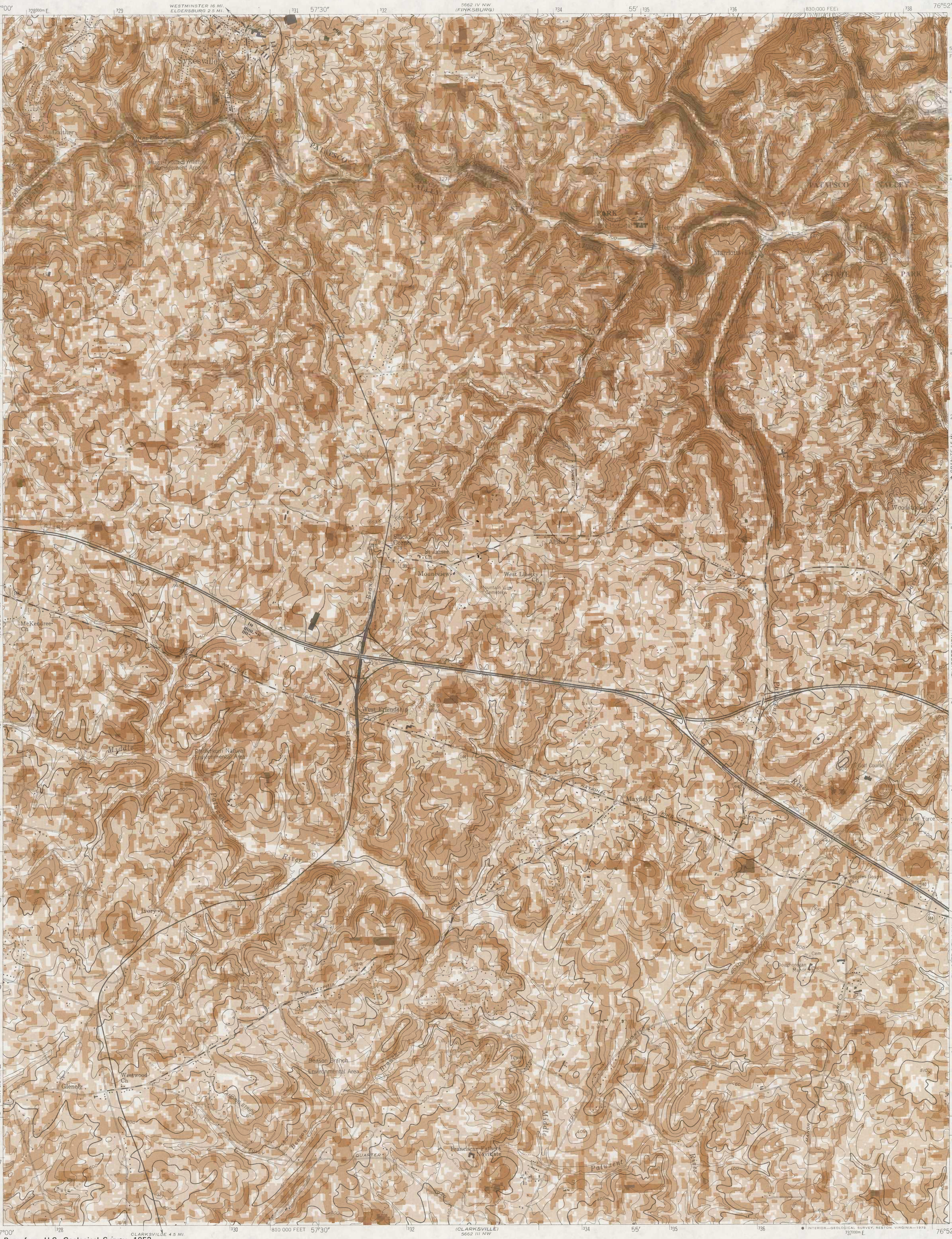
QUADRANGLE LOCATION

1994

Prepared in cooperation with the Howard County Department of Public Works

Maryland Geological Survey Quadrangle Atlas No. 24

MAP 1. SLOPE OF THE LAND SURFACE



Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

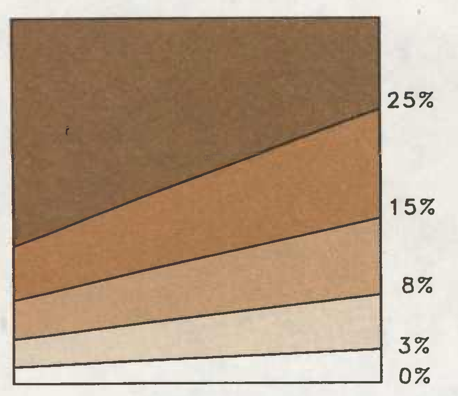
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

Prepared by Daft-McCune-Walker, Inc., Towson, Maryland using Digital Elevation Models produced by the United States Geological Survey.

EXPLANATION

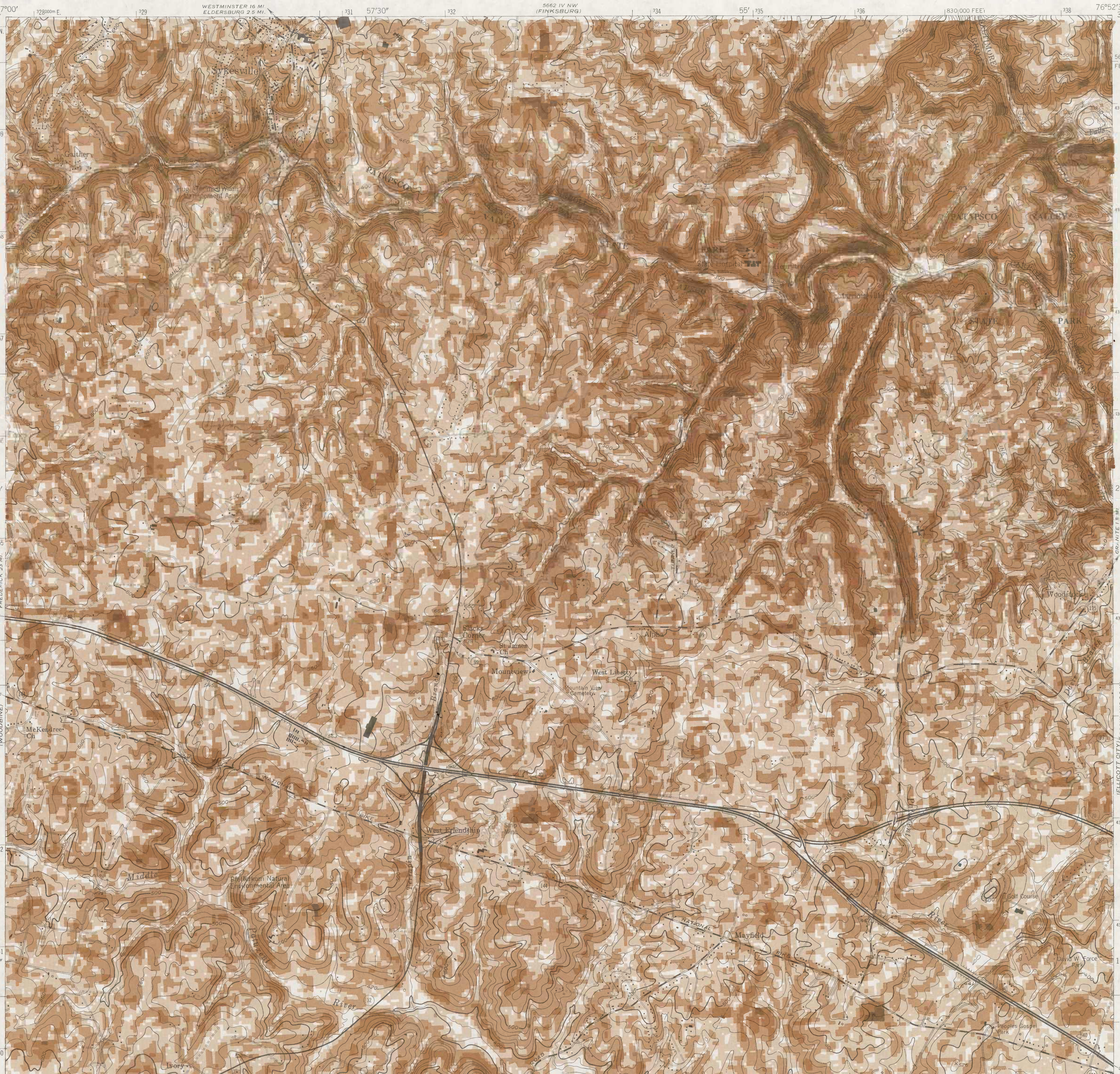
This map shows the slope of the land surface of the Sykesville quadrangle. The slopes are grouped into five categories. The map was prepared using ARC-INFO, a Geographic Information System product of Environmental Systems Research Institute, Inc. (trade names are used here for information only) and a Digital Elevation Model (DEM) of the Sykesville 7.5-minute quadrangle obtained from the U.S. Geological Survey. The DEM consists of elevation data arranged in a square grid having a 30-meter (approximately 98 feet) spacing. The square grid results in a checkerboard or jagged appearance when detailed areas are examined; the smallest area shown is about one-quarter acre.



