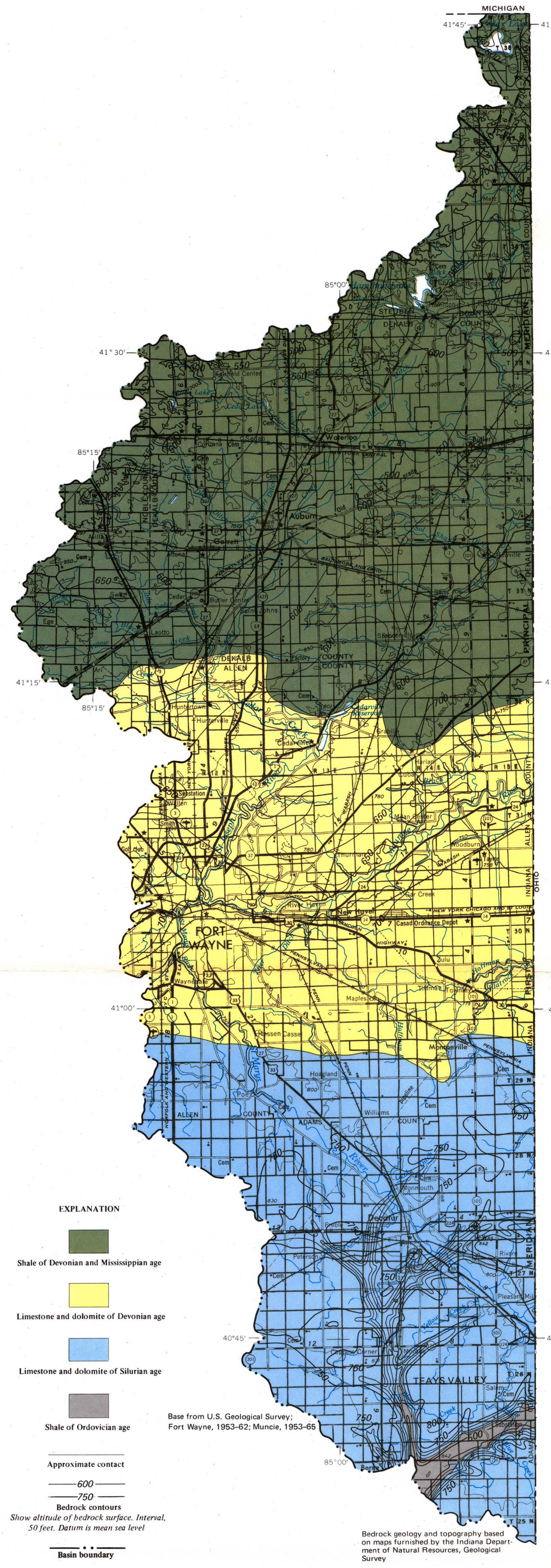
GROUND WATER



SCALE 1:250 000

5 0 5 10 MILES

5 0 5 10 KILOMETERS

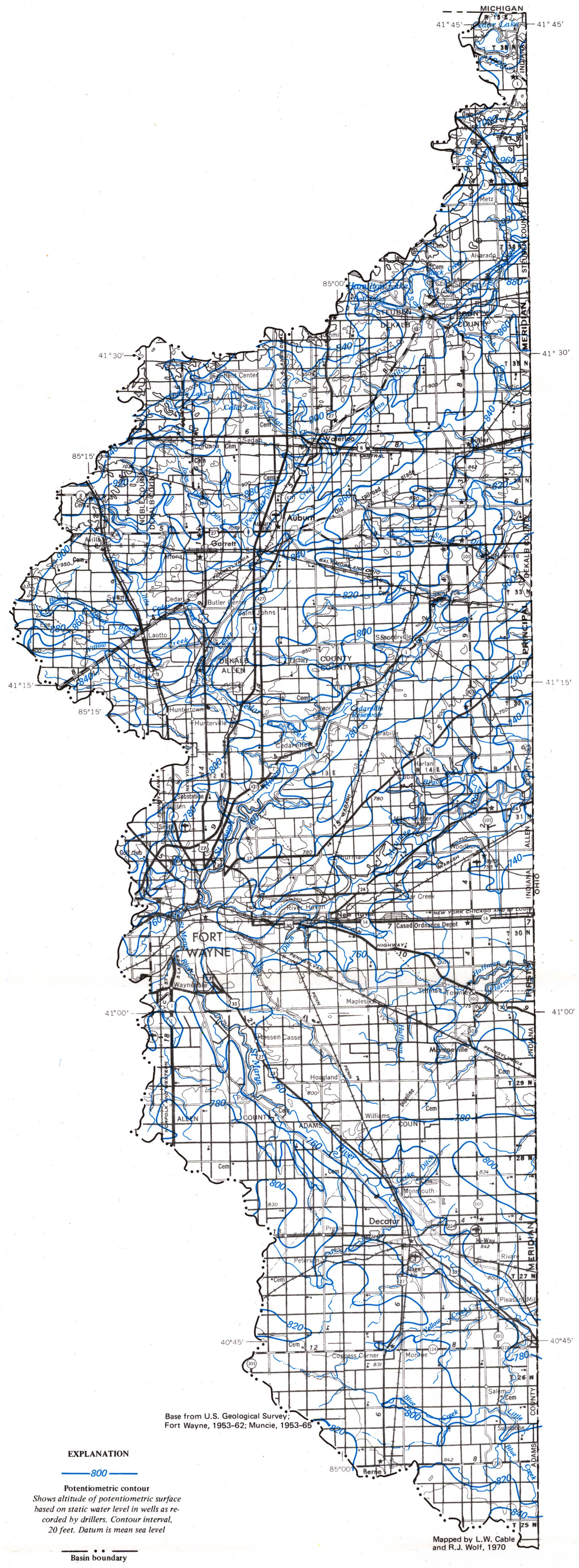
CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

BEDROCK GEOLOGIC AND TOPOGRAPHIC MAP

The bedrock underlying the basin ranges from shale of Devonian and Mississippian age in the northern part to limestone and dolomite of Silurian and Devonian age in the southern part. The bedrock in the Teays Valley, a preglacial valley in the southern part of the basin, and its tributary is mostly shale of Ordovician age.

The bedrock surface ranges from less than 50 feet below land surface in the southern part to about 500 feet below land surface in the northern part of the basin and is the lower geologic boundary of the unconsolidated ground-water reservoir. Consolidated rock below the bedrock surface contains water that is hydraulically connected to the overlying unconsolidated deposits.

The principal consolidated aquifer is the limestone and dolomite formation in the top 200 feet of the bedrock. Because of the higher solubility of limestone, secondary openings play a major role in providing storage for water. As the size, number, and degree of interconnection of these openings increase, the potential productivity of the aquifer increases. Because density of both secondary and primary openings vary from place to place, so must the transmissivity and yield vary. This aquifer may yield as much as 300 to 500 gallons per minute to wells. The median transmissivity value as estimated from drillers' specific capacity tests is about 23,000 gallons per day per foot. However, the Ohio Division of Water (oral commun., 1970) reports that recent pumping tests (1970) showed that transmissivities of the limestone and dolomite aquifer on the Ohio side of the basin generally range from 25,000 to 30,000 gallons per day per foot.



