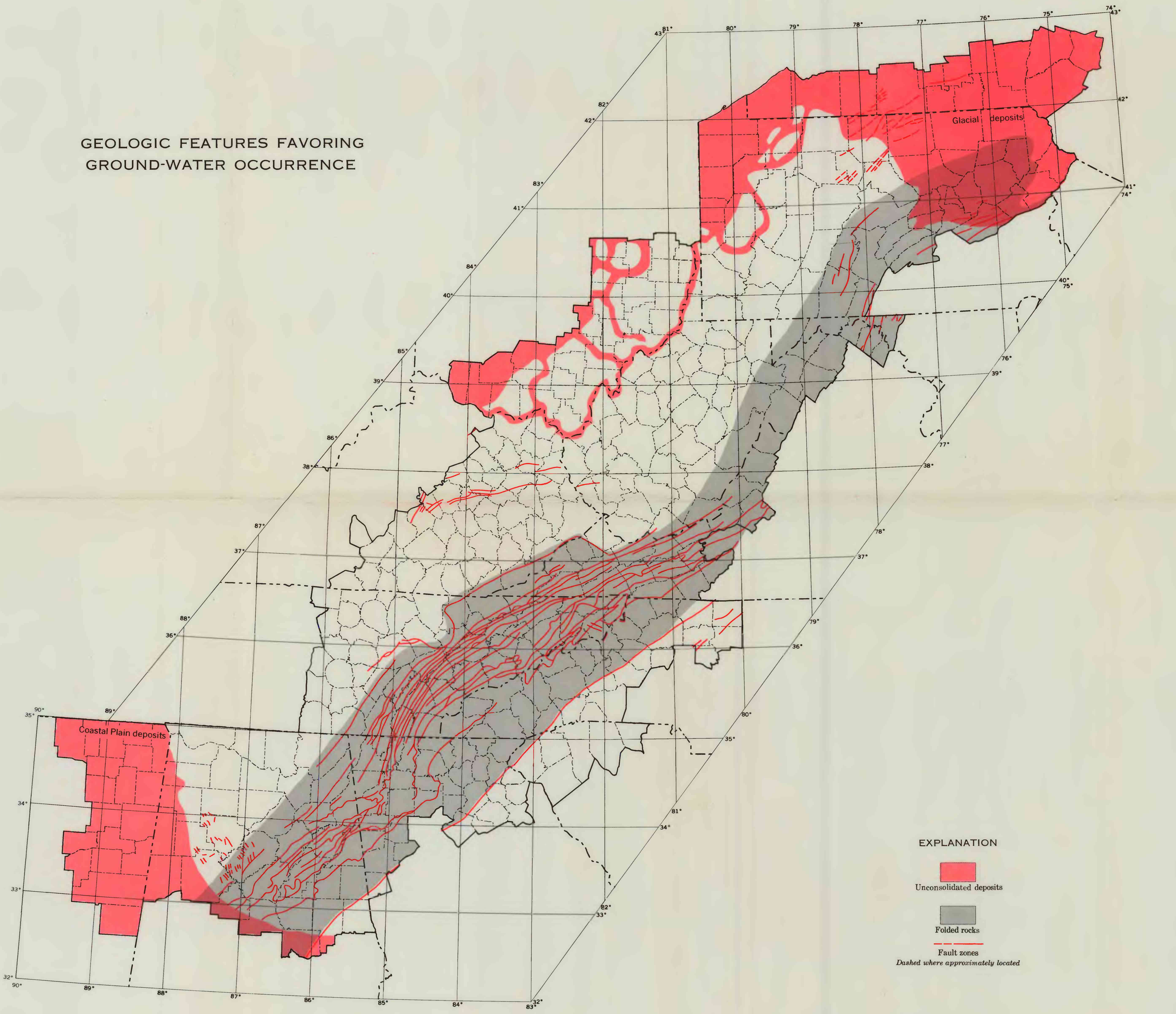
GEOLOGIC FEATURES FAVORING GROUND-WATER OCCURRENCE



Glacial deposits taken from: Appendix E, Ohio River Basin Comprehensive Survey U.S. Corps of Engineers (In Press)

This map indicates the locations of geologic features most favorable to the occurrence of ground water in the Appalachian Region. The features shown—unconsolidated deposits, folded rocks, and major fault zones, have the most regional significance in providing highly permeable reservoirs for ground-water storage and transmission. Faulting and jointing occur in many places throughout the region. Whenever found, they improve the chances of obtaining ground water. Only the major fault zones are indicated on this map.