1993

Prepared in cooperation with the
Howard County Department of Public Works

MAP 1. SLOPE OF THE LAND SURFACE



Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Prepared by Daft-McCune-Walker, Inc., Towson, Maryland using Digital Elevation Models produced by the United States Geological Survey.

EXPLANATION

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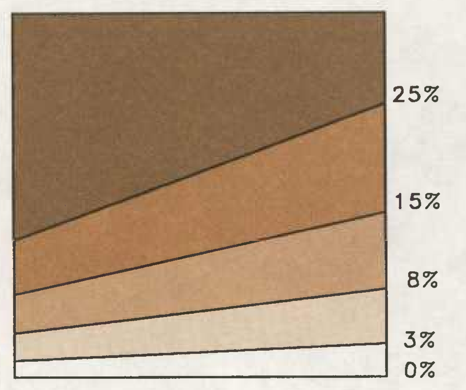
MARYLAND
QUADRANGLE LOCATION

1993

Prepared in cooperation with the Howard County Department of Public Works



LOCATIONS OF WELLS AND SPRINGS

By Michael D. Tompkins
and
Mark T. Duigon

Records of wells and springs inventoried in Howard County over the years were recently compiled and placed into a computer data base (Dine et al., 1992). Additional wells in the vicinity of Alpha were inventoried and data describing them are tabulated herein. Locations of wells and springs in the northern part of the quadrangle, in Carroll County (Hilleary and Weigle, 1981), were verified and the inventory supplemented; information for these wells was added to the data base and is also presented. The data base, known as the Ground-Water Site Inventory (GWSI) is operated by the U.S. Geological Survey and is part of a national hydrologic data base, the National Water Data Storage and Retrieval System (WATSTORE). Within WATSTORE, site-location, water-quality, and daily water-level-measurement data are related and indexed.

The State of Maryland has required a permit for drilling water wells since 1945. The permit requires that the driller furnish construction and yield information for each well completed. Wells drilled since 1973 have attached metal tags stamped with the permit numbers, which facilitates matching up completion reports and wells. These numbers are included in the well tables.

Wells and springs are identified using a State-wide numbering system. The first pair of letters of an identifying number is the county abbreviation. A grid is superimposed on each county, with a 5-minute by 5-minute spacing based on latitude and longitude. The second pair of letters in the identifier refers to the 5-minute quadrangle in which the well or spring is located; the first of these, upper-case, identifies the tier (with A being northernmost) and the second identifies the column (with a being westernmost). The remaining numbers are the sequential numbers assigned to sites in that quadrangle. Thus, for example, well HO Bd 151 is the 151st site inventoried in the second tier from the north, fourth column from the west, in Howard County.

REFERENCES

Dine, J.R., Adamski, J.C., and Tompkins, M.D., 1992, Hydrologic data for Howard County, Maryland: Maryland Geological Survey, Basic Data Report No. 19, 240 p.

Hilleary, J.T., and Weigle, J.M., 1981, Carroll County ground-water information: Well records, spring records, and chemical-quality data: Maryland Geological Survey, Basic Data Report No. 12, 251 p.