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5 0 5 10 KILOMETERS

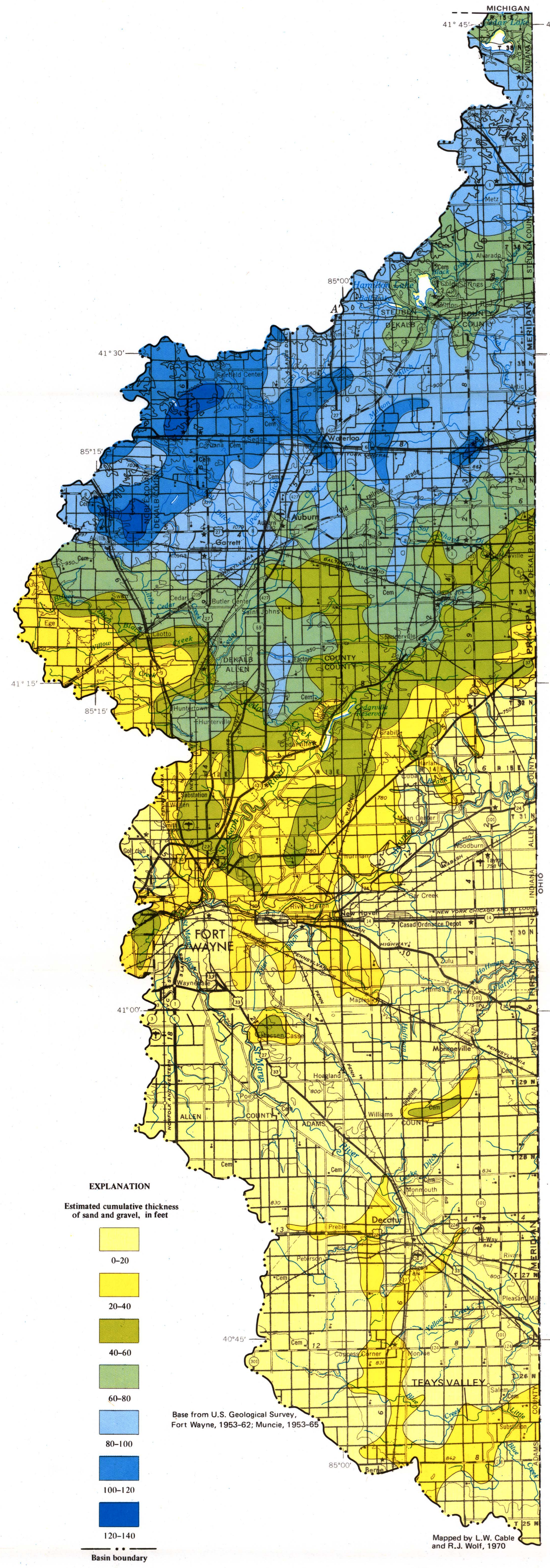
CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

GENERALIZED POTENTIOMETRIC-SURFACE MAP

The static water level in wells, as recorded by drillers, was used to make the generalized map of the potentiometric surface. This surface, generated by connecting points of equal water-level altitude, represents the average static water-level conditions.

The potentiometric surface is the approximate upper boundary of the saturated ground-water system and fluctuates in response to recharge and discharge. The regional configuration of the potentiometric surface does not change significantly from year to year owing to the balance between recharge and discharge and to the large storage capacity of the ground-water reservoir in comparison to the difference between recharge and discharge.

The regional hydraulic gradient in the basin is approximately 10 feet per mile. Ground water moves from high points on the potentiometric surface and discharges into streams, lakes, and areas of pumpage. Because ground-water divides only generally follow surface-water divides, ground water may flow into or out of the surface-water basin near its borders.



