University of Wisconsin-Extension

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A SUMMARY OF GEOLOGY AND MINERAL AND WATER RESOURCES OF ROCK COUNTY

by

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Physiography

Rock County is nearly equally divided between the Eastern Ridges and Lowlands Province and the Western Upland Province (fig. 1) as described by Martin (1916). The Western Upland Province is characterized by deep valleys and high ridges formed in bedrock with a thin soil or glacial drift veneer. The Eastern Ridges and Lowland Province is characterized by low relief and gentle slopes with thick glacial dirft cover over bedrock.

Prominent topographic features in Rock County are the flat outwash plains extending southeasterly across the north central part of the county and southward along the Rock River and the hilly morainal area in the northern part of the county.

Geology

Rock County is underlain by a thick section of sedimentary rocks of Cambrian and Ordovician age that consist largely of sandstone, a lesser amount of dolomite (a magnesium-rich limestone), and some shale. Overlying the sedimentary rocks are glacial deposits and alluvium consisting predominantly of till and outwash. The geologic map of Wisconsin (fig. 2)

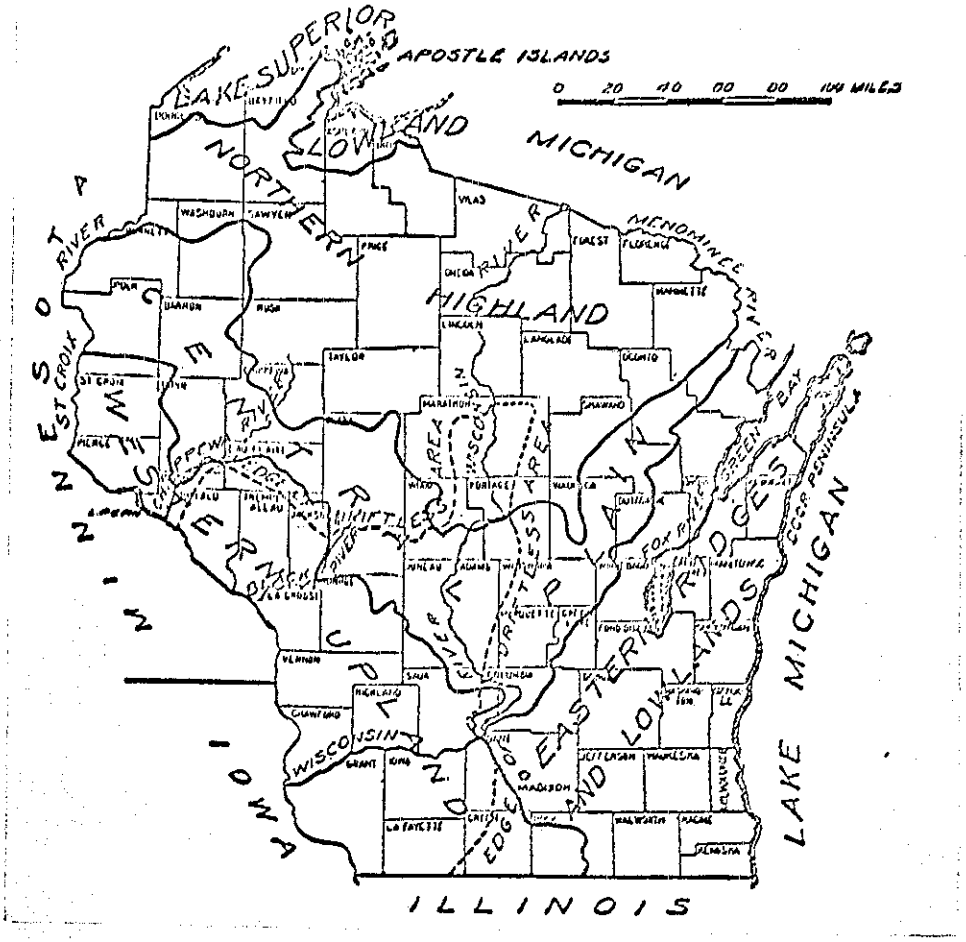
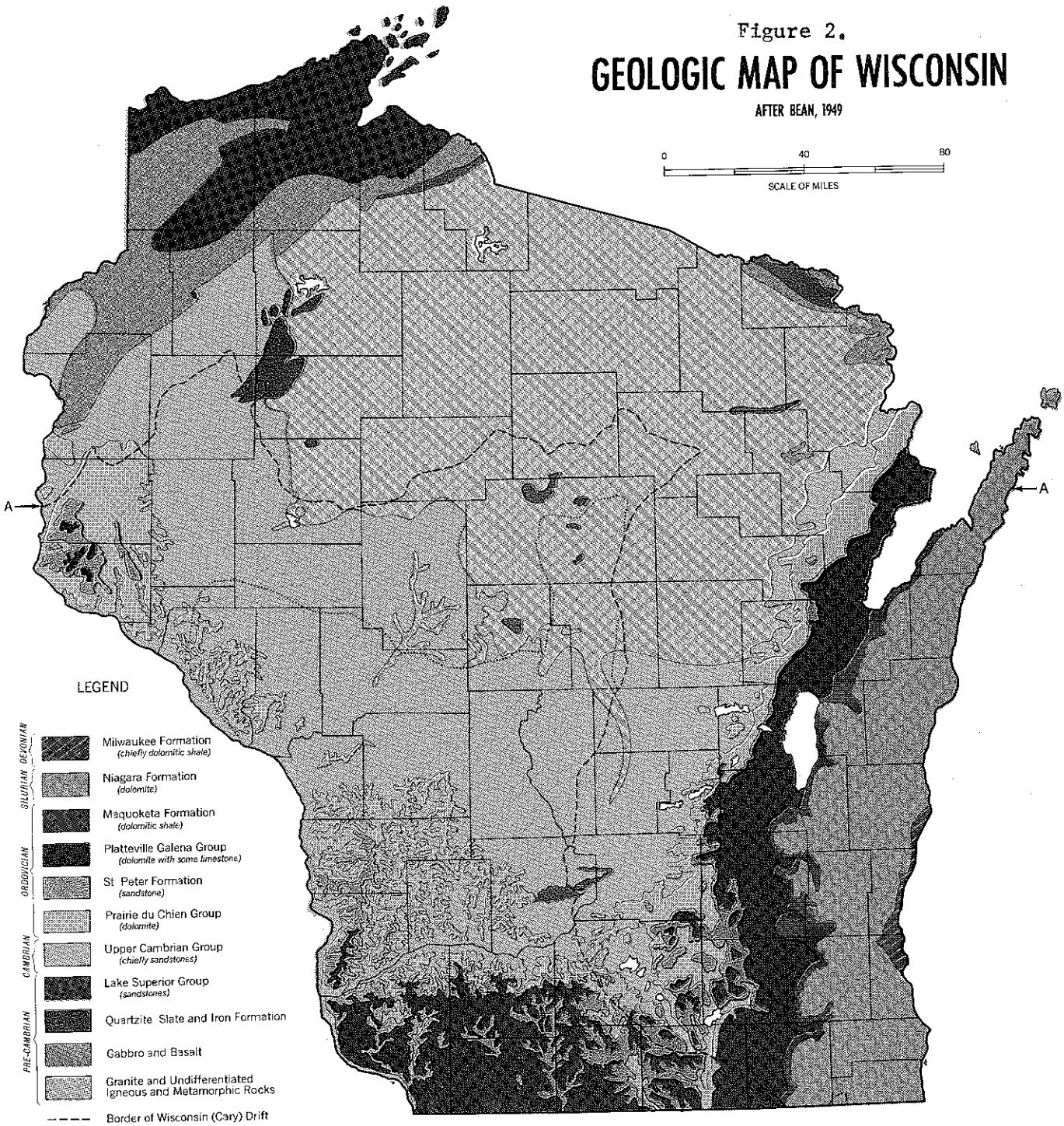


Figure 1. Physiographic provinces of Wisconsin. (After Martin, 1916)

Figure 2.