EXPLANATION

14○ Water well and number

13○~ Spring and number

SUPPLEMENTAL RECORDS OF WELLS IN THE SYKESVILLE QUADRANGLE

Well number	Well permit number	Owner	Driller	Date of construction	Altitude of land surface (ft)	Topo-graphic setting	Depth drilled (ft)	Use of water	Geologic unit	Casing Depth (ft)	Casing Diameter (in)	Fin-ish	Water level (ft)	Date measured	Yield (gpm)	Pumping test Drawdown (ft)	Specific capacity (gpm/ft)	Hours pumped	Date	Other data avail-able	Well number
CL Ee 1	CL-00-1108	Howard Co Farmers Coop.	Edward Brown	03-14-1947	455	S	90	U	300SKVL	38	6	X	10	03-14-1947	25	22	1.14	10	03-14-1947	-	CL Ee 1
CL Ee 2	--	MD State Highway Admin.	--	--	370	V	97.8	U	300SKVL	--	6	-	14.82 M	08-29-1955	--	--	--	--	--	-	CL Ee 2
CL Ee 25	CL-01-5935	Manahan, Herman	L F Easterday	07-30-1954	560	H	75	H	300SKVL	40	6	X	42	07-30-1954	8	8	1.00	--	07-30-1954	-	CL Ee 25
CL Ee 28	CL-66-0224	Patapsco Valley St. Pk.	John Wells	11-12-1965	550	H	168	U	300MRGR	--	--	X	45	11-12-1965	.5	--	--	--	11-24-1965	C,L	CL Ee 28
CL Ee 29	CL-66-0224	Patapsco Valley St. Pk.	John Wells	11 -- 1965	550	H	114	U	300MRGR	--	--	X	45	11 -- 1965	1	--	--	--	11 -- 1965	-	CL Ee 29
CL Ee 30	CL-66-0224	Patapsco Valley St. Pk.	John Wells	12-02-1965	550	H	159	U	300MRGR	59.6	6	X	42.70 M	12-09-1965	2	100	.02	8	12-02-1965	C,L	CL Ee 30
CL Ee 58	CL-67-0348	Kipke, Richard	W Edmondson	12-14-1966	480	S	90	H	300SKVL	57	6	X	47	12-14-1966	14	4	3.50	1	12-14-1966	-	CL Ee 58
CL Ee 62	CL-67-0533	Spates, James Jr	L F Easterday	06-07-1968	535	H	160	H	300SKVL	55	6	X	30	06-07-1968	1	130	.01	.5	06-07-1968	-	CL Ee 62
CL Ee 66	CL-72-0626	Feezer, Bernard T	H Edmondson	07-29-1972	580	S	80	H	300MRGR	70	6	X	40	07-29-1972	8	5	1.60	2	07-29-1972	-	CL Ee 66
CL Ee 79	CL-68-0020	Pfeiffer, H Theodore	L F Easterday	08-22-1967	580	H	200	H	300MRGR	50	6	X	40	08-22-1967	1	160	.01	.5	08-22-1967	-	CL Ee 79
CL Ee 80	CL-73-0755	Burns, Leonard	Joseph Mayne	04-21-1973	540	H	180	H	300SKVL	40	6	X	60	04-21-1973	10	120	.08	2	04-21-1973	-	CL Ee 80
CL Ee 82	CL-71-0292	Johnson, Wesley L	Harry Green	04-07-1971	540	H	105	H	300SKVL	55.5	6	X	35	04-07-1971	10	65	.15	3	04-07-1971	-	CL Ee 82
CL Ee 84	CL-70-0239	Carpenter, Robert	L F Easterday	04-01-1970	500	H	80	H	300MRGR	38	6	X	30	04-01-1970	20	50	.40	1	04-01-1970	-	CL Ee 84
CL Ee 85	CL-73-2681	Reaver, Lacy M	C A Cromwell	01-22-1974	600	H	200	H	300MRGR	42	6	X	40	01-22-1974	3	105	.03	2	01-22-1974	-	CL Ee 85
CL Ee 86	CL-73-6187	--	H Dillon	08-24-1977	500	S	150	H	300SKVL	40	6	X	30	08-24-1977	15	20	.75	6	08-24-1977	-	CL Ee 86
CL Ee 90	--	Boller, Wilbur	J Edmondson	04 -- 1957	435	S	50	H	300SKVL	--	6	X	--	--	--	--	--	--	--	-	CL Ee 90
CL Ee 92	CL-03-4443	Volkert, Howard M	J Edmondson	05-05-1959	485	S	--	H	300MRGR	20	6	X	30	05-05-1959	12	5	2.40	1	05-05-1959	-	CL Ee 92
CL Ee 93	CL-03-0618	Strickland, Benjamin C	C Edmondson	05-02-1958	550	S	56	U	300SKVL	35	6	X	35	05-02-1958	12	4	3.00	1	05-02-1958	-	CL Ee 93
CL Ee 94	CL-03-0356	Watkins, Robert	Robert Stern	06-03-1958	490	S	76	H	300SKVL	44	6	X	50	06-03-1958	10	10	1.00	.5	06-03-1958	-	CL Ee 94
CL Ee 95	--	Franklin	Dewey Brown	1958	575	S	91	U	300SKVL	60	6	X	--	--	6	--	--	.5	-- 1958	-	CL Ee 95
CL Ee 96	CL-03-2685	Wimmer, Wilbur	Dewey Brown	11-01-1958	535	S	65	U	300SKVL	45	6	X	40	11-01-1958	10	10	1.00	.5	11-01-1958	-	CL Ee 96
CL Ee 97	CL-03-5858	Haines, Claude E	C Edmondson	08-18-1959	455	S	63	U	300SKVL	--	6	X	45	08-18-1959	8	5	1.60	4	08-18-1959	-	CL Ee 97
CL Ee 98	CL-03-4920	Rogers, Coman H	R E Thompson	06-08-1959	620	S	79	H	300MRGR	57	6	X	45	06-08-1959	15	--	--	2	06-08-1959	-	CL Ee 98
CL Ee 99	CL-65-0347	Stony Ridge Baptist Ch.	Westminster	03-10-1965	420	S	112	H	300MRGR	52	6	X	41	03-10-1965	5	64	.08	2	03-10-1965	-	CL Ee 99
CL Ee 103	CL-04-3368	Schneider, William	J Edmondson	06-28-1961	545	S	84	H	300MRGR	50	6	X	30	06-28-1961	8	10	.80	1	06-28-1961	-	CL Ee 103
CL Ee 104	CL-04-1118	Ford, Thomas H	Dewey Brown	01-05-1961	530	S	73	U	300SKVL	22	--	X	45	01-05-1961	5	10	.50	.5	01-05-1961	-	CL Ee 104
CL Ee 106	CL-04-5122	Schneider, William	J Edmondson	11-03-1961	555	S	90	H	300MRGR	35	6	X	40	11-03-1961	--	--	--	--	--	-	CL Ee 106
CL Ee 108	CL-03-1992	Rae, Melville C	Dewey Brown	09-02-1958	540	S	96	U	300SKVL	80	--	X	50	09-02-1958	4	30	.13	.5	09-02-1958	-	CL Ee 108
CL Ee 109	--	Jaeger, George	A Edmondson	04 -- 1960	555	S	42	H	300SKVL	35	6	X	20	04 -- 1960	10	--	--	1	04 -- 1960	-	CL Ee 109
CL Ee 113	CL-73-2328	Carroll Co Sanit Comm	G E Harr Sons	09-26-1974	410	V	250	H	300MRGR	20	6	X	8	09-26-1974	12	84	.14	24	09-26-1974	-	CL Ee 113
CL Ee 119	CL-04-3487	Spencer, Webster	Edward Brown	07-05-1961	400	S	80	H,S	300SKVL	20 32	8 6	X	36	07-05-1961	12	--	--	1	07-05-1961	-	CL Ee 119
CL Ee 145	CL-66-0184	Keefer, John	W Barnes	10-28-1965	600	H	--	P	300MRGR	--	--	-	33.06 M	08-11-1983	--	--	--	--	--	-	CL Ee 145
CL Ee 146	CL-81-5250	Duffy, James J	W W Reichart	01-20-1988	505	S	125	H	300SKVL	20	6	X	50	01-20-1988	9	7	1.29	4	01-20-1988	-	CL Ee 146
CL Ef 13	CL-02-2055	Patapsco Valley St. Pk.	G E Harr Sons	02-24-1956	485	H	178	H	400BLMR	56.8	6	X	58	02-24-1956	4	87	.05	8	02-24-1956	-	CL Ef 13
CL Ef 14	--	Patapsco Valley St. Pk.	L P Shultz	--	485	H	95	U	400BLMR	--	6	X	--	--	12	--	--	--	--	-	CL Ef 14
CL Ef 15	CL-66-0245	Westinghouse Corp.	G E Harr Sons	10-26-1965	660	H	178.5	H	300LCRV	23.5	6	X	90	10-27-1965	10	120	.08	24	10-26-1965	C,L	CL Ef 15
CL Ef 24	CL-03-8536	Patapsco Valley St. Pk.	G E Harr Sons	05-05-1960	400	W	200	H	400BLMR	34.1	6	X	20	05-05-1960	15	45	.33	24	05-05-1960	-	CL Ef 24
CL Ef 31	CL-67-0595	Kitchen, Clarence E	J Edmondson	08-05-1968	555	H	120	H	300SKVL	60	6	X	70	08-05-1968	10	--	--	1	08-05-1968	-	CL Ef 31
CL Ef 37	CL-73-1770	Brooks, Ross E	Tri County	01-07-1973	490	H	100	H	300LCRV	38	6	X	35	01-07-1973	7	35	.20	6	01-07-1973	-	CL Ef 37
CL Ef 42	CL-73-0546	Hurd, Harmie	G E Harr Sons	01-04-1973	440	S	300	H	300LCRV	24	6	X	-1	01-04-1973	.5	--	--	4	01-04-1973	-	CL Ef 42
CL Ef 43	CL-65-0025	Hadel, William E	J Edmondson	11-17-1964	480	S	110	H	300LCRV	44	6	X	20	11-17-1964	8	10	.80	1	11-17-1964	-	CL Ef 43
HO Bd 411	HO-81-0511	Wright, Danny	Westminster	04-26-1984	560	S	103	H	300STRS	85	6	F	30	04-26-1984	15	27	.56	3	04-26-1984	-	HO Bd 411
HO Bd 412	HO-81-1430	Palencar, Mike	G E Harr Sons	05-06-1986	562	S	300	H	400BLMR	60	6	X	28	05-06-1986	1.4	252	.006	6	05-06-1986	-	HO Bd 412
HO Bd 413	HO-81-1430	Palencar, Mike	G E Harr Sons	05-06-1986	562	S	300	H	400BLMR	--	--	-	dry	05-06-1986	0	--	.000	--	05-06-1986	-	HO Bd 413
HO Bd 414	HO-81-1430	Palencar, Mike	G E Harr Sons	05-06-1986	562	S	100	H	400BLMR	--	--	-	dry	05-06-1986	0	--	.000	--	05-06-1986	-	HO Bd 414
HO Bd 415	HO-81-1454	Douglas, Mark	L F Easterday	05-28-1986	565	S	280	H	L-O	52	6	X	31	05-28-1986	5	51	.10	3	05-28-1986	-	HO Bd 415
HO Bd 416	HO-73-3474	Howard County DPW	Frank's Well	11-15-1979	543	S	20	L	OVERBDN	15	4	G	6.3	11-15-1979	.5	8.7	.06	1	11-15-1979	-	HO Bd 416
HO Bd 417	HO-73-3475	Howard County DPW	Frank's Well	11-15-1979	584	S	17	L	OVERBDN	12	4	G	9.9	11-15-1979	1	4.1	.24	1	11-15-1979	-	HO Bd 417
HO Bd 418	HO-81-0015	Howard County DPW	Atec Assoc.	12-02-1982	590	S	28	L	--	18	4	G	5.4	12-02-1982	--	--	--	--	--		HO Bd 418
HO Bd 419	HO-73-3476	Howard County DPW	Frank's Well	11-15-1979	582	W	17	L	OVERBDN	12	4	G	8	11-15-1979	1	4	.25	1	11-15-1979	-	HO Bd 419
HO Bd 420	HO-81-0016	Howard County DPW	Atec Assoc.	11-30-1982	581	W	27	L	--	17	4	G	15	11-30-1982	--	--	--	--	--		HO Bd 420
HO Bd 421	HO-73-3467	Howard County DPW	Frank's Well	11-15-1979	542	W	17	L	OVERBDN	12	4	G	6	11-15-1979	1	8	.13	1	11-15-1979	-	HO Bd 421
HO Bd 422	HO-81-0744	Howard County DPW	L F Easterday	02-06-1985	522	W	17	L	OVERBDN	7	4	G	--	--	--	--	--	--	--		HO Bd 422
HO Bd 423	HO-81-0017	Howard County DPW	Atec Assoc.	11-30-1982	573	S	20	L	--	10	4	G	12	11-30-1982	--	--	--	--	--		HO Bd 423
HO Bd 424	HO-88-2127	Howard County DPW	G E Harr Sons	08-26-1992	585	S	77	L	L-O	60	8,4	G	--	--	1	--	--	1	08-26-1992		HO Bd 424
HO Be 141	HO-73-3468	Howard County DPW	Frank's Well	11-15-1979	523	C	22	L	OVERBDN	17	4	G	dry	11-15-1979	0	--	.000	--	11-15-1979		HO Be 141
HO Be 142	HO-73-3468	Howard County DPW	Frank's Well	11-15-1979	523	C	17	L	OVERBDN	7	4	G	4	11-15-1979	1	1	1.00	10	11-15-1979		HO Be 142
HO Be 143	HO-81-0018	Howard County DPW	Atec Assoc.	12-02-1982	523	C	21	L	--	11	4	G	5	12-02-1982	--	--	--	--	--		HO Be 143
HO Be 144	HO-73-3469	Howard County DPW	Frank's Well	11-15-1979	523	S	23	L	OVERBDN	18	4	G	7.6	11-15-1979	1	10.4	.10	1	11-15-1979		HO Be 144
HO Be 145	HO-73-3470	Howard County DPW	Frank's Well	11-15-1979	501	S	21	L	OVERBDN	16	4	G	4	11-15-1979	1	4	.25	1	11-15-1979		HO Be 145
HO Be 146	HO-73-3471	Howard County DPW	Frank's Well	11-15-1979	547	S	24	L	OVERBDN	19	4	G	18.4	11-15-1979	1	3.6	.28	1	11-15-1979		HO Be 146
HO Be 147	HO-81-0743	Howard County DPW	L F Easterday	02-06-1985	550	S	40.5	L	OVERBDN	30	4	G	--	--	--	--	--	--	--		HO Be 147
HO Be 148	HO-73-3472	Howard County DPW	Frank's Well	11-15-1979	522	S	20	L	OVERBDN	15	4	G	8.3	11-15-1979	1.5	7.7	.19	1	11-15-1979		HO Be 148
HO Be 149	HO-73-3473	Howard County DPW	Frank's Well	11-15-1979	495	S	16	L	OVERBDN	11	4	G	10	11-15-1979	.5	4	.13	1	11-15-1979		HO Be 149
HO Be 150	HO-73-3560	Howard County DPW	Frank's Well	02-27-1980	533	S	25	L	OVERBDN	15	4	G	18	02-27-1980	1	7	.14	1	02-27-1980		HO Be 150
HO Be 151	HO-81-0019	Howard County DPW	Atec Assoc.	12-03-1982	536	S	38	L	--	28	4	G	30	12-03-1982	--	--	--	--	--		HO Be 151

SUPPLEMENTAL RECORDS OF SPRINGS IN THE SYKESVILLE QUADRANGLE

Spring number	Owner	Altitude of land surface (ft)	Topo-graphic setting	Use of water	Geologic unit	Discharge (gpm)	Date discharge measured	Im-prove-ments	Other data available
CL Ef 50	Patapsco Valley State Park	430	S	U	300LCRV	2	03-24-1981	G	Z

EXPLANATION OF CODES

Topographic setting
C Channel
H Hilltop
S Hillside
V Valley
W Draw

Use of water
H Domestic
L Monitoring
P Public supply
S Stock
U Unused

Finish
F Gravel filled
G Gravel-packed screen
X Open hole

Water Level
M Measured

Geologic unit
OVERBDN Surficial material which may include alluvium, colluvium, saprolite, and artificial fill
300MRGR Morgan Run Formation
300SKVL Sykesville Formation
L-O Loch Raven Schist-Oella Formation, undifferentiated
300LCRV Loch Raven Schist
300STRS Setters Formation
400BLMR Baltimore Gneiss

Improvements
G Gallery

Other data available
C Drill cuttings
L Geophysical logs
Z Additional data published in Md. Geol. Survey Rept. of Investigations No. 42.