SCALE 1:250 000

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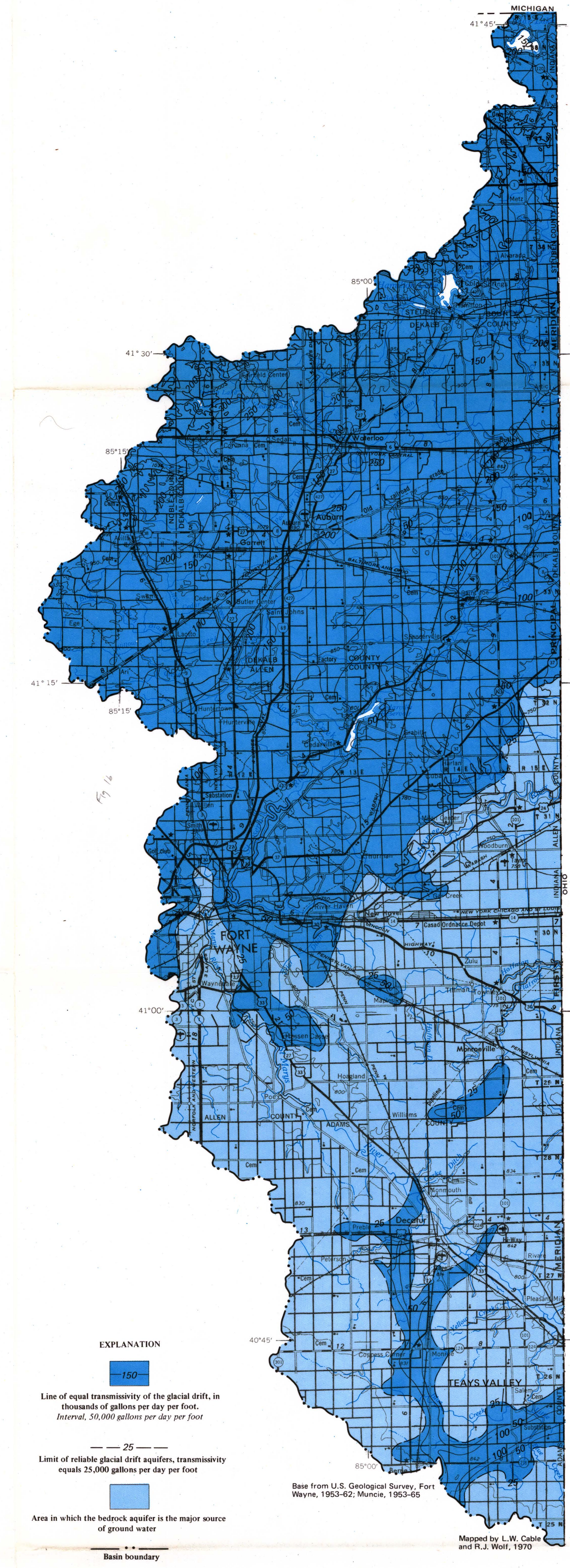
5 0 5 10 KILOMETERS

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

MAP SHOWING ESTIMATED CUMULATIVE THICKNESS OF SAND AND GRAVEL



SCALE 1:250 000

5 0 5 10 MILES

5 0 5 10 KILOMETERS

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

MAP SHOWING ESTIMATED COMPOSITE TRANSMISSIVITY OF SAND AND GRAVEL

AQUIFER SYSTEM

The sand layers and sand and gravel layers that occur randomly throughout the unconsolidated deposits are mapped as a composite aquifer rather than individual aquifers. The estimated cumulative thickness of these layers range from less than 20 feet to about 140 feet. Data used to determine their thickness were obtained from well drillers' logs on file at the Indiana Department of Natural Resources.

Water wells penetrate only the upper section of the unconsolidated deposits in most of the northern half of the basin; therefore, the geological and hydrological properties of the lower or "undefined" section were statistically estimated from properties of the upper or "defined" section. The values obtained are incorporated in the maps of cumulative thickness and transmissivity of the unconsolidated aquifer system.

The geologic section illustrates the thickness of the "undefined" section and the arrangement and distribution patterns of the layers of sand and sand and gravel in the "defined" section.

The estimated composite transmissivity of the sand and gravel layers in the unconsolidated deposits ranges from less than 25,000 to about 300,000 gallons per day per foot.

Transmissivity is equal to the product of the hydraulic conductivity and aquifer thickness. Hydraulic conductivity values were assigned only to lithologic types considered permeable enough to have aquifer potential and were based on particle size.

The data presented here is intended for planning purposes only; additional data is necessary for the estimation of yields at specific sites.

The basin may be subdivided on the basis of ground-water availability into three approximately equal areas: north, central, and south. The northern one-third is the area of highest ground-water potential. This area has the thickest unconsolidated deposits and probably the largest number of aquifer units. The composite transmissivity of aquifers in this area is estimated to be at least 100,000 gallons per day per foot and in a few places may exceed 300,000 gallons per day per foot. Present data indicate that high-yield wells can be developed any place in this area.