Ground water is stored in and transmitted through the openings in the rock units. The intergranular pore space of the rocks may comprise a high percentage of the total rock volume, as in sand and gravel, and may store considerable quantities of water. If the pore spaces are well connected and not too small, the rocks will readily yield water and are said to be highly permeable. If, however, the pore spaces are poorly connected, the rocks will not readily yield water and the permeability of the rocks is said to be low.

Geologic processes tend to alter the permeability of the rocks. As rocks become indurated the pore spaces and their interconnections are generally reduced in size by the deposition of cementing materials in the spaces. Rocks that have not been consolidated or those that have been subjected to fracturing by tectonic forces, generally have higher permeability than unfractured well-indurated rocks.

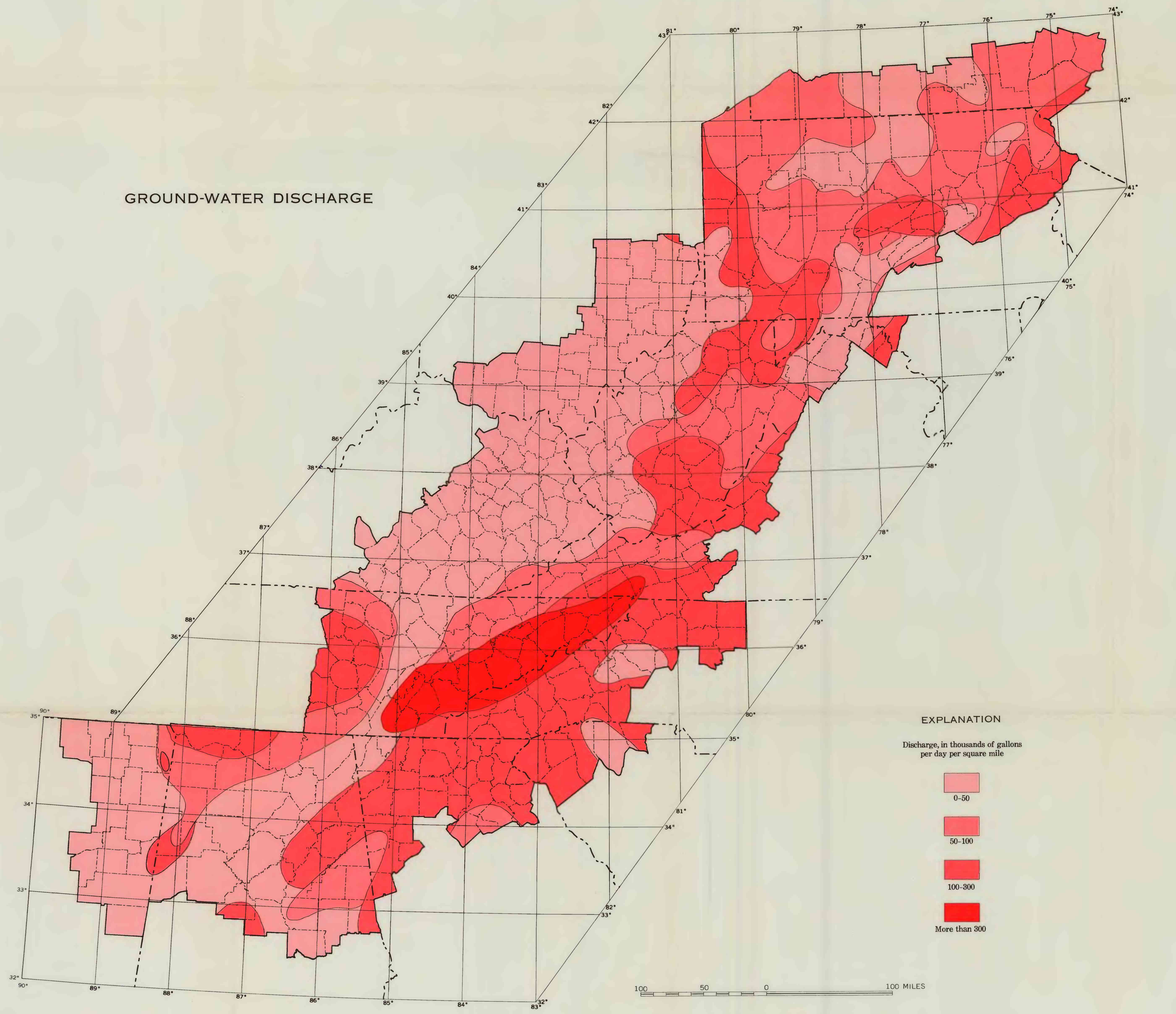
The most significant, highly permeable, unconsolidated rock units in the Appalachian Region are those resulting from glaciation. Glacial deposits and the outwash from them deposited in the stream valleys occur in northern and northwestern parts of the region. Wells in these deposits, particularly those in the outwash, generally have a high yield. Individual wells in outwash deposits along the Ohio River may yield as much as 3,500 gpm (gallons per minute). These deposits generally do not store a large volume of water but they readily transmit water from streams to the wells. The outwash deposits constitute a major source of ground water in stream valleys where they have been well sorted and where they are fairly thick.