MAP 2. LOCATIONS OF WELLS AND SPRINGS

Maryland Geological Survey
Quadrangle Atlas No. 24

Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

1993

Prepared in cooperation with the
Howard County Department of Public Works

DEPTH TO THE WATER TABLE

By Mark T. Duigon

EXPLANATION

This map shows the depth from land surface to the water table. It is generalized, showing three depth zones where the water table, on average, may be encountered. Water-level data were obtained mostly from completion reports submitted by drillers, and were supplemented by soil survey information (Matthews and Hershberger, 1968; Matthews, 1969), topographic analysis, and observation of springs, swamps, and other natural features. Water-level data from completion reports and from monitoring programs have been compiled by Dine *et al.* (1992). Statistical analysis of water-level data from long-term observation wells in Howard County indicate that extreme water levels occurred most commonly during January (highest levels) and May—June (lowest levels); consequently, water levels measured during these months were excluded from the set used to construct this map.

Ground-water levels undergo long-term fluctuations (fig. 1) in response to year-to-year climatic variation, as well as seasonal fluctuations (fig. 2). The water level in well HO Bd 1, seen in figure 1, varied between a depth of about 28 feet below land surface to about 47 feet during the period 1946-92; half of the time the water was at a depth of approximately 39 feet (fig. 3). Precipitation information at Woodstock provided in figures 1 and 2 was obtained from the U.S. Weather Bureau (subsequently an agency within the Environmental Science Services Administration, or ESSA, and the National Oceanic and Atmospheric Administration, or NOAA).

The water table is the surface of the zone of saturation where ground water is not confined by an overlying impermeable zone. This surface has a configuration similar to that of the land surface, although its relief is less. Because of this similarity, the shallowest zone shown on the map generally follows the drainage network and the deepest zone generally occurs beneath hills and interfluves. Certain soils contain low-permeability layers that can impede the downward percolation of water (such as rainfall infiltrating during a storm), thereby allowing an additional zone of saturation to grow, perched above the impermeable zone. These perched zones are generally shallow and of limited extent; they are not indicated on this map. Local areas where the water table is temporarily depressed because of pumping are likewise not indicated.

REFERENCES

Dine, J. R., Adamski, J. C., and Tompkins, M. D., 1992, Hydrologic data for Howard County, Maryland: Maryland Geological Survey, Basic Data Report No. 19, 240 p.

Matthews, E.D., 1969, Soil survey of Carroll County, Maryland: U.S. Department of Agriculture, Soil Conservation Service, 92 p.

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U.S. Weather Bureau, 1946-64, Climatological data annual summary (published annually).

APPROXIMATE DEPTH TO WATER TABLE FEET BELOW LAND SURFACE

Less than 10 feet | 10 to 35 feet | Greater than 35 feet

HO Bd 1 ○ Observation well and number

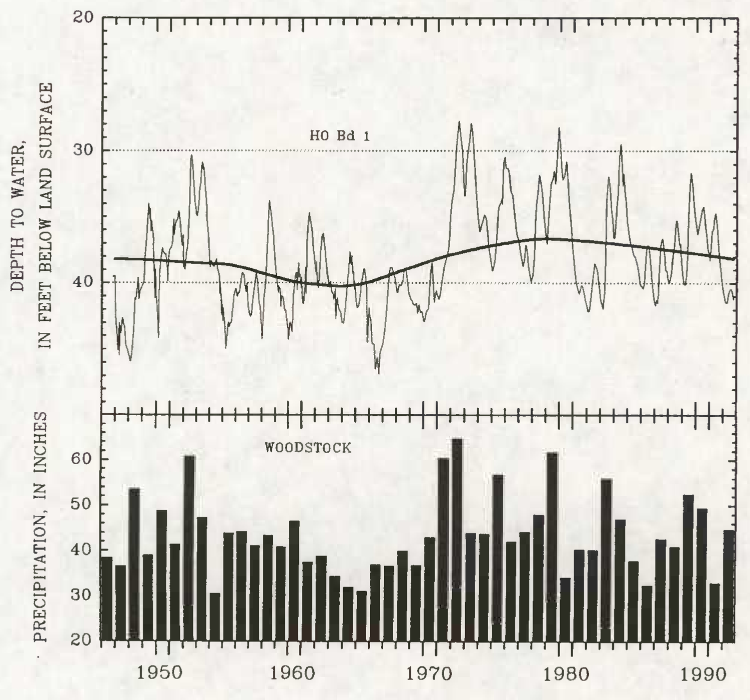


Figure 1.—Water-level fluctuations in well HO Bd 1 during the period 1946-92. Precipitation measured at Woodstock (Weather Bureau, ESSA, and NOAA).

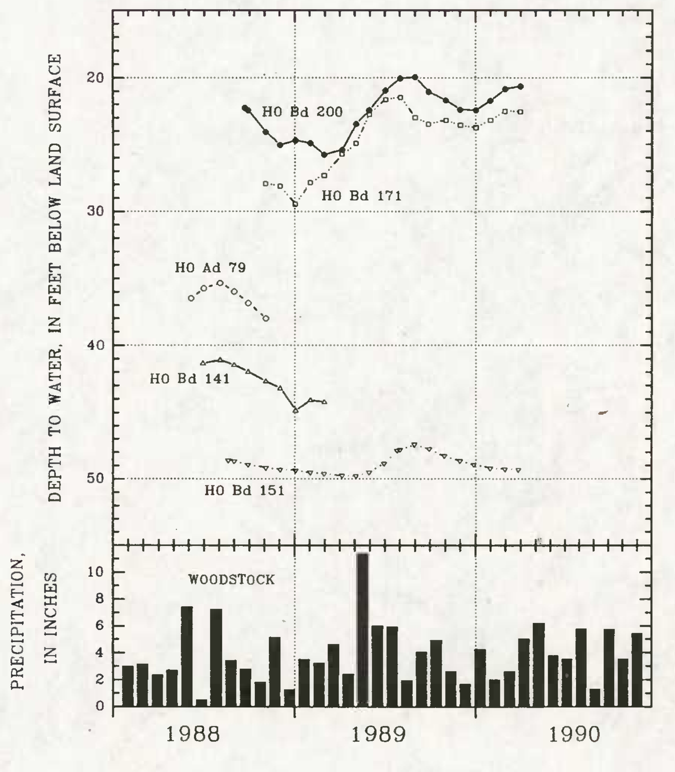


Figure 2.—Seasonal water-level fluctuations measured in five observation wells. Precipitation measured at Woodstock (Weather Bureau, ESSA, and NOAA).

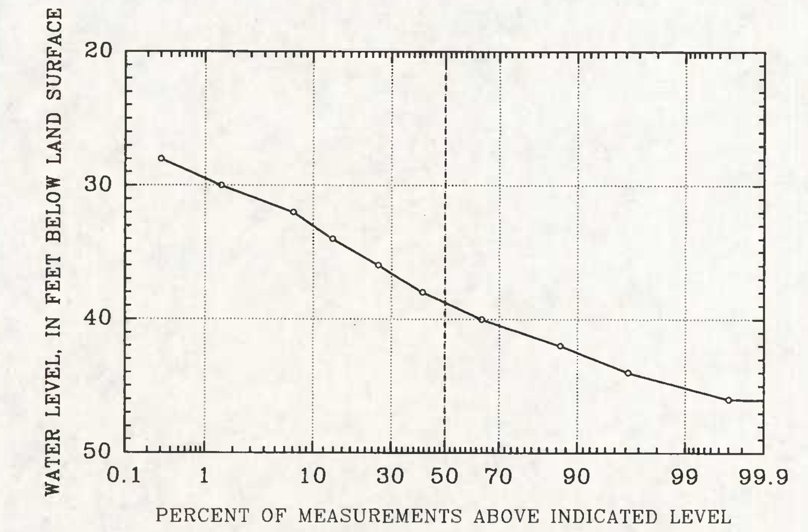
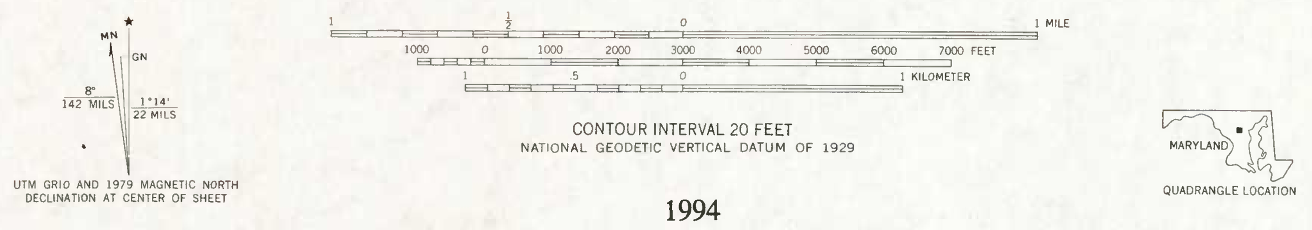


Figure 3.—Water-level duration curve for observation well HO Bd 1, based on the period 1946-92.