GEOLOGIC MAP OF WISCONSIN

AFTER BEAN, 1949



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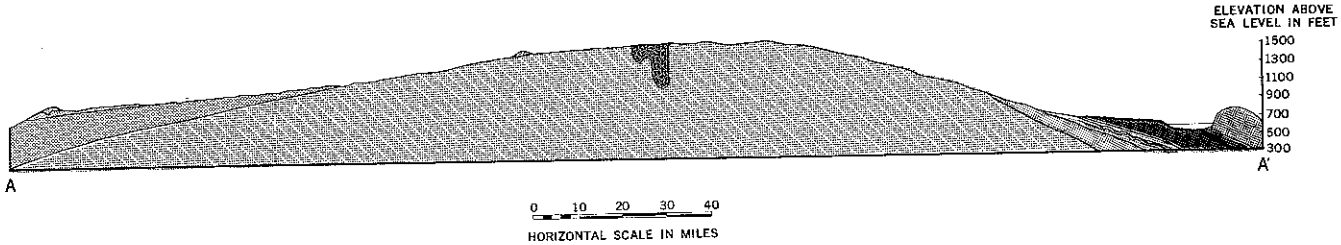
George F. Hanson, Director and State Geologist



shows the bedrock geology of Rock County and its relationship to the geology of Wisconsin. Similarly, the map of Wisconsin glacial deposits (fig. 3) outlines the glacial geology of the county and its relationship to surrounding areas. Table 1 is a summary of the lithology, maximum thickness, and water-bearing characteristics of the geologic units of Rock County.

Sandstones of late Cambrian age overlie crystalline rocks of Precambrian age throughout the county. Both the crystalline rock surface and the sedimentary rocks dip southeastward and the rocks of Cambrian age thicken in the direction of dip from about 950 feet in the northwestern corner to over 1300 feet in the southeastern corner of the county.

Rock formations of Cambrian age are, in ascending order, the Mt. Simon Sandstone, Eau Claire Sandstone, Galesville Sandstone, Franconia Sandstone, and Trempealeau Formation. In the Rock River and Sugar River valleys these rocks of Cambrian age underlie unconsolidated glacial deposits. Elsewhere they are overlain by rocks of Ordovician age.

Rock formations of Ordovician age include in ascending order the Prairie du Chien Group (dolomite), the St. Peter Sandstone, and the Platteville-Galena unit (dolomite). The Prairie du Chien Group and St. Peter Sandstone are exposed at the bedrock surface in the major river valleys and in much of the western part of the county. Bedrock east of the Rock River valley and ridge tops west of the valley are formed by the Platteville-Galena unit. The Prairie du Chien Group was greatly thinned by erosion before deposition of the St. Peter Sandstone. Because it was laid down on this uneven erosion surface, the St. Peter varies considerably

Figure 3.