Ground water may be obtained from wells in the consolidated rocks of every county of the region. The yield of wells tapping consolidated rock ranges from less than 5 gpm to more than 1000 gpm. The highest yields in these rocks occur in association with faults as in Carter County, Tennessee. The major fault zones trend generally northeast-southwest along the eastern part of the region. They occur in what are probably the most highly indurated rocks of the region. Faults shear and grind the rocks, greatly increasing their permeability. The increase in the capacity of the rocks to store water and their ability to transmit it, due to faulting, is indicated in some parts of the region by the correlation of the fault zones on this map with the areas of high well yield and areas of high ground-water discharge as shown on other sheets of the atlas.

Areas of the region where the rocks have been folded also offer a greater ground-water potential than areas where the same types of rocks are undisturbed. Folding of strata usually results in the warping of less resistant beds and fracturing of the more resistant beds in the unit. The resulting fractures increase the capacity of the rocks to store water to some extent and greatly increase their ability to transmit water.

Locally, there are many minor faults or folds that also favor ground-water occurrence. These features are so small that they may not be mapped at this scale. Usually, these minor features may be readily observed in the field and used to advantage in the development of ground-water supplies at specific well field sites.

GROUND-WATER DISCHARGE



This map indicates an assumed dependable ground-water discharge to streams in thousands of gallons per day per square mile of drainage area. Ground water is constantly being discharged into the stream systems at variable rates depending upon the slope of the water table. The water in streams during periods of higher flow is derived from both surface runoff and ground-water discharge. As the streamflow decreases, the water is derived to a lesser extent from runoff and to a greater extent from ground-water discharge. At the streamflow rate which is exceeded about 90 percent of the time, almost all streamflow in the region is derived from ground water. The low streamflow exceeding 90 percent duration has been generally accepted as the dependable ground-water contribution to stream flows. This figure was originally used in determining the base flow for the generation of firm power. Later data indicate that the ground-water yields of a basin to streamflow exceeded 60 percent of the time, in areas underlain by thick glaciofluvial deposits, to that exceeded 95 percent of the time in areas underlain by the clayey soils of the southern Piedmont or glacial till. Since no single duration point on the streamflow curves for the Appalachian Region can be considered as uniformly applicable, the amount of streamflow that was exceeded between 90 and 95 percent of the time was used in preparing this map. This amount of streamflow was divided by the size of the drainage areas to afford a general indication of the water-yielding properties of the rocks within the drainage areas.

About 250 stream gaging stations are maintained by the U.S. Geological Survey, in the region, largely under cooperative programs with the States. The data are published by the U.S. Geological Survey and, in specialized reports, by the various States.

This map should be used in connection with other maps of this atlas in assessing ground-water occurrence and availability. Estimates of the amount of ground water available for development based entirely upon this map might lead to erroneous conclusions. Rocks having both high water-storing and water-transmitting properties are indicated by the higher discharge areas on the map. Rocks having a high storage capacity but a very low transmitting capacity, such as clay units, or massive indurated sandstone units, show as lower discharge areas on the map. Rocks having high transmitting capacities and lower storage capacities also show as lower discharge areas on the map.

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GROUND-WATER RESOURCES OF THE APPALACHIAN REGION

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