MAP 3. DEPTH TO THE WATER TABLE

Maryland Geological Survey Quadrangle Atlas No. 24

Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.



1994

Prepared in cooperation with the Howard County Department of Public Works

AVAILABILITY OF GROUND WATER

By Mark T. Duigon

INTRODUCTION

Ground water in the Piedmont physiographic province occupies and moves through rock fractures. These fractures are not uniformly distributed throughout the rocks, and individual water-bearing fractures cannot be detected without drilling. Consequently, well yields in this region are highly variable across short distances and cannot be predicted with much certainty. The extent of fracturing varies somewhat among geologic formations owing to lithologic differences and differences in the stresses to which they have been subjected, and this allows them to be assigned to three geohydrologic units based on well-yield and construction data (fig. 1). This map was developed from a statistical analysis (multiway analysis of variance) of specific-capacity data with wells grouped by geologic unit and topographic setting. (Topographic setting was not a significant factor affecting specific capacity.) The geologic units are those of Edwards (1993, written communication).

Domestic water demand is typically 50 to 75 gallons per day per resident of single-family homes (Whitsell, 1982, p. 15), but minimum acceptable well yield is specified by the State. Most domestic well sites are chosen to meet regulations dealing with property lines, septic systems, and structures, as well as for convenience. If greater yields are required, more consideration should be given to site selection and well construction and development. Location of fracture traces (linear zones of concentrated rock fractures), which can be seen on aerial photographs, is a suitable technique for well-site selection in fractured-rock terrane. Fractures may also be more numerous beneath stream valleys and upland draws, making these sites more favorable than hilltop sites.

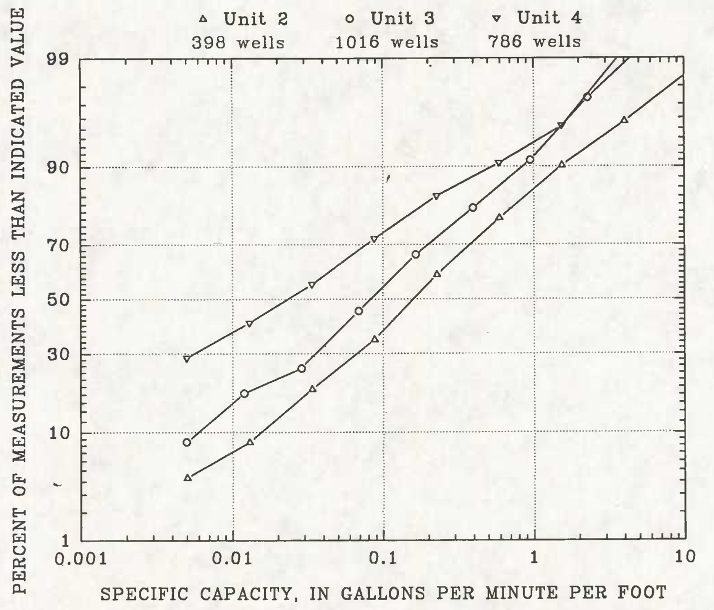


Figure 1.—Cumulative-frequency distributions of specific capacities of wells in the three geohydrologic units.

EXPLANATION

○ Well having reported yield less than 2 gallons per minute

● Well having reported yield greater than 15 gallons per minute

GEOHYDROLOGIC UNIT 1, not present in this quadrangle, is underlain by Coastal Plain sediments and is located elsewhere in Maryland.

GEOHYDROLOGIC UNIT 2: Geohydrologic Unit 2 comprises areas underlain by the Sykesville Formation, a fine- to medium-grained gneiss or fels, and by the Cockeysville Formation, a marble interlayered with calc-schist. Reported yields of 148 wells in the Sykesville quadrangle range from 0 ("dry hole") to 100 gallons per minute, with a median yield of 10 gallons per minute. Mean yield is 15.1 gallons per minute. The distribution of well yields among four yield classes related to adequacy for various uses is shown in figure 2. Specific capacities of 133 wells range from 0.000 to 20 gallons per minute per foot of drawdown, with a median of 0.25 (gal/min)/ft. Mean specific capacity is 1.1 (gal/min)/ft. Well depths range from 32 to 400 feet for 155 wells, with a median of 125 ft and a mean of 147.7 ft. Water levels measured in 149 wells range from 5 to 90 ft below land surface, with a median of 36 ft and a mean of 37.8 ft.

Wells drilled in Geohydrologic Unit 2 will be adequate for domestic use in most cases, and in many cases, can meet the needs of limited commercial, municipal, and industrial uses.

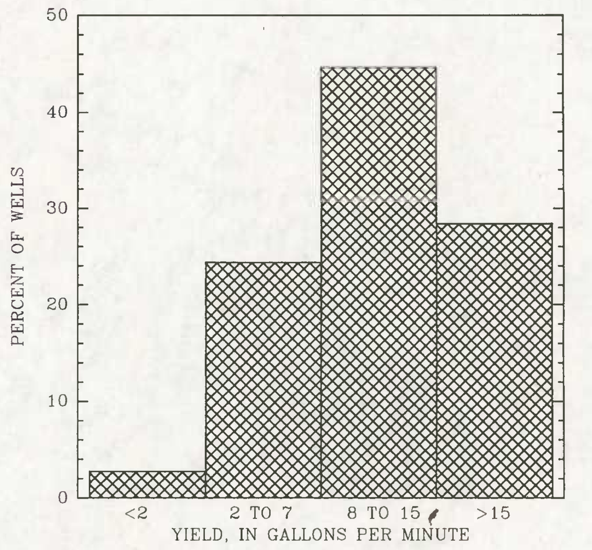


Figure 2.—Distribution of well yields, Geohydrologic Unit 2 (148 wells).

GEOHYDROLOGIC UNIT 3: In the Sykesville quadrangle this unit includes areas underlain by Baltimore Gneiss, Morgan Run Formation, Setters Formation, and some narrow pegmatite bodies. These rocks consist predominantly of gneiss and schist, and include quartzite and mafic and ultramafic schists and fels as well. Reported yields of 253 wells in the Sykesville quadrangle range from 0 to 60 gal/min; the median is 8 gal/min and the mean is 9.9 gal/min. Specific capacities of 225 wells range from 0.000 to 15 (gal/min)/ft, with a median of 0.08 (gal/min)/ft and a mean of 0.508 (gal/min)/ft. Depths of 257 wells range from 40 to 480 ft. Median well depth is 200 ft and mean depth is 207.6 ft. Water levels measured in 241 wells range from 5 to 215 ft below land surface, with a median of 36 ft and a mean of 38.0 ft.

About 5 percent of the wells in Geohydrologic Unit 3 were dry holes, and more than 10 percent yield less than 2 gal/min (fig. 3). Household demands can generally be met, as can some other uses if the demand is not very high.

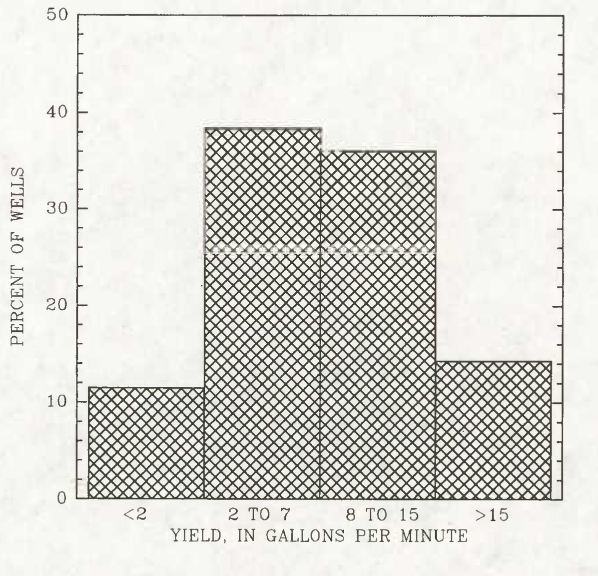


Figure 3.—Distribution of well yields, Geohydrologic Unit 3 (253 wells).