The central one-third of the basin and the Teays Valley and tributary in the southern part of the basin have a generally lower ground-water potential than the northern area. This is due to fewer sand and gravel layers and a decrease in the particle size of the aquifer material. The composite transmissivity of unconsolidated aquifers in this area is estimated to range from 25,000 to 100,000 gallons per day per foot. High-yield wells may be developed at some sites in this area.

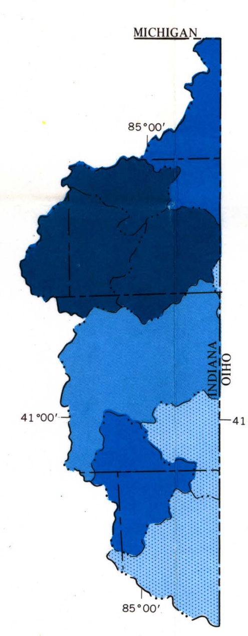
The southern one-third of the basin (excludes the preglacial valley and its tributary) is characterized by a relatively thin unconsolidated cover over bedrock. The principal aquifer in this area is the limestone and dolomite formation in the top 200 feet of the bedrock. The median transmissivity value of this aquifer is estimated to be about 23,000 gallons per day per foot. This part of the basin shows the least potential for the development of high-yield wells.

GROUND-WATER RUNOFF

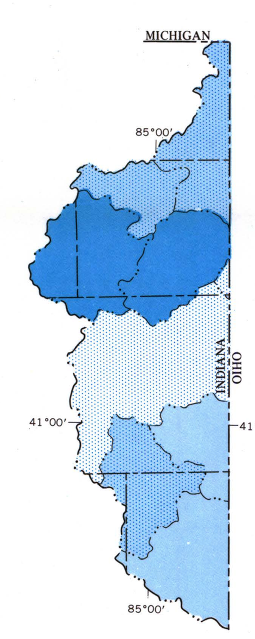
Runoff is all the water in a particular stream flowing past a place of measurement in that stream. Streamflow is a combination of surface runoff and ground-water runoff. During snowmelt and periods of prolonged, heavy precipitation, surface runoff is quickly carried off by streams. Water that is recharged to the ground-water reservoir during these periods is discharged more slowly and maintains streamflow during dry periods.

Estimates of ground-water runoff were made by separating the stream discharge hydrograph into overland runoff and base-flow components. The average ground-water runoff represents an approximation of the potential for development from ground-water sources, neglecting the effect of such development on streamflow. Ground-water runoff is expressed here in gallons per day (gpd) per square mile, and is assumed to be distributed evenly over the entire drainage area. These are regional estimates and not applicable for local development without further investigation.

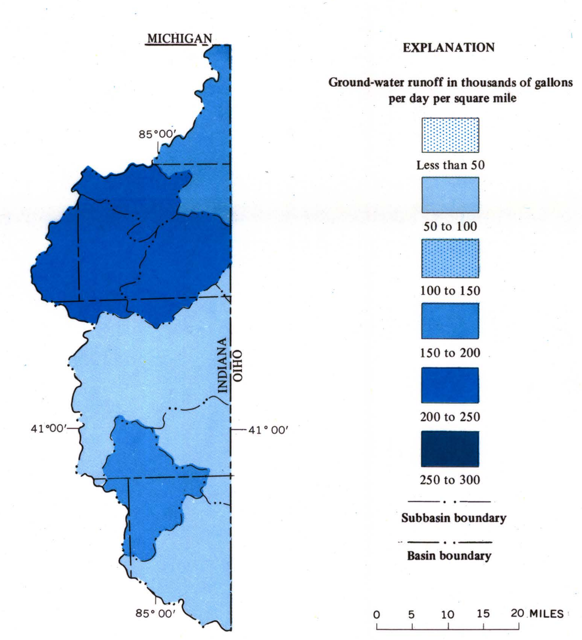
The average ground-water runoff from the basin is estimated to be 453 mgd or 213,000 gpd per square mile. The average ground-water runoff from the smaller subbasins ranges from 123,000 to 282,000 gpd per square mile. The smaller subbasins are defined by the intervening surface drainage between gaging stations, and thus do not necessarily reflect geologic control.