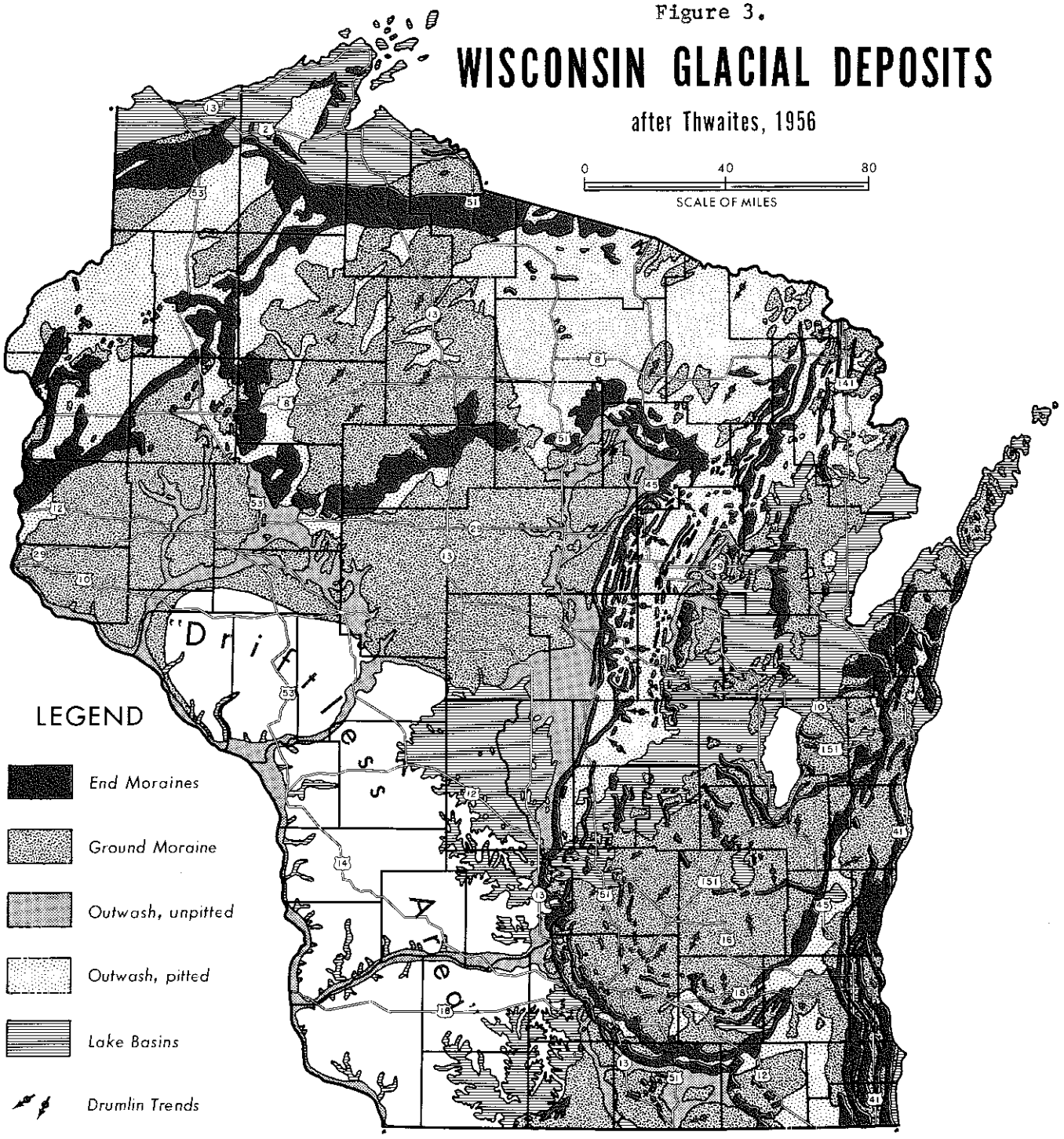


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Table 1. Lithologic and water-bearing characteristics of geologic units in Rock County, (After LeRoux, 1963)

System	Geologic unit	Maximum thickness (ft)	Description	Water-bearing characteristics
Quaternary	Recent alluvium		Silt, sand, peat, and marl.	Not determined. Probably too thin to yield significant quantities of water to wells.
	—— Unconformity ——			
	Pleistocene deposits	382	Till and outwash, gray to brown; consists of clay, silt, sand, gravel, and boulders.	Outwash sand and gravel in the Rock River valley yields large amounts of water. Other bodies of sand and gravel yield moderate amounts of water to properly developed wells.
	—— Unconformity ——			
Ordovician	Platteville, Decorah, and Galena formations, undifferentiated.	288	Dolomite, light-gray to blue-gray, yellowish-gray, sandy, fractured at top, fine- to medium-grained sandstone at base; and green shale.	Yield sufficient water for domestic and stock use from fractures and solution openings. Principal source of supply for wells east of the buried Rock River valley.
	St. Peter sandstone.	185	Sandstone, yellowish-gray to white, fine- to medium-grained; white chert and chert conglomerate; and red shale.	Yields sufficient water for domestic, stock, and small industrial supplies. Principal source of ground water west of the buried Rock River valley. Usually left uncased to contribute water to wells tapping rocks of Cambrian age.
	—— Unconformity ——			
Cambrian	Prairie du Chien group.	60	Dolomite, yellowish-brown to gray; and white and gray chert.	Not determined.
	Trempealeau formation	960	Sandstone, white, gray, red, fine- to very coarse-grained, dolomitic; siltstone, shale; and dolomite.	Yield large amounts of water to deep wells throughout the county. Lower part usually more permeable.
	Franconia sandstone			
	Galesville sandstone			
	Eau Claire sandstone			
	Mount Simon sandstone			
	Dresbach group			
	—— Unconformity ——			
Precambrian	Crystalline rocks	?	Not penetrated by wells in Rock County.	Not determined. May yield some water from possible weathered and creviced zone.

in thickness. The Prairie du Chien is thin at Edgerton, Janesville, Brodhead, Footville and Milton. Elsewhere it is absent and the St. Peter Sandstone rests directly on sandstones of Cambrian age.