GEOHYDROLOGIC UNIT 4: Geohydrologic Unit 4 is underlain by the Loch Raven and Oella Formations in the Sykesville quadrangle. In places these formations are interlayered and not mapped separately; they were, therefore, treated as one entity for ground-water availability considerations. Both formations consist of schist with gneiss (more gneiss in the Oella Formation, which also includes minor quartzite locally). Reported yields of 240 wells range from 0 to 50 gal/min, and have a median yield of 3 gal/min and a mean yield of 5.0 gal/min. Specific capacities of 230 wells range from 0.000 to 10 (gal/min)/ft, with a median of 0.02 (gal/min)/ft and a mean of 0.27 (gal/min)/ft. Depths of 227 wells range from 18 to 600 ft, with a median of 260 ft and a mean of 256.7 ft. Water levels measured in 195 wells range from above land surface (flowing) to 240 ft below land surface. Median water level is 40 ft and mean water level is 43.0 ft below land surface.

Obtaining an adequate well yield in this unit can be a serious problem (fig. 4). Almost 20 percent of the wells were dry holes, and about 33 percent yield less than 2 gal/min. The chances of obtaining a yield sufficient for municipal or certain industrial or commercial uses are quite low, as only about 2 percent of inventoried wells yield more than 15 gal/min.

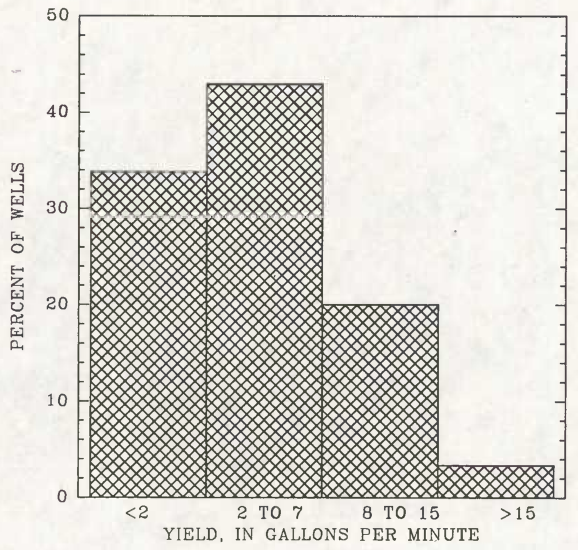


Figure 4.—Distribution of well yields, Geohydrologic Unit 4 (227 wells).

SUMMARY

Reported yields of 647 wells in the Sykesville quadrangle range from 0 to 100 gal/min, with a median of 6 gal/min. Mean yield is 9.2 gal/min. Nearly 10 percent of the wells inventoried in the Sykesville quadrangle were dry holes, and about 18 percent yield less than 2 gal/min. Approximately 13 percent of the wells yield more than 15 gal/min. Specific capacities of 594 wells range from 0.000 to 20 (gal/min)/ft, have a median of 0.07 (gal/min)/ft and a mean of 0.56 (gal/min)/ft. Depths of 646 wells range from 18 to 600 ft, with a median of 200 ft and a mean of 210.5 ft. Water levels measured in 591 wells range from above land surface (a flowing well) to 240 ft below land surface, with a median of 38 ft and a mean of 39.6 ft.

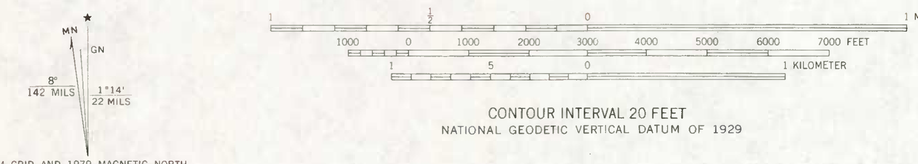
REFERENCE

Whitsell, W.J. (Committee Chairman), 1982, Manual of individual water supply systems: U.S. Environmental Protection Agency, EPA-570/9-82-004, 155 p.

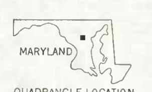
MAP 4. AVAILABILITY OF GROUND WATER

Maryland Geological Survey | Quadrangle Atlas No. 24

Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.



CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929



QUADRANGLE LOCATION

1994

Prepared in cooperation with the
Howard County Department of Public Works

GROUND-WATER QUALITY

by Mark T. Duigon

INTRODUCTION

Ground-water quality data for Howard County were compiled by Dine, Adamski, and Tompkins (1992) and discussed by Dine, Adamski, and Duigon (1995). Geographic variation of basic ground-water chemistry in the Sykesville quadrangle is shown on this map using Stiff diagrams (Stiff, 1951). A diagram is included for one stream-sampling station, Middle Patuxent River near West Friendship (site 01593600; the diagram is based on the median values of three samples). The stream site is included because samples were collected under base-flow conditions, when all of the streamflow consisted of ground-water discharge, and the quality indicative of ground water in the basin. Ground-water chemistry varies considerably and non-systematically in the Sykesville quadrangle. Some of the variation is due to the mineralogy of the aquifer, but anthropogenic sources, perhaps including road-deicing salt, likely affect the chemistry of about half of the samples. The shapes representing wells HO Bd 3 and HO Be 33, both completed in the Cockeysville Marble, are characteristic of ground water from carbonate rocks. Shapes wide at the top, such as for HO Bd 390, may indicate movement of road-deicing salt into the ground (sewage effluent, from treatment plants or from septic systems, and other wastes are possible sources of chloride and sodium). Deicing salt may be in the form of calcium chloride as well as sodium chloride. Many sources provide nitrogen in a variety of forms. Much of the nitrogen is converted to nitrate (the most common, oxidized form of nitrogen in ground water) before entering ground water. Concentrations of more than a few milligrams per liter (nitrate plus nitrite, as N) are likely due to contamination; septic systems are the most significant sources of nitrate in ground water in unsewered areas.

Most of the samples may be classified either as calcium-sodium—chloride-sulfate-bicarbonate or as calcium-sodium—bicarbonate-chloride-sulfate water types (fig. 1). Chloride makes up less than about 40 percent of the total anion content in 40 percent of the samples, and more than about 60 milliequivalents per liter in 60 percent of the samples.

Basic chemical data for the wells are shown in table 1. Some trace metals were detected at all sites (table 2), although chromium, cobalt, molybdenum, and vanadium were undetected at all sites. Radon concentrations in ground water in the Sykesville quadrangle range from 170 to 25,000 picocuries per liter (pCi/L). The U.S. Environmental Protection Agency had proposed a Maximum Contaminant Level (MCL) for radon of 300 pCi/L (1991); uncertainties involved in assessing health risks of waterborne radon have delayed implementation of a MCL (Stone, 1993), and a value of 3,000 pCi/L has been proposed (reauthorization of the Safe Drinking Water Act, S. 1316, 1995). Prometone was the only pesticide detected (table 3).

REFERENCES

Dine, J.R., Adamski, J.C., and Duigon, M.T., 1995, Water resources of Howard County, Maryland: Maryland Geological Survey, Bulletin 38, 128 p.

Dine, J.R., Adamski, J.C., and Tompkins, M.D., 1992, Hydrologic data for Howard County, Maryland: Maryland Geological Survey, Basic Data Report No. 19, 240 p.

S. 1316, 104th Congress, § 8 (1995).

Stiff, H.A., 1951, The interpretation of chemical water analysis by means of patterns: Journal of Petroleum Technology, vol. 3, no. 10, section 1,p. 15-16; section 2,p. 3.

Stone, Richard, 1993, EPA analysis of radon in water is hard to swallow: Science, vol. 261, no. 5128, p. 1514-1516.

U.S. Environmental Protection Agency, 1991, Notice of proposed rulemaking, national primary drinking water regulation—radionuclides: U.S. Federal Register, vol. 56, no. 13 (July 18, 1991), p. 33,050-33,124.

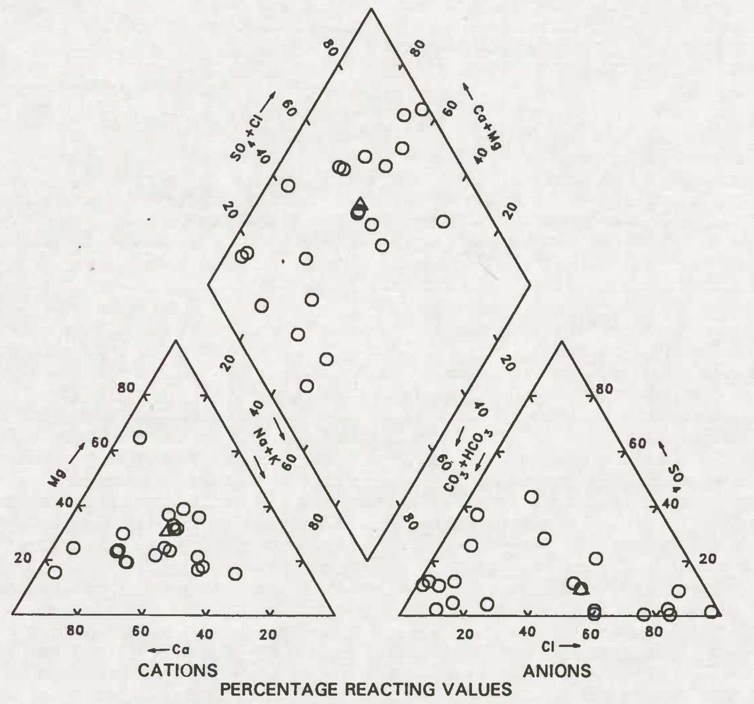


Figure 1.—Major-ion percentages in ground water in the Sykesville quadrangle (22 samples). Samples from wells are shown by circles; the triangles are based on the median values of three base-flow samples from Middle Patuxent River near West Friendship. Percentages are computed from concentrations expressed in milliequivalents per liter.

