INTRODUCTION

Northwestern Missouri is primarily an agricultural area with livestock and livestock products furnishing the greatest source of farm revenue. Although several of the larger towns in the area have been successful in attracting industries, significant urban expansion is expected to occur only in those counties near Kansas City, notably, Platte, Clay, and Ray Counties. The populations of these counties increased by 32, 39, and 14 percent, respectively, during the 8-year period, 1960-67, while the populations of most of the other counties in the area decreased during the same period (Missouri State Highway Department, 1968).

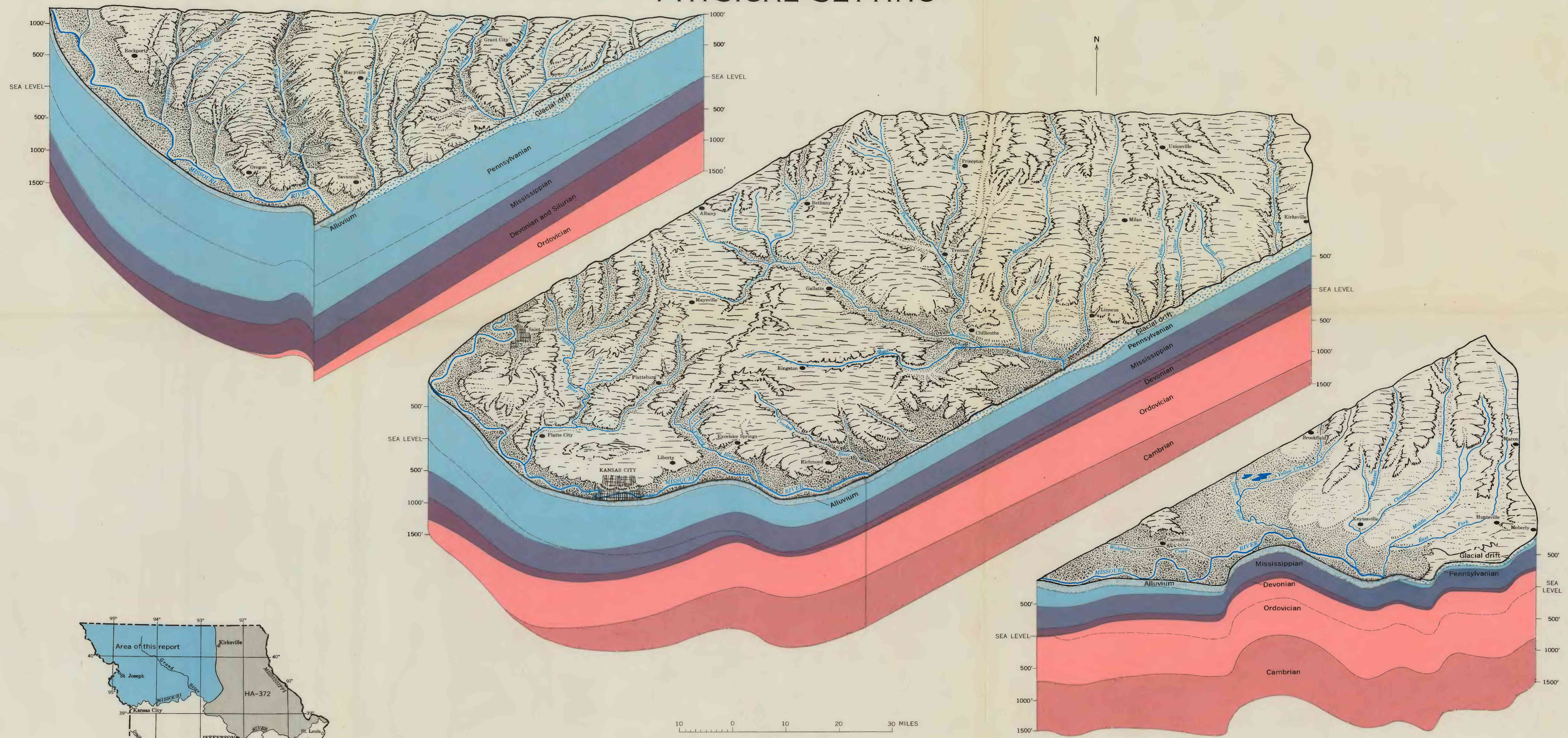
An important limiting factor in the development of any area is the availability of adequate water resources information on which to base the many water-related planning decisions. The purpose of this atlas is to present a general summary of information concerning the occurrence, availability, use, and quality of water in northwestern Missouri. Also included is a definition of problems and potentials which should be considered in the development of the water resources of the area.

This atlas covers an area of approximately 13,000 square miles. The study area is bounded on the east by the eastern drainage divide of the Chariton and Little Chariton Rivers, on the south by the southern edge of the Missouri River flood plain, on the west by the Missouri River, and on the north by the Missouri-Iowa border.

This investigation was made in cooperation with the Missouri Geological Survey and Water Resources. Special appreciation is expressed to the many individuals, public utilities, private industries, and representatives of other State and Federal agencies who furnished information and assistance for this study.

The nomenclature used in this atlas follows that of the U.S. Geological Survey and the Missouri Geological Survey and Water Resources. However, there are some variations from the current usage of the Missouri Geological Survey.

PHYSICAL SETTING



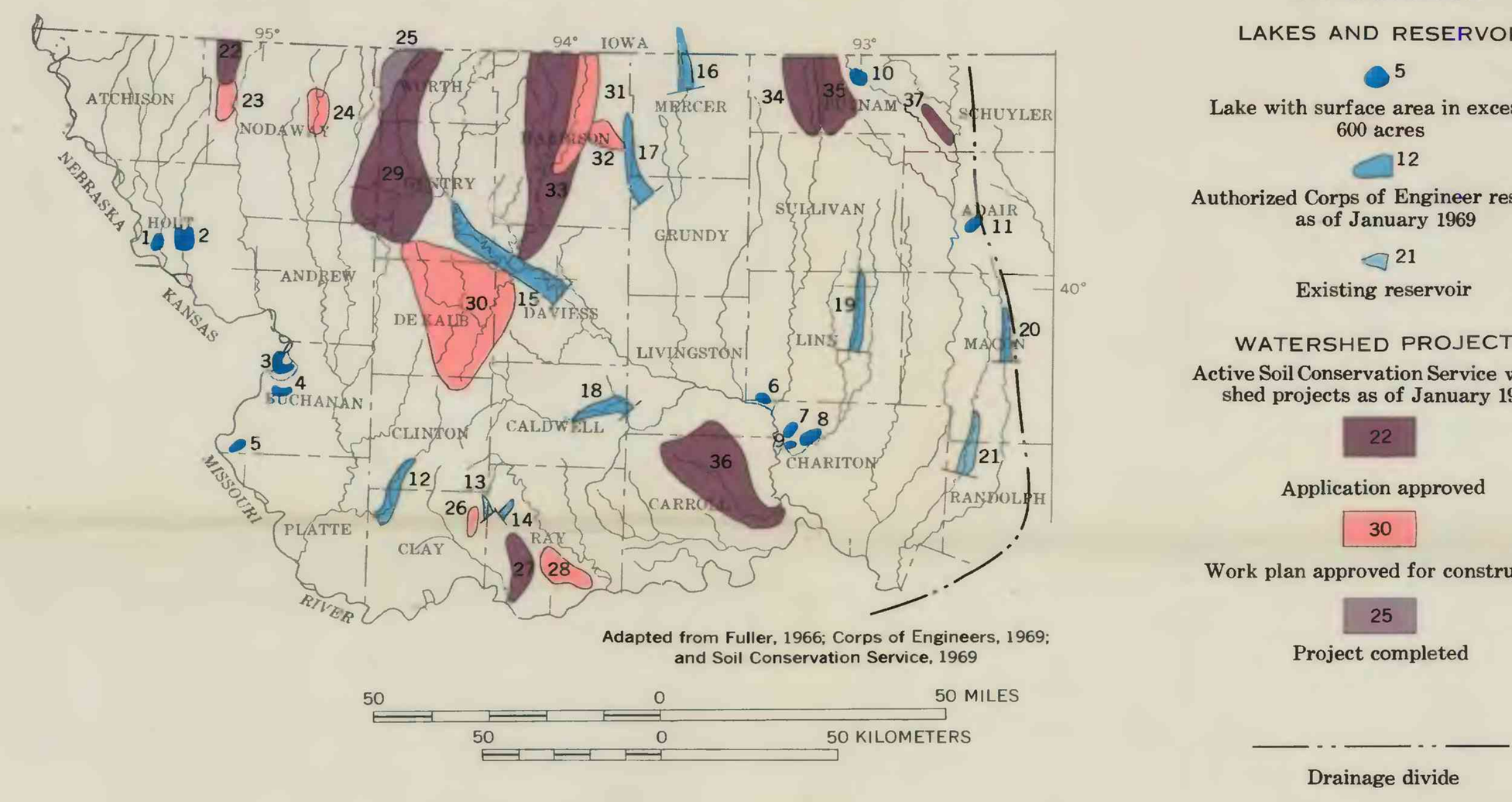
THE LAND SURFACE IN NORTHWESTERN MISSOURI IS GENTLY UNDULATING WITH GREATEST RELIEF IN THE NORTHWESTERN PART OF THE AREA WHERE TRIBUTARY STREAMS HAVE DISSECTED THE MORE ABUNDANT AND EASILY ERODED LOESS DEPOSITS.—*Land surface altitudes range from 1,220 feet in the northwestern part of the area to 620 feet in the southeastern part. The larger streams originate in southern Iowa and flow in a southerly or southeasterly direction into the Missouri River.*

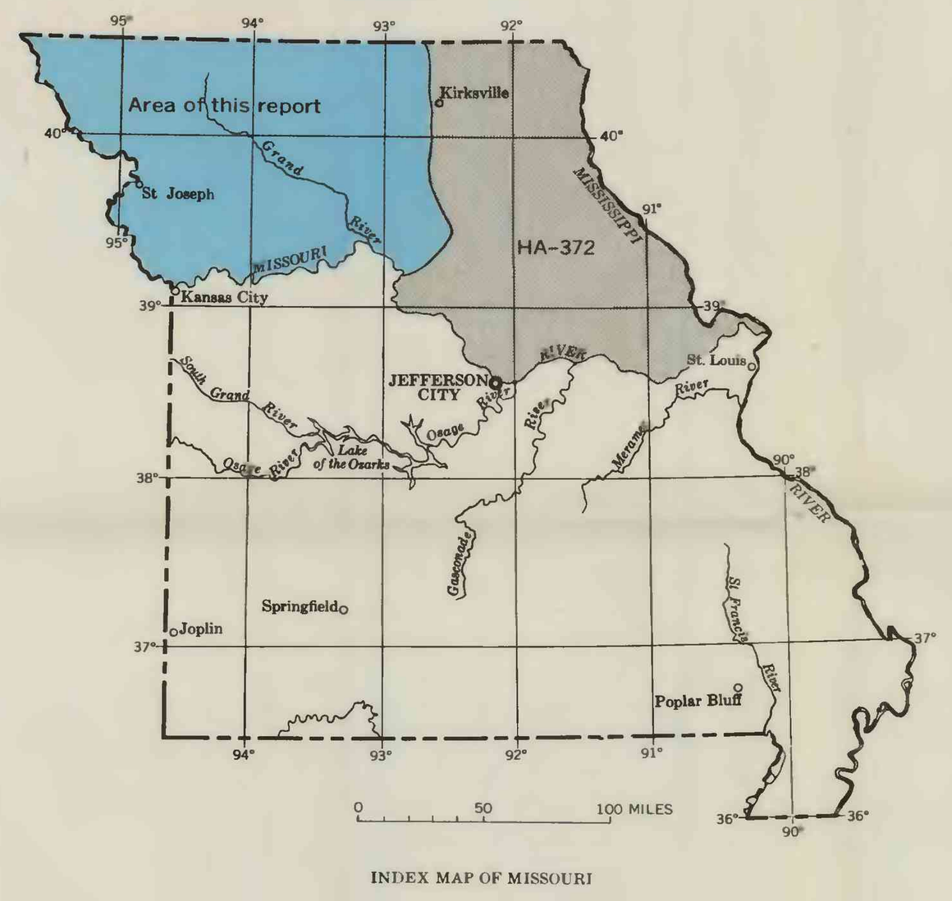
Bedrock formations have a gentle dip to the northwest and all systems from the Cambrian to the Pennsylvanian are represented in most areas. The thickness of rocks of Pennsylvanian age and Devonian and Silurian age increases toward the northwest; that of Ordovician and Cambrian age decreases in the same direction.

Map number	Existing lakes	Surface area (acres)
1	Big Lake	700
2	Squaw Creek Wildlife Refuge	
3	Browning Lake	2, 560
4	Lake Contrary	1, 280
5	Sugar Lake	1, 920
6	Fountain Grove Wildlife Refuge	2, 150
7	Swan Lake	2, 000
8	Silver Lake	3, 000
9	South Lake	1, 000
10	Lake Thunderhead	1, 500
11	Forest Lake	703

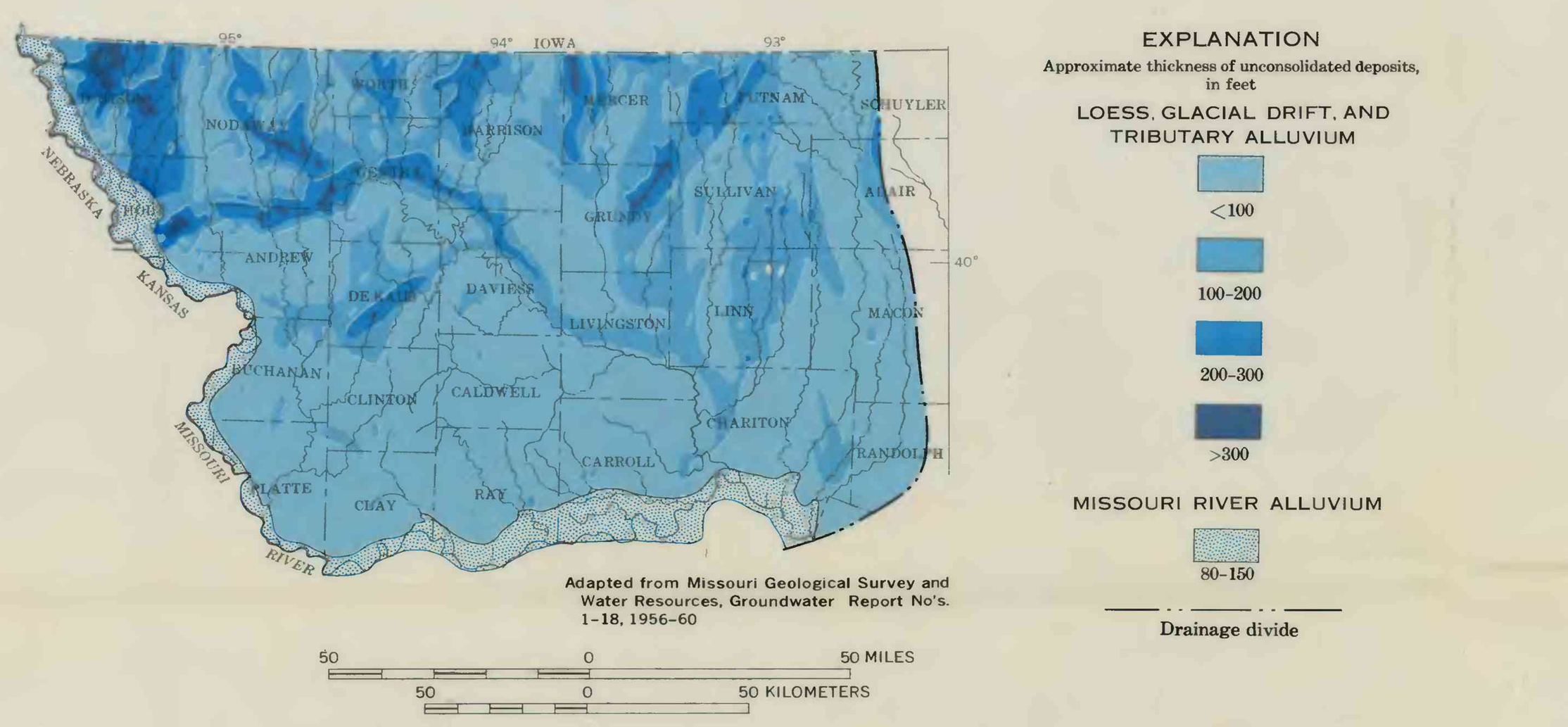
Map number	Existing or authorized reservoirs	Total storage capacity (acre-feet)
12	Smithville	289, 400
13	Dry Fork	3, 670
14	East Fork	27, 000
15	Pattonsburg	2, 720, 000
16	Mercer	625, 700
17	Trenton	1, 675, 000
18	Braymer	573, 500
19	Brookfield	215, 600
20	Long Branch	67, 900
21	Thomas Hill	85, 175

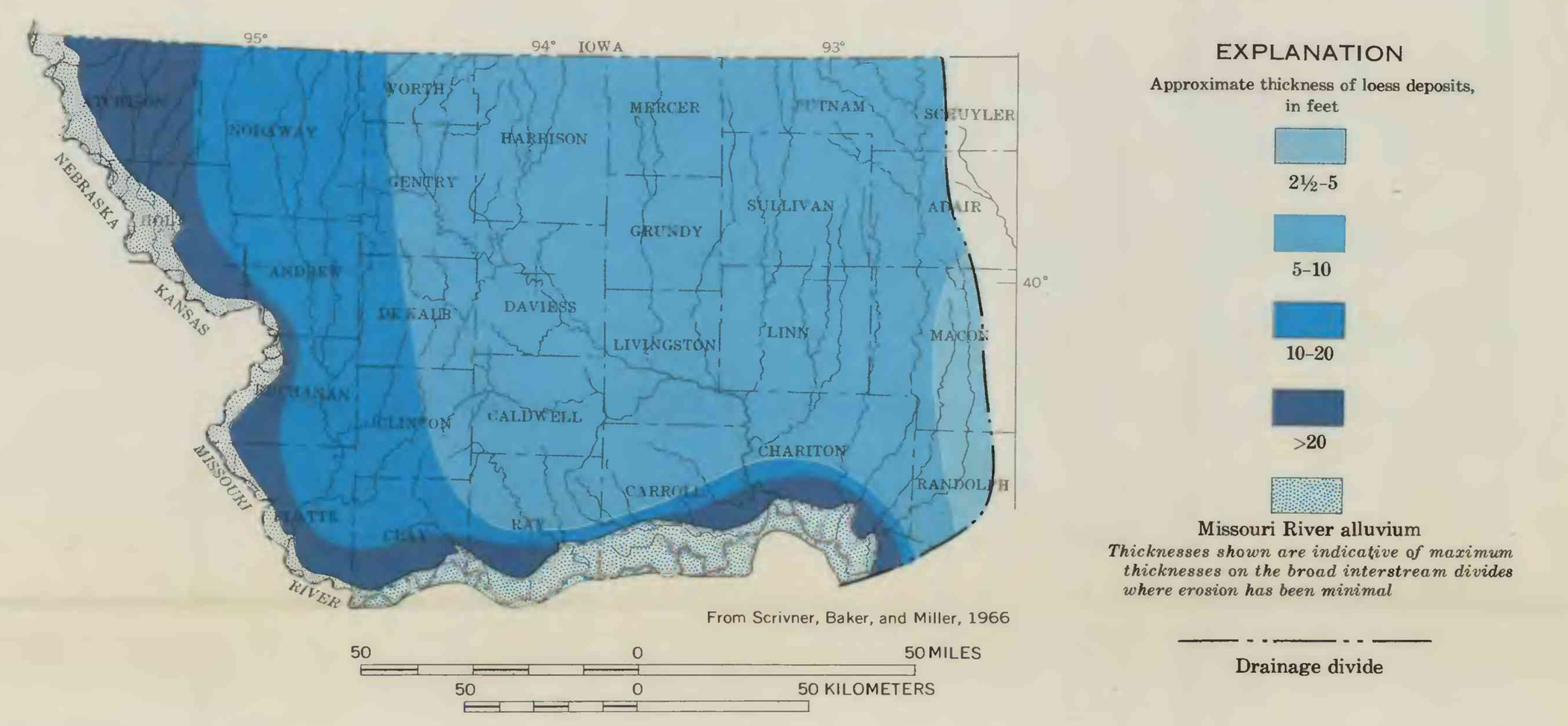
Map number	Active watershed projects	Drainage area (sq mi)
22	Mill Creek	40. 0
23	Hoover-Frankum	28. 6
24	102 River tributaries	30. 2
25	Platte River tributaries	20. 0
26	Williams Creek	21. 4
27	Kinney-Rollins Creek	39. 1
28	Willow Creek	26. 8
29	West Fork Grand River	287
30	Grindstone-Lost-Muddy Creek	327
31	East Fork Big Creek	82. 4
32	Panther Creek	34. 4
33	Big Creek tributaries	209
34	West Locust	41. 0
35	East Locust	65. 4
36	Big Creek	17. 0
37	Wildcat Creek	10. 8



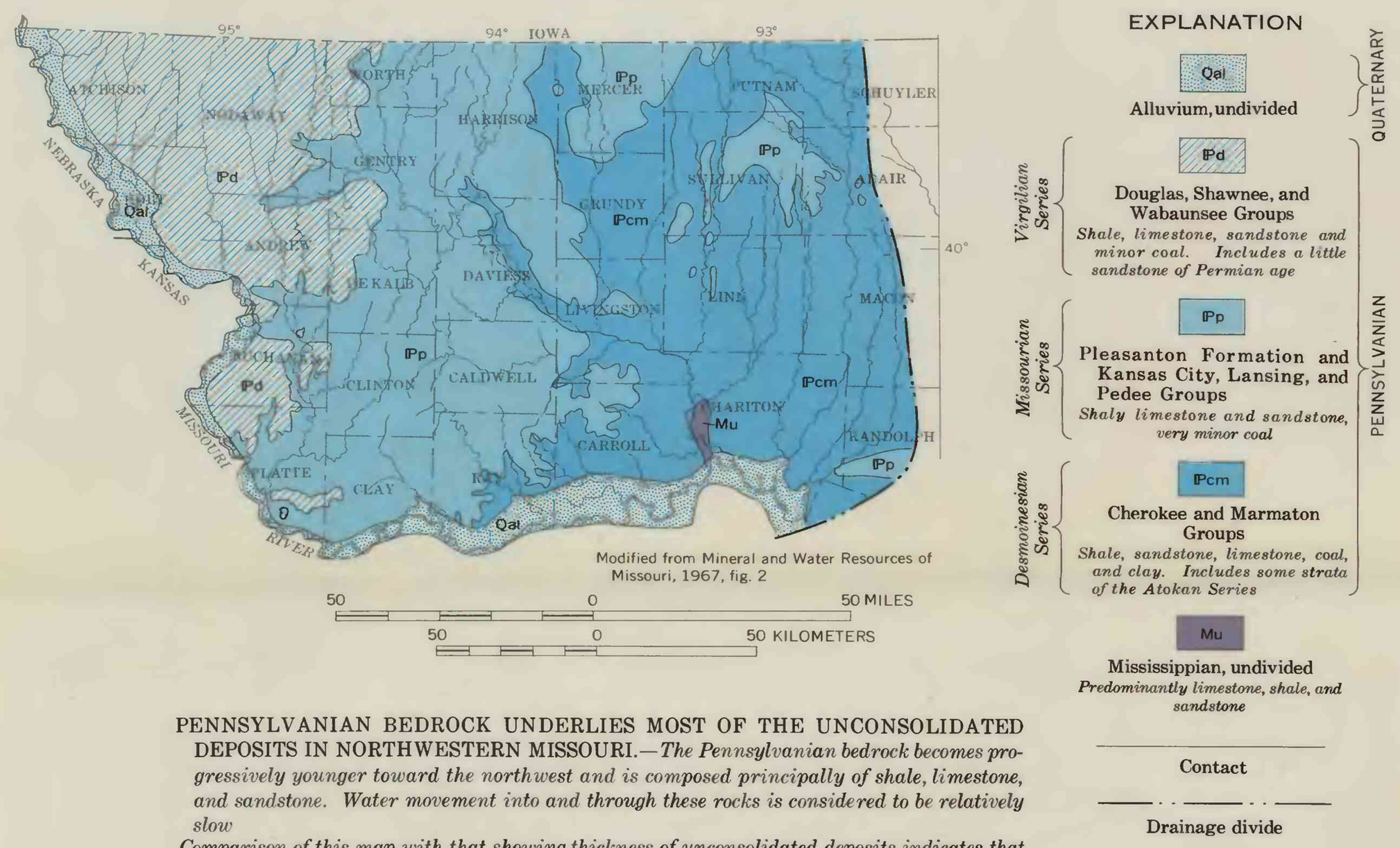


LAKES, RESERVOIRS, AND WATERSHED PROJECTS HELP TO STABILIZE STREAMFLOW, TO REDUCE DAMAGES FROM FLOODS AND EROSION, AND TO PROVIDE SITES FOR WATER-BASED RECREATION.—*Approximately 240 lakes, mostly man-made, with surface areas in excess of 5 acres are known to exist in northwestern Missouri. Numerous oxbow lakes, generally less than 600 acres in size, exist on the flood plain of the Missouri River. Several large reservoirs and watershed projects have been approved for future construction in the area.*



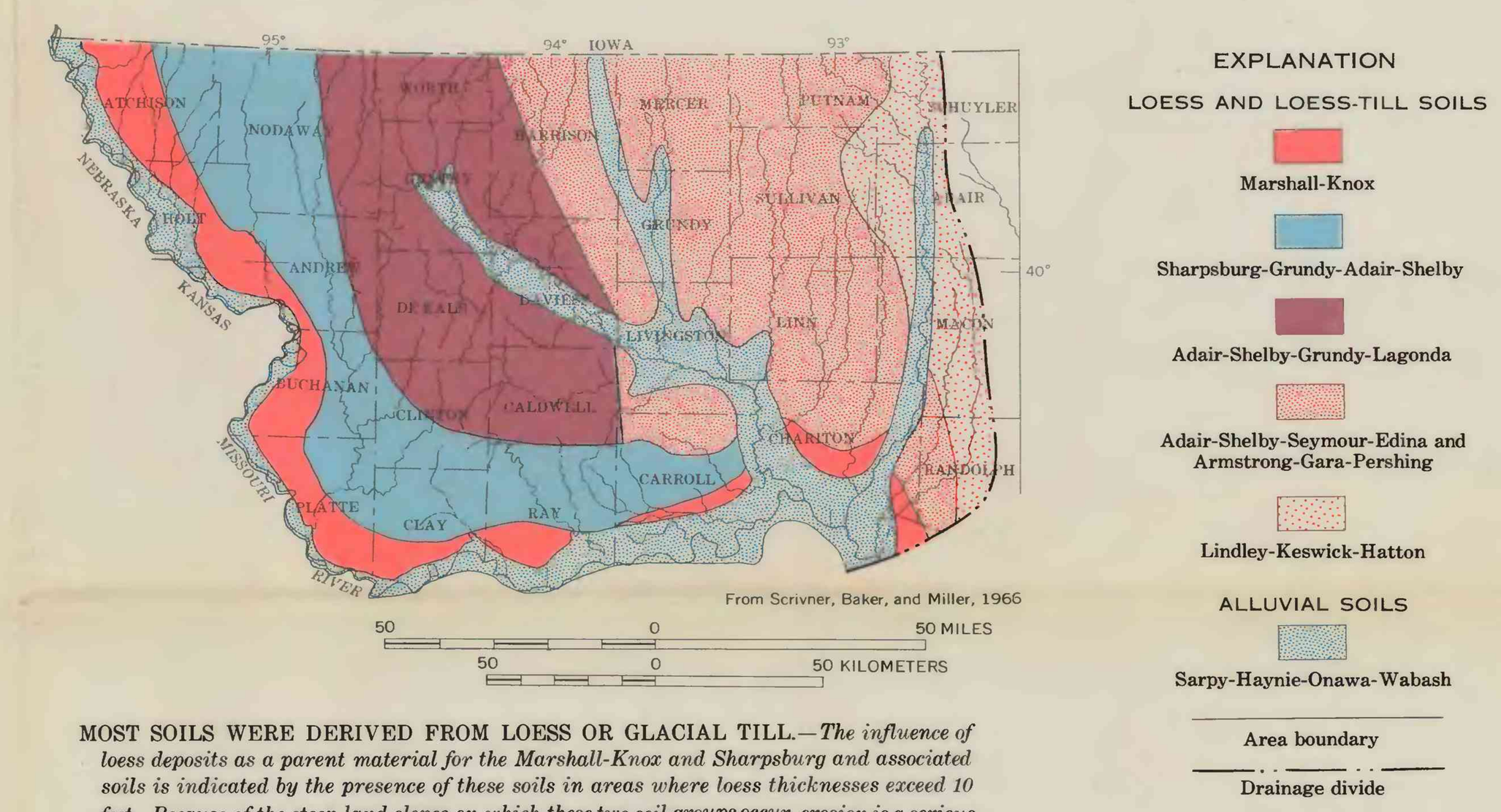


SURFICIAL DEPOSITS OF LOESS, GLACIAL DRIFT, AND ALLUVIUM MANTLE BEDROCK IN NORTHWESTERN MISSOURI.—*These unconsolidated deposits are less than 100 feet in thickness over much of the area but are greater than 300 feet in thickness in some areas where preglacial valleys are filled with glacial deposits. Loess, a silty, wind-blown material, covers the drift to depths in excess of 20 feet along the bluffs adjacent to the Missouri River. Most streams have eroded their channels through the loess and into the drift and some have eroded to bedrock. Outcrops of bedrock are found in most counties.*



PENNSYLVANIAN BEDROCK UNDERLIES MOST OF THE UNCONSOLIDATED DEPOSITS IN NORTHWESTERN MISSOURI.—*The Pennsylvanian bedrock becomes progressively younger toward the northwest and is composed principally of shale, limestone, and sandstone. Water movement into and through these rocks is considered to be relatively slow*

Comparison of this map with that showing thickness of unconsolidated deposits indicates that the existing bedrock surface was shaped largely prior to the final stages of glaciation and was later mantled by thick deposits of glacial materials as the ice receded. Indentations of rocks of the Demoinesian Series into rocks of the Missourian Series in the central part of the area and similar indentations of rocks of the Missourian Series into rocks of the Virgilian Series in the western part of the area correspond to former bedrock valleys which were filled by the receding glaciers.

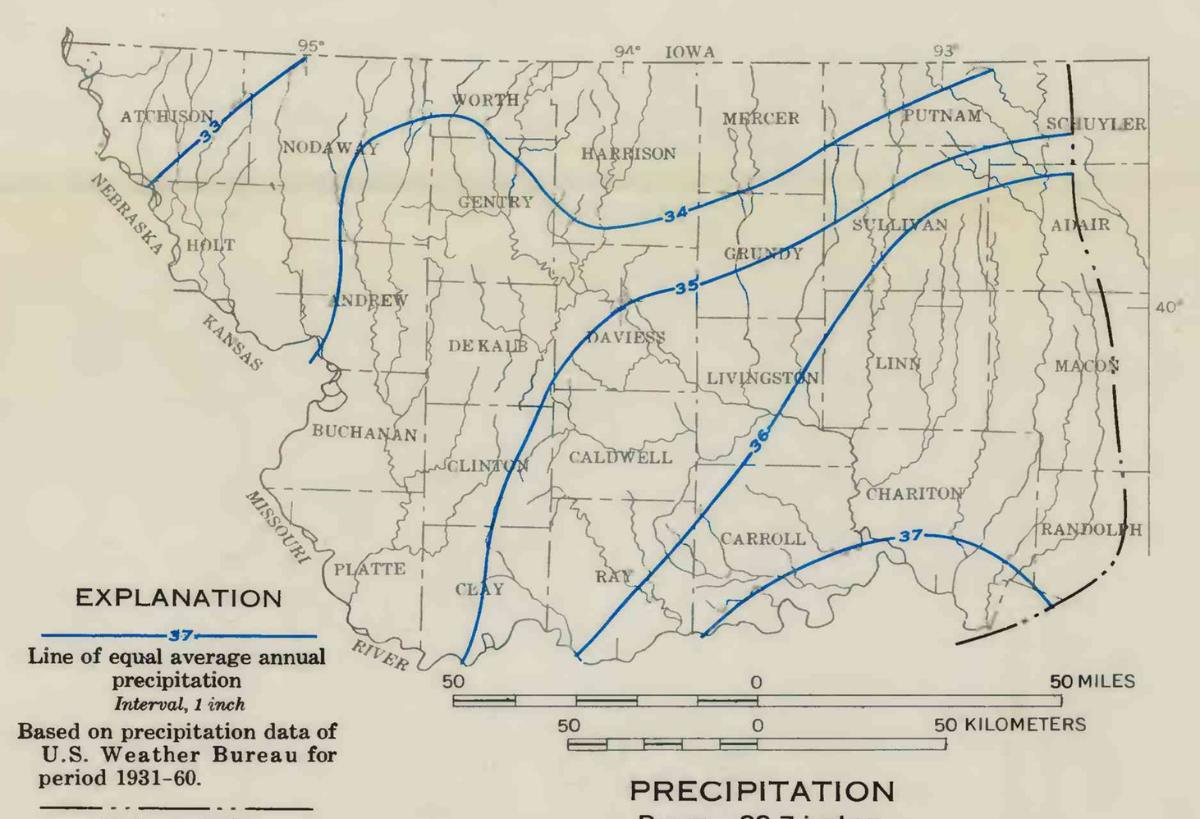


MOST SOILS WERE DERIVED FROM LOESS OR GLACIAL TILL.—*The influence of loess deposits as a parent material for the Marshall-Knox and Sharpsburg and associated soils is indicated by the presence of these soils in areas where loess thicknesses exceed 10 feet. Because of the steep land slopes on which these two soil groups occur, erosion is a serious problem, particularly in the western part of the area, as suggested by the high average annual sediment yields shown on sheet 3.*

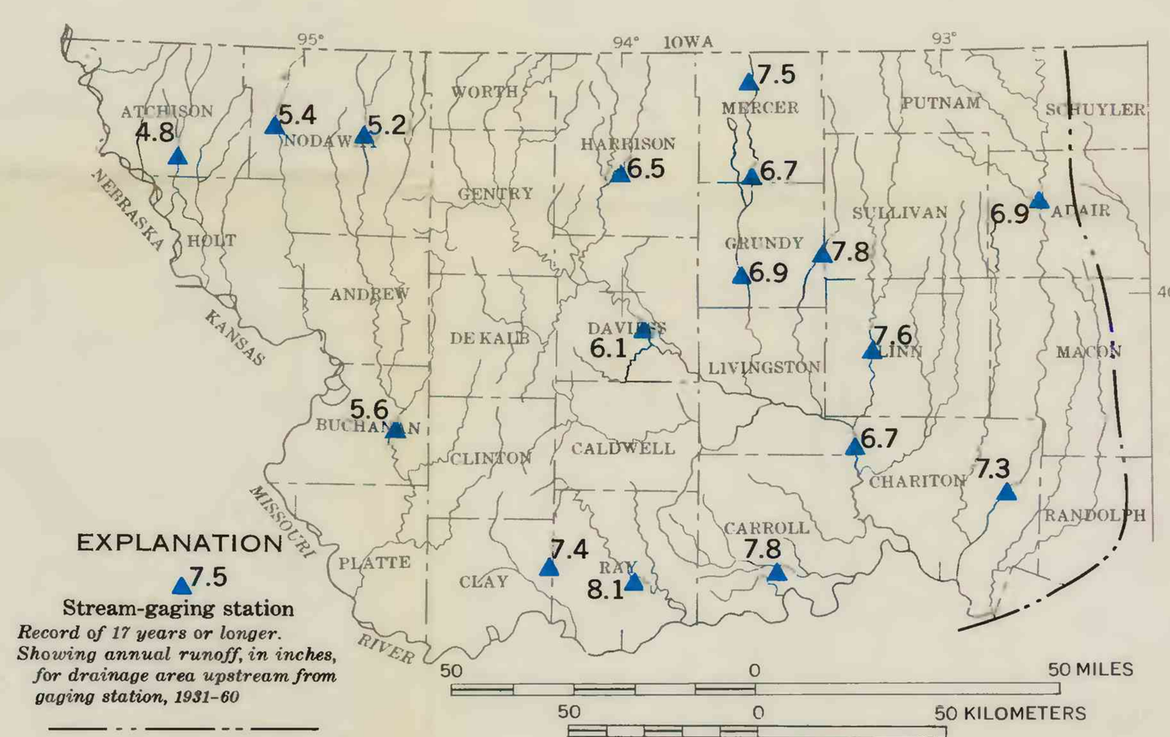
Soil permeability (a measure of the relative ease with which water is able to move through the soil) ranges from high to medium for the alluvial soils. Soil permeabilities generally decrease toward the northeast in the loess and loess-till soils, ranging from high for the Marshall and Knox soils to very low for Edina soil.

WATER BUDGET

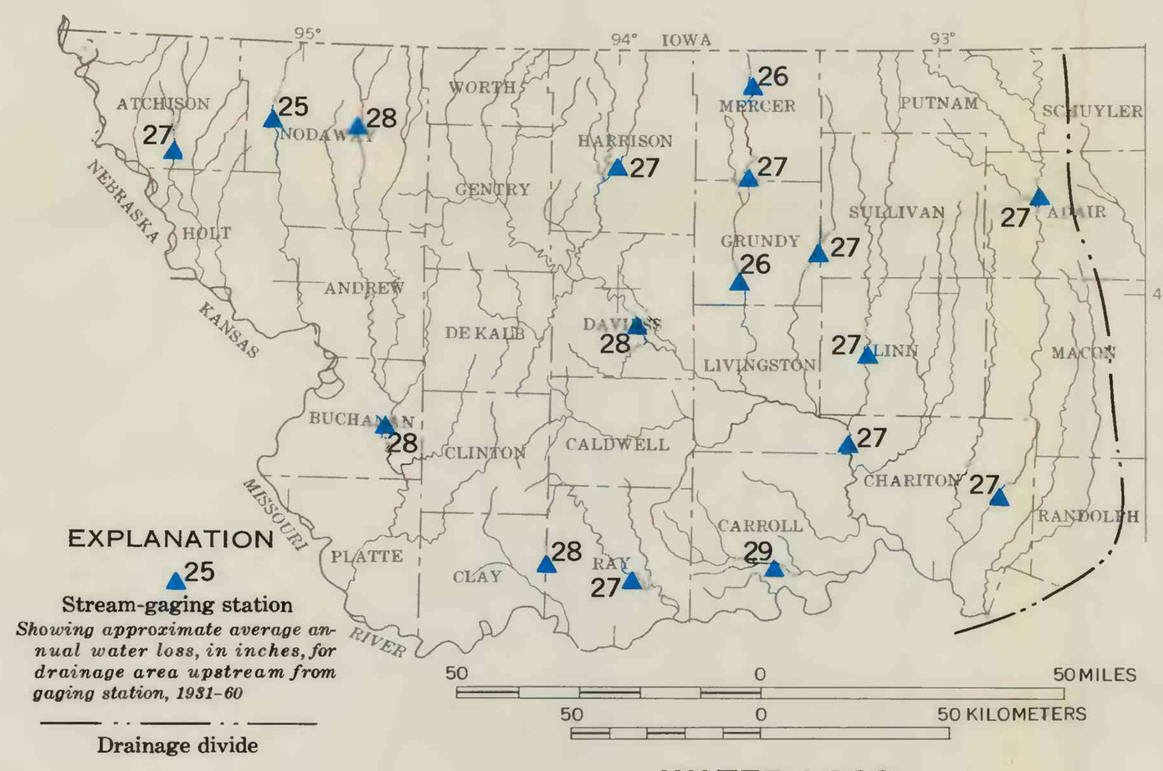
APPROXIMATELY 19 PERCENT OF THE AVERAGE ANNUAL PRECIPITATION APPEARS AS STREAMFLOW.—*The remaining 81 percent is lost primarily to evapotranspiration. Although ground-water storage may vary from year to year, the long-term change in storage is assumed to be zero. The amount of underflow into and from the area is not known, but is assumed to be negligible in comparison to runoff and evapotranspiration. Except where noted, average figures shown include contributing drainage area in Iowa.*



PRECIPITATION
P avg.=33.7 inches
(35.0 inches for northwestern Missouri only)