Unconsolidated glacial deposits overlie bedrock throughout the county (fig. 3) and represent at least two stages of glaciation. Approximately the northern one third of the county is covered by terminal and recessional moraines of the Wisconsinan Stage of glaciation. Extensive outwash deposits associated with this terminal moraine extend southeasterly across the county south of the moraine and southward along the Rock River valley. The remainder of the county is covered largely by ground moraine of an earlier episode of Wisconsinan Stage glaciation.

The terminal and recessional moraines in the northern part of the county consist largely of unsorted and unstratified clay, silt, sand, gravel, and boulders and the deposit is relatively thick. The older ground moraine is of a similar composition but generally is thin, highly weathered, and somewhat eroded. Outwash consists largely of silt, sand, and sand and gravel with some cobbles and boulders and is well sorted and stratified. Outwash deposits in the Rock River valley, which is underlain by a deep preglacial valley cut in the bedrock surface, have a reported thickness over 300 feet.

Mineral Resources

The principal mineral production from Rock County includes only sand and gravel and crushed and broken limestone (Olson, 1966). Reported production of sand and gravel, representing 86 percent of the county mineral

value and a 49 percent increase over the previous year, was 2.4 million tons in 1966. Fifty-six percent of this sand and gravel was used for building, 25 percent for road construction, and 19 percent for railroad ballast, molding sand, and fill. The principal production came from deposits of glacial outwash near Janesville, Edgerton, Beloit, and Shopiere and from the St. Peter Sandstone near Hanover.

Crushed and broken limestone production in the county was about 406,000 tons in 1966. The stone was used for concrete aggregate, road construction, aglime, and riprap. Principal production was from quarries in the Platteville Formation and Galena Dolomite located near Footville, Beloit, Milton, Clinton, Janesville, Evansville, and Allens Grove.

Rock County has large reserves of sand and gravel from the extensive outwash deposits (fig. 3) in the county. Large reserves of limestone are available from ridge tops located west of the Rock River and from about the eastern one third of the county where overburden is thin (fig. 2).

Surface Water

Rock County is partly in the Rock River basin and partly in the Sugar River and Coon Creek basins. The Rock River flows southward through the central part of the county with a gradient of about 1.4 feet per mile. The northwestern part of the county is drained by the Yahara River which flows southeastward to join the Rock about four miles south of Edgerton. The Rock is joined by Marsh Creek north of Janesville which flows generally eastward. The western and southwestern parts of the county are drained by the Sugar River and Coon Creek which flow southeasterly into Illinois to join the Pecatonica River which in turn empties into the Rock.

Turtle Creek drains the southeastern part of the county flowing westward and southward to join the Rock just south of the Illinois border. The upper part of Turtle Creek and the Rock and Sugar rivers are all discharge areas for ground water which makes up a considerable part of their flow. The lower part of Turtle Creek loses water to the ground water body as it enters the flat outwash deposits in the Rock River valley.

Three U. S. Geological Survey stream gaging stations are located in Rock County on the Rock River at Afton, Turtle Creek near Clinton and the Sugar River near Brodhead. Table 2 summarizes data from the gaging stations.

Table 2 Stream Gaging Stations in Rock County

	Period of record	Area of drainage basin	Average discharge	Maximum flow	Minimum flow
Rock River at Afton	1914-66	3,300 sq.mi.	1,715 cfs	13,000 cfs	22 cfs
Turtle Creek near Clinton	1939-66	186 sq.mi.	103 cfs	6,560 cfs	8 cfs
Sugar River near Brodhead	1914-66	527 sq.mi.	335 cfs	14,800 cfs	35 cfs

Industrial cooling and recreation on the lakes and streams are probably the principal uses of surface water in Rock County. Surface water is not used for municipal or industrial supply except for cooling.

Chemical quality of streams in Rock County generally is adequate for most uses and reflects the chemical quality of ground water which makes up much of the stream flow. Selected chemical analyses are shown in Table 3. Chemical quality of streams will vary with discharge; greatest mineralization will occur during low flow conditions when stream flow is

largely ground water discharge and mineralization will be least with high flow conditions when much of the streamflow is from surface runoff. Analyses in Table 3 all reflect low flow conditions.