TABLE 1. BASIC GROUND-WATER CHEMISTRY
[Concentrations are for dissolved forms; B, stream base flow; W, well; S, spring]

Site	Site type	Geologic unit	Open interval (ft below land surface)	Date sampled	Specific conductance (µS/cm at 25°C)	pH	Hardness (mg/L as $CaCO_3$)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Alkalinity (mg/L as $CaCO_3$)	Sulfate (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate + Nitrite (total, mg/L as N)	Silica (mg/L)	Total dissolved solids (residue at 180°C, mg/L)	Site
01593600	B	—	—	12-20-88	141	6.7	46	10	5.1	9.4	1.8	19	5.1	19	<0.1	—	11	95	001593600
				04-26-89	141	7.1	46	10	5.2	8.7	1.8	21	5.3	20	.1	—	6.7	100	
				10-16-89	182	7.2	48	11	4.9	9.1	2.9	24	4.0	30	.1	—	10	92	
CL Ee 145	W	SKVLG	unknown	08-11-83	283	5.5	—	—	—	—	—	—	—	—	—	—	—	—	CL Ee 145
HO Ad 26	W	SKVLG	20-345	05-23-89	186	6.9	67	20	4.2	9.5	2.4	55	21	5.7	.1	.70	17	119	HO Ad 26
HO Ad 34	W	SKVLG	31-120	05-10-90	48	5.0	11	1.8	1.6	3.0	.6	4	<1.0	3.8	<.1	2.9	7.9	34	HO Ad 34
HO Ad 83	W	UMFC	22-90	05-09-89	193	6.0	89	11	15	2.3	1.0	50	31	3.4	.1	1.9	19	116	HO Ad 83
HO Ae 3	W	BLMR	20-140	05-15-89	204	5.7	72	20	5.2	7.4	2.4	24	27	8.7	.1	7.2	18	139	HO Ae 3
HO Bd 3	W	CCKV	16-203	05-15-52	263	7.8	130	45	5.3	2.0	2.6	119	17	3.0	.1	—	15	166	HO Bd 3
HO Bd 4	W	BLMR	58-173	05-15-52	65	6.6	13	3.4	1.0	4.9	1.2	30	.8	2.5	.1	—	26	62	HO Bd 4
HO Bd 9	W	SKVLG	33-55	12-16-52	34	6.3	7	1.8	.60	2.7	.9	10	1.6	1.0	<.1	—	15	34	HO Bd 9
HO Bd 18	S	BLMR	—	08-14-81	280	7.1	120	31	11	4.6	1.8	—	1.9	5.3	<.1	—	24	166	HO Bd 18
HO Bd 77	W	SKVLG	21-80	03-28-89	156	5.2	45	7.4	6.3	9.3	1.7	7	<.2	16	.1	8.0	13	88	HO Bd 77
HO Bd 150	W	L-O	61-400	05-15-90	85	5.8	26	6.5	2.4	5.5	1.5	17	<1.0	4.3	<.1	4.6	16	66	HO Bd 150
HO Bd 246	W	L-O	66-128	03-28-89	151	5.2	35	8.4	3.4	13	1.9	10	<.2	11	.1	8.9	15	99	HO Bd 246
HO Bd 325	W	L-O	47-300	03-27-89	167	6.5	64	19	4.0	8.7	2.6	7	5.0	8.9	.1	.10	30	120	HO Bd 325
HO Bd 390	W	SKVLG	26-125	03-27-89	272	5.5	46	11	4.4	32	2.1	17	.6	65	.1	2.3	14	157	HO Bd 390
HO Bd 401	W	STRS	30-180	11-20-89	109	5.5	33	8.3	3.0	7.7	2.0	35	2.0	4.4	<.1	2.5	28	79	HO Bd 401
HO Bd 402	W	L-O	36-145	01-24-90	—	5.7	120	31	11	11	3.9	55	3.0	61	<.1	2.2	25	232	HO Bd 402
HO Bd 403	W	L-O	20-410	02-06-90	920	4.7	250	52	29	56	6.4	8	6.0	250	.1	1.2	16	554	HO Bd 403
HO Bd 404	W	SKVLG	43-165	02-06-90	82	5.6	23	4.7	2.8	4.5	1.4	12	8.0	6.4	.1	2.9	13	62	HO Bd 404
HO Bd 405	W	L-O	52-58	02-27-90	160	5.4	42	8.6	5.0	9.2	2.1	6	<1.0	23	.3	7.3	13	121	HO Bd 405
HO Bd 406	W	L-O	46-85	02-27-90	350	5.6	95	18	12	16	4.1	10	10	67	<.1	9.4	16	244	HO Bd 406
HO Be 21	W	BLMR	20-125	06-05-89	112	5.5	33	8.8	2.6	6.4	1.8	14	4.0	12	.1	3.2	22	88	HO Be 21
HO Be 33	W	CCKV	20-350	05-01-90	308	7.8	150	45	9.6	2.5	3.9	133	17	7.9	<.1	1.6	13	187	HO Be 33
HO Be 112	W	L-O	62-453	05-31-90	167	8.0	60	17	4.2	5.4	2.8	71	8.8	1.0	<.1	.40	16	101	HO Be 112

Geologic unit codes

BLMR	Baltimore Gneiss	SKVLG	Sykesville Formation
CCKV	Cockeysville Marble	STRS	Setters Formation
L-O	Loch Raven-Oella Formations (undifferentiated)	UMFC	Morgan Run Formation (undifferentiated ultramafic and mafic rock)

TABLE 2. DISSOLVED TRACE METALS AND RADON
[All concentrations in micrograms per liter except radon, which is in picocuries per liter]

Site	Date sampled	Aluminum	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Molybdenum	Nickel	Silver	Strontium	Vanadium	Zinc	Radon	Site
HO Ad 26	05-23-89	<10	5	<0.5	2	<5	<3	<10	6	<10	6	29	<10	10	<1.0	120	<6	9	2,500	HO Ad 26
HO Ad 34	05-10-90	<10	19	<.5	2	<5	<3	10	6	<10	<4	4	<10	<10	<1.0	19	<6	6	2,600	HO Ad 34
HO Ad 83	05-09-89	<10	33	<.5	1	<5	<3	60	<3	<10	<4	5	<10	<10	<1.0	47	<6	13	170	HO Ad 83
HO Ae 3	05-15-89	<10	56	<.5	<1	<5	<3	40	12	<10	<4	<1	<10	<10	<1.0	120	<6	4	15,000	HO Ae 3
HO Bd 77	03-28-89	10	40	<.5	4	<5	<3	30	11	<10	<4	25	<10	<10	<1.0	90	<6	10	3,100	HO Bd 77
HO Bd 150	05-15-90	<10	18	<.5	<1	<5	<3	40	<3	<10	9	8	<10	<10	<1.0	57	<6	4	4,800	HO Bd 150
HO Bd 246	03-28-89	30	49	<.5	3	<5	<3	30	14	<10	<4	180	<10	10	1.0	91	<6	14	6,700	HO Bd 246
HO Bd 325	03-27-89	<10	8	<.5	2	<5	<3	10	27	<10	11	140	<10	<10	<1.0	81	<6	6	1,900	HO Bd 325
HO Bd 390	03-27-89	40	140	<.5	2	<5	<3	20	8	20	<4	49	<10	10	2.0	140	<6	17	2,500	HO Bd 390
HO Bd 401	11-20-89	<10	55	<.5	<1	<5	<3	50	34	20	<4	200	<10	10	4.0	87	<6	9	3,300	HO Bd 401
HO Bd 402	01-24-90	<10	55	<.5	2	<5	<3	40	49	<10	15	3	<10	20	<1.0	240	<6	<3	5,200	HO Bd 402
HO Bd 403	02-06-90	50	310	<.5	6	<5	<3	70	36	10	4	74	<10	<10	<1.0	670	<6	18	—	HO Bd 403
HO Bd 404	02-06-90	20	24	<.5	1	<5	<3	20	16	<10	<4	3	<10	<10	<1.0	49	<6	8	—	HO Bd 404
HO Bd 405	02-27-90	30	88	.7	3	<5	<3	20	19	<10	<4	10	<10	10	<1.0	97	<6	20	15,000	HO Bd 405
HO Bd 406	02-27-90	20	130	<.5	<1	<5	<3	40	8	10	<4	16	<10	10	<1.0	250	<6	10	4,100	HO Bd 406
HO Be 21	06-05-89	20	46	<.5	<1	<5	<3	60	6	<10	<4	3	<10	<10	<1.0	120	<6	15	9,000	HO Be 21
HO Be 33	05-01-90	<10	64	<.5	4	<5	<3	<10	5	<10	4	<1	<10	<10	<1.0	220	<6	5	1,400	HO Be 33
HO Be 112	05-31-90	<10	10	<.5	<1	<5	<3	<10	<3	<10	12	4	<10	<10	<1.0	100	<6	<3	25,000	HO Be 112

TABLE 3. PESTICIDES
[ND, not detected]

Site	Date sampled	Triazine group	Carbamate group
CL Ee 145	08-11-83	ND[1]	—
HO Ad 26	05-23-89	ND	ND
HO Ad 34	05-10-90	ND	—
HO Ae 3	05-15-89	Prometone 0.2 µg/L	ND
HO Bd 150	05-15-90	ND	ND
HO Bd 246	03-28-89	—	ND
HO Bd 390	03-27-89	—	ND
HO Bd 402	01-24-90	ND	ND
HO Bd 403	02-06-90	ND	—
HO Bd 404	02-06-90	ND	—
HO Bd 405	02-27-90	ND	ND
HO Bd 406	02-27-90	ND	ND
HO Be 21	06-05-89	ND	ND
HO Be 33	05-01-90	ND	ND

[1] Analysis included Atratone, Cyprazine, and Simetone, but not Alachlor, Metolachlor, Metribuzin, or Trifluralin.