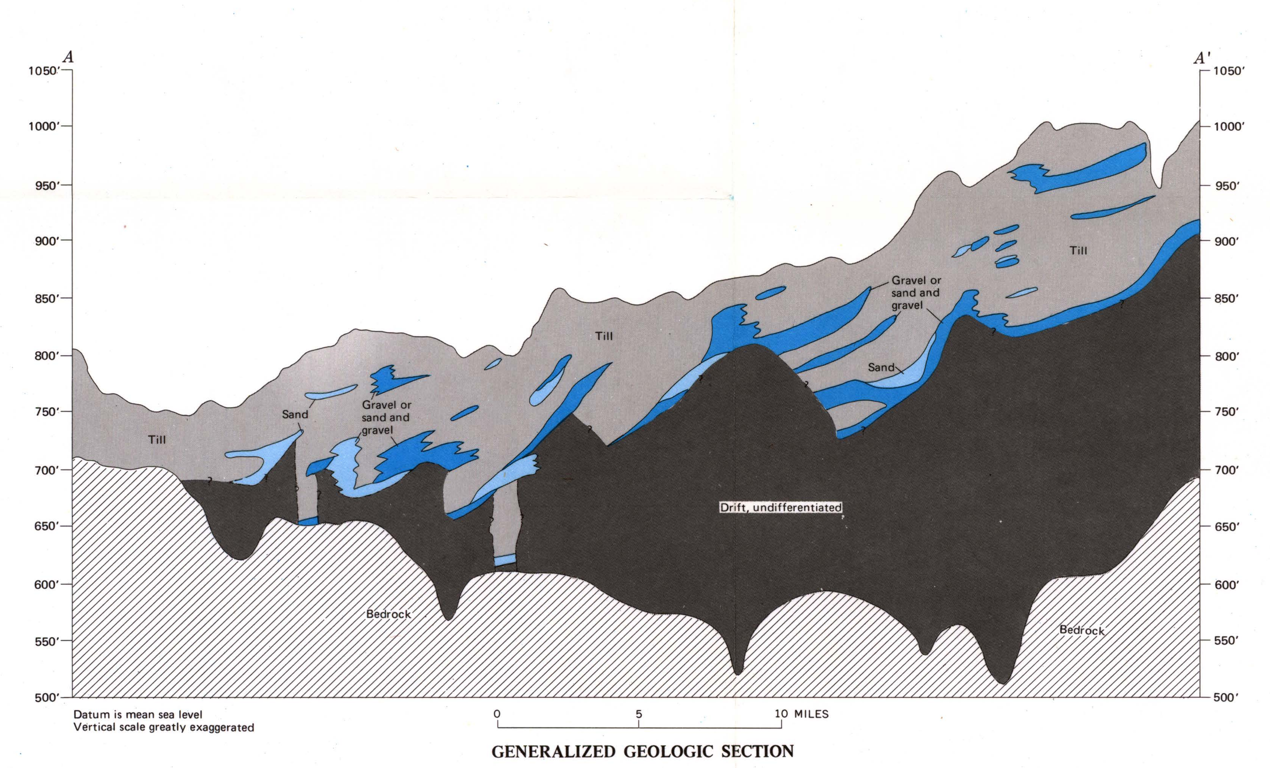
MAP SHOWING AVERAGE ANNUAL GROUND-WATER RUNOFF WITH 50 PERCENT PROBABILITY OF BEING EXCEEDED



MAP SHOWING AVERAGE ANNUAL GROUND-WATER RUNOFF WITH 90 PERCENT PROBABILITY OF BEING EXCEEDED



MAP SHOWING 5-YEAR AVERAGE GROUND-WATER RUNOFF WITH 90 PERCENT PROBABILITY OF BEING EXCEEDED



GENERALIZED GEOLOGIC SECTION

WATER RESOURCES OF THE MAUMEE RIVER BASIN, NORTHEASTERN INDIANA

By
R. A. Pettijohn and L. G. Davis

1973