Table 3 Selected Chemical Analyses of Streams in Rock County

(all values except pH and flow in parts per million; analyses by U. S. Geological Survey)

	Rock River at Afton	Turtle Creek near Clinton	Marsh Creek near Janesville	Yahara River near Fulton
Silica (SiO_2)	10	9.5	15	14
Iron (Fe)	.16	.13	.2	.17
Manganese (Mn)	.0	.05	.0	.02
Calcium (Ca)	56	71	99	56
Magnesium (Mg)	38	39	39	29
Sodium (Na)	27	10	3.0	24
Potassium (K)	3.3	1.5	.9	3.8
Bicarbonate (HCO_3)	316	341	301	264
Sulfate (SO_4)	39	43	128	36
Chloride (Cl)	37	20	7.0	34
Fluoride (F)	.6	.4	.2	.4
Nitrate (NO_3)	.2	13	4.9	8.6
Phosphorus as PO_4	---	---	.02	3.5
Dissolved Solids	376	368	461	348
Hardness as $CaCO_3$	296	338	408	259
Noncarbonate	36	58	157	42
pH	7.1	7.9	8.2	7.8
Estimated flow, cfs	452	38	38	---
Date	Oct 27, 1966	Oct 27, 1966	Nov 13, 1967	Nov 15, 1967

Hydrogeology

Ground water availability depends chiefly on the character and thickness of water-bearing rocks. Although bedrock formations are of moderate permeability in Rock County, high capacity wells can be easily developed because of the great saturated thickness of rocks of Cambrian and Ordovician age. Wells penetrating the sandstones of Cambrian age and the St. Peter Sandstone generally will yield up to 1000 gpm (gallons per minute) or more in most areas of the county.

The best water yielding units of the bedrock formations appear to be the Mt. Simon Sandstone, Galesville Sandstone, and the St. Peter Sandstone. The Franconia Sandstone, Eau Claire Sandstone, and Trempealeau Formation yield moderate to small amounts of water to wells penetrating the more productive units. The Platteville-Galena unit generally yields only small quantities of water to wells but it is important as an aquifer for domestic wells particularly east of the Rock River. The St. Peter Sandstone is an important source of water for domestic wells west of the Rock River valley. The Prairie du Chien Group is not considered an aquifer in Rock County. Water-bearing characteristics of geologic units are outlined in Table 1.

Thick and highly permeable outwash deposits consisting of generally well sorted and stratified sand and sand and gravel fill a preglacial bedrock valley system to a depth of more than 300 feet in its deepest part and up to two miles in width. This valley system generally underlies the present Rock River and its tributaries. Yields of more than 5000 gpm with only seven feet of drawdown have been obtained from wells penetrating

the outwash. Large yields can be obtained from outwash in much of the Rock River valley. Permeable outwash deposits are present also in the Sugar River valley and in a narrow valley extending east and west from Milton (fig. 3). Small yields are obtained from wells penetrating lenses and layers of sand and gravel in glacial till elsewhere in the county but these wells generally are adequate only for domestic use.

Ground Water Use

Withdrawal of groundwater in Rock County for all purposes was about 23 mgd in 1957 (LeRoux, 1963). Of the 23 mgd one half was used for municipal supply, one third for industrial purposes, and one sixth for domestic and stock purposes. About 90 percent of the water was pumped in the heavily industrialized area along the Rock River.

Table 4 Municipal pumpage of ground water in the Rock River basin Rock County, Wisconsin in 1957 and 1966

City or Village	1957 Daily Pumpage (Mgd) Average	1957 Daily Pumpage (Mgd) Maximum	1966 Daily Pumpage (Mgd) Average	1966 Daily Pumpage (Mgd) Maximum
Janesville	6.3	10.49	8.9	16.0
Beloit	4.4	8	5.9	8.8
Edgerton	.33	.65	.44	.85
Milton	.15	.28	.14	.34
Clinton	.11	.20	.12	.22
Footville	.05	---	.07	.22
TOTAL	11.34		15.57	

Municipal pumpage in the Rock River basin for 1957 and 1966 are summarized in Table 4. Figures for total pumpage in the basin are not available. The totals in Table 4 show pumpage has increased about 37 percent in the Rock River basin in the nine years between 1957 and 1966. Pumpage in the county for uses other than municipal supply undoubtedly has also increased during the 1957-66 period but probably not as much as municipal pumpage. Present water use represents only a small part of the water that can be withdrawn perennially from the ground water reservoir (LeRoux, 1963).

Quality of Ground Water

Ground water in Rock County is generally a hard calcium magnesium bicarbonate type which is slightly alkaline. Although differences occur, water from the several water bearing units in the county are similar in chemical quality. Iron in the water is excessive in places, but generally it is not a problem.

A summary of chemical constituents in ground waters of the county is shown in Table 5.

Table 5 Summary of chemical constituents of ground water in Rock County, Wis.

(In parts per million, except pH)

	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Dissolved solids	Hardness as $CaCO_3$	pH
Average	12	0.6	60	34	6.9	343	14	6.4	310	317	7.5
Maximum	18	5.4	73	40	15	460	52	17	422	386	7.8
Median	9.8	.2	60	34	6.3	345	9.4	6.0	304	310	7.4
Minimum	8.4	.0	49	26	.0	277	.0	1.2	230	260	7.2
Number of analyses	10	33	30	30	30	44	44	44	42	37	27

Summary

Rock County is nearly equally divided between the Western Upland and Eastern Ridges and Lowland Provinces as defined by Martin (1916). Prominent topographic features are the Rock River valley and associated flat lying plains and a hilly area in the northern part of the county.

A thick section of sedimentary rocks of Cambrian and Ordovician age, predominantly sandstones, underlie extensive Pleistocene outwash plains, older ground moraine, and terminal and recessional moraines. Sedimentary rocks range from about 950 feet to 1300 feet in thickness. Glacial drift thickness is over 300 feet in the Rock River valley.

Mineral resources of the county include sand and gravel and crushed and broken limestone. Production of sand and gravel and limestone in 1966 was 2.4 million tons and 406,000 tons, respectively. Extensive reserves remain in the county.

Rock County is drained by the Rock River and its tributaries and the Sugar River and Coon Creek. Three U. S. Geological Survey gaging stations in the county show an average (for period of record) discharge of 1,715 cfs (cubic feet per second) for the Rock River at Afton; 103 cfs for Turtle Creek near Clinton; and 335 cfs for the Sugar River near Brodhead. Chemical quality of streams generally is adequate for most uses and reflects the quality of ground water. For the most part there is no withdrawal use of surface water in the county.

Extremely large quantities of ground water can be obtained from thick outwash deposits in the Rock River valley in Rock County. Yields in excess

of 5,000 gpm with little drawdown can be expected from properly constructed wells in the deepest part of the buried valley. Yields of 1000 gpm or more can be obtained from sandstones of Cambrian and Ordovician age throughout most of the county. Adequate supplies of ground water for domestic and stock use also are available from the Platteville-Galena unit, the St. Peter Sandstone, or sand and gravel layers in unconsolidated Pleistocene deposits.

About 23 mgd was pumped from wells in 1957 in the county and 90 percent of this water was withdrawn in the Rock River basin. This pumpage represents only a small part of the water that can be withdrawn perennially from the ground water reservoir. Average municipal pumpage in the Rock River basin increased about 37 percent between 1957 and 1966 from 11.34 mgd to 15.57 mgd.

Ground water in the county generally is a hard calcium magnesium bicarbonate type that is slightly alkaline and is adequate for most uses.

Bibliography

Bean, E. F., 1949, Geologic Map of Wisconsin: Wisconsin Geological and Natural History Survey.

LeRoux, E. F., 1963, Geology and Ground-Water Resources of Rock County Wisconsin: U. S. Geological Survey Water-Supply Paper 1619-X, 50 p.

Martin, Lawrence, 1916, The Physical Geography of Wisconsin: Wisconsin Geological and Natural History Survey Bulletin XXXVI, 549 p.; repr. 1932, 609 p., 1965, 608 p.

Olson, K. S., 1966, The Mineral Industry of Wisconsin, in the Minerals Yearbook: U. S. Bureau of Mines Minerals Yearbook, v. III, p.853-869.

Thwaites, F. T., 1956, Wisconsin Glacial Deposits: Unpublished map in the files of the Wisconsin Geological and Natural History Survey.