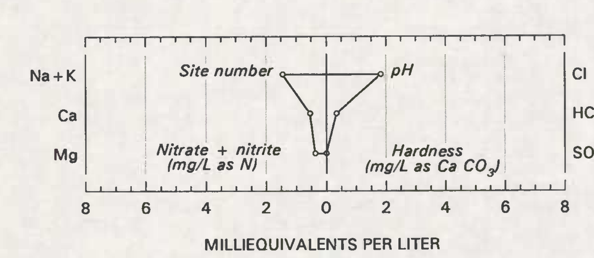
Triazine group	*Carbamate group*
Alachlor	Aldicarb
Ametryne	Aldicarb sulfone
Atrazine	Aldicarb sulfoxide
Cyanazine	Carbofuran
Metolachlor	3-Hydroxy carbofuran
Metribuzin	Methomyl
Prometone	1-Naphthol
Prometryne	Oxamyl
Propazine	Propham
Simazine	Sevin
Simetryne	
Trifluralin	

EXPLANATION

Stream base-flow sampling site

Well

Spring



Maryland Geological Survey

MAP 5. GROUND-WATER QUALITY

Quadrangle Atlas No. 24

Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

Prepared in cooperation with the
Howard County Department of Public Works

1995

GEOHYDROLOGIC CONSTRAINTS ON SEPTIC SYSTEMS

By Mark T. Duigon and Barbara F. Cooper

INTRODUCTION

The septic-tank–soil-absorption system ("septic system") is an effective means of disposing of wastewater and sewage in many areas not served by public treatment systems. General descriptions of designs and principles of waste-disposal systems are provided by Bernhart, 1975; Leich, 1977; Johnson, 1978; American Society of Agricultural Engineers, 1978; Purdin, 1979; and Warshall, 1979. Site evaluation is discussed by Huddleston and Olson, 1967; Bouma, 1971 and 1974; Healy and Laak, 1973 and 1974; American Society of Agricultural Engineers, 1978; and Baker, 1978. Romero (1970), Allen and Morrison (1973), Keswick and Gerba (1980), Yates and Yates (1989), Pell, Nyberg, and Ljunggren (1990), and Gross and Mitchell (1990) describe movement of bacteria and viruses through soil and bedrock. Other water-quality aspects relating to septic systems are discussed by Viraraghavan and Warnock (1976), Scalf, Dunlap, and Kreissl (1977), DeWalle and Schaff (1980), Rea and Upchurch (1980), Hagedorn, McCoy, and Rahe (1981), Yates (1985), Alhajjar, Chesters, and Harkin (1990), Tinker (1991), Foster and Alexander (1992), Hantzsche and Finnemore (1992), and Wilhelm, Schiff, and Cherry (1994).

Materials in the household waste stream include excrement, food scraps, laundry detergents, bleach, and cleaning compounds and usually are mixed with large quantities of water for transport out of the house. Inside the septic tank, solids are separated from the waste slurry by settling and are broken down by anaerobic decomposition. Liquids flow out of the septic tank and are piped to a distribution field or seepage pit for distribution into the soil. As the water used to transport the wastes percolates through the soil it is depurated by the processes of filtration, adsorption on minerals (particularly clays), microbial action, and dilution. The cleansed water may subsequently recharge the local ground water.

Septic systems must be properly sited, constructed, and maintained to be efficacious. This map identifies areas where geohydrologic features impose maximum, moderate, and minimum constraints on the installation of typical septic systems consisting of septic tank and seepage field. Certain geohydrologic limitations can be overcome through alternative system designs such as mounding of the seepage field, aerobic tanks, sand filters, and other methods; some of these require more intensive maintenance, although some, such as mounding, have come into routine use (mound systems are now included under conventional systems—COMAR 26.04.02.05.Q). Various alternatives to the septic tank and drainfield disposal system are described by Duff (1979), Plews and Lenning (1979), and Bernhart (1979).

CONSTRAINT FACTORS

Certain geohydrologic conditions must be considered in order to determine the suitability of a site for installation of a septic system. The Code of Maryland Regulations (COMAR) specifies values for the following factors (as well as for some additional factors that cannot be shown at the scale of this map—see pamphlet for summary of regulations); however, peculiarities of individual sites may lead the approving authority to deny issuance of a permit, grant a variance, or increase required distances. The dimensions of the absorption field (and, in some cases, other system design aspects) are determined from the results of a percolation test. The percolation test consists of digging a number of holes deep enough to determine whether there is a sufficient thickness of unsaturated, unconsolidated material for effluent treatment, and an indication of the rate at which the soil can accept effluent (percolation rate). A small hole dug at the intended level of the disposal trenches is filled with water to a measured depth; the water level is allowed to drop one inch (pre-wetting), and then timed as it drops another inch. For conventional systems, the percolation rate must be within 2 to 30 minutes per inch after pre-wetting.

1. ***Flood hazard:*** Soil-absorption systems do not drain properly when flooded, and may be damaged. Flood waters can mix with sewage, spreading contamination to surface water and ground water. Areas prone to flooding were obtained from the Soil Surveys (Matthews, 1969; Matthews and Hershberger, 1968).

2. ***Depth to water table:*** Water flows more slowly under unsaturated than under saturated conditions, thereby allowing longer contact with soil and more thorough purification. Unsaturated soil is also better suited for the growth of the aerobic soil bacteria that break down wastes. Schwartz and Bendixen (1970) noted that nearly all removal of chemical oxygen demand (COD) and methylene-blue active substances (MBAS, which are surfactants contained in detergents) occurred within 2 ft of unsaturated soil, and nearly all ammonia was removed within 4 ft. The actual unsaturated thickness necessary for contaminant removal depends on the particular contaminant, as well as the soil environment. Areas of shallow depth to the water table were obtained from the Soil Surveys and from Map 3 of this atlas.

3. ***Depth to bedrock:*** Bedrock in the area mapped consists of crystalline metamorphic rocks having negligible primary, or intergranular, permeability. Ground water flows through fractures which are variably spaced throughout the rock and which have variable apertures; the fractured rock does not treat wastewater as effectively as soil, which has a much greater mineral surface area (per unit volume) than does the bedrock. Areas of very shallow depth to bedrock were obtained from the Soil Surveys.

4. ***Slope of the land surface:*** There may be a lateral component to the movement of septic-system effluent, resulting in surface discharge in steep areas having shallow soils. Land slopes were obtained from Map 1 of this atlas.

5. ***Distance to surface-water bodies:*** Streams and lakes are commonly areas of ground-water discharge. A septic system should be located at a sufficient distance from surface water to allow adequate treatment underground. Buffers were determined automatically from digital hydrography.

6. ***Geologic unit:*** Ground water in the marble aquifers tends to be more susceptible to contamination than ground water in the other rock units, owing to the solutional enlargement of fractures, which allows rapid ground-water flow. Ground-water availability is a problem in some of the other geologic units, and the presence of septic systems in a neighborhood could preclude installation or replacement of an on-site potable water supply. Geologic units were obtained from Edwards (1993).

MAP UNITS

UNIT I: Septic-tank–soil-adsorption systems constructed in this unit face a high probability of failure. This unit mostly occurs adjacent to streams, where flooding is an occasional hazard, the water table comes within 4 ft of land surface (at least seasonally), and the slope of valley walls exceeds 25 percent in some areas. Unit I includes 100-ft-wide buffer zones along streams tributary to Triadelphia Reservoir (located about 2.5 miles southwest of the Sykesville Quadrangle). It also includes areas where bedrock is less than 3 ft from land surface, mostly in the northern part of the quadrangle (characterized by Mt. Airy soils).

UNIT II: Conditions in this unit are less severe or more variable than in Unit I. A large part of Unit II comprises areas not served by public water (Howard County Master Plan for Water and Sewerage, 1985) that are underlain by marble (in which ground water may be more susceptible to contamination) or by rocks included in Geohydrologic Unit 4 (Map 4 of this atlas) (where obtaining an adequate water supply could be problematic). This unit also includes areas where the high water table is between 3 and 10 ft below land surface, and areas underlain by soils having a fragipan (a low-permeability horizon that impedes percolation). The Alpha Ridge landfill is included in this unit.

UNIT III: Conditions in Unit III, which comprises those areas not included in Unit I or Unit II, generally pose only slight limitations on the operation of septic systems. Onsite inspection is still required to verify site suitability and to estimate drainfield size.

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MAP 6. GEOHYDROLOGIC CONSTRAINTS ON SEPTIC SYSTEMS

Quadrangle Atlas No. 24

Base from U.S. Geological Survey, 1953, photorevised 1979; scale 1:24,000.

1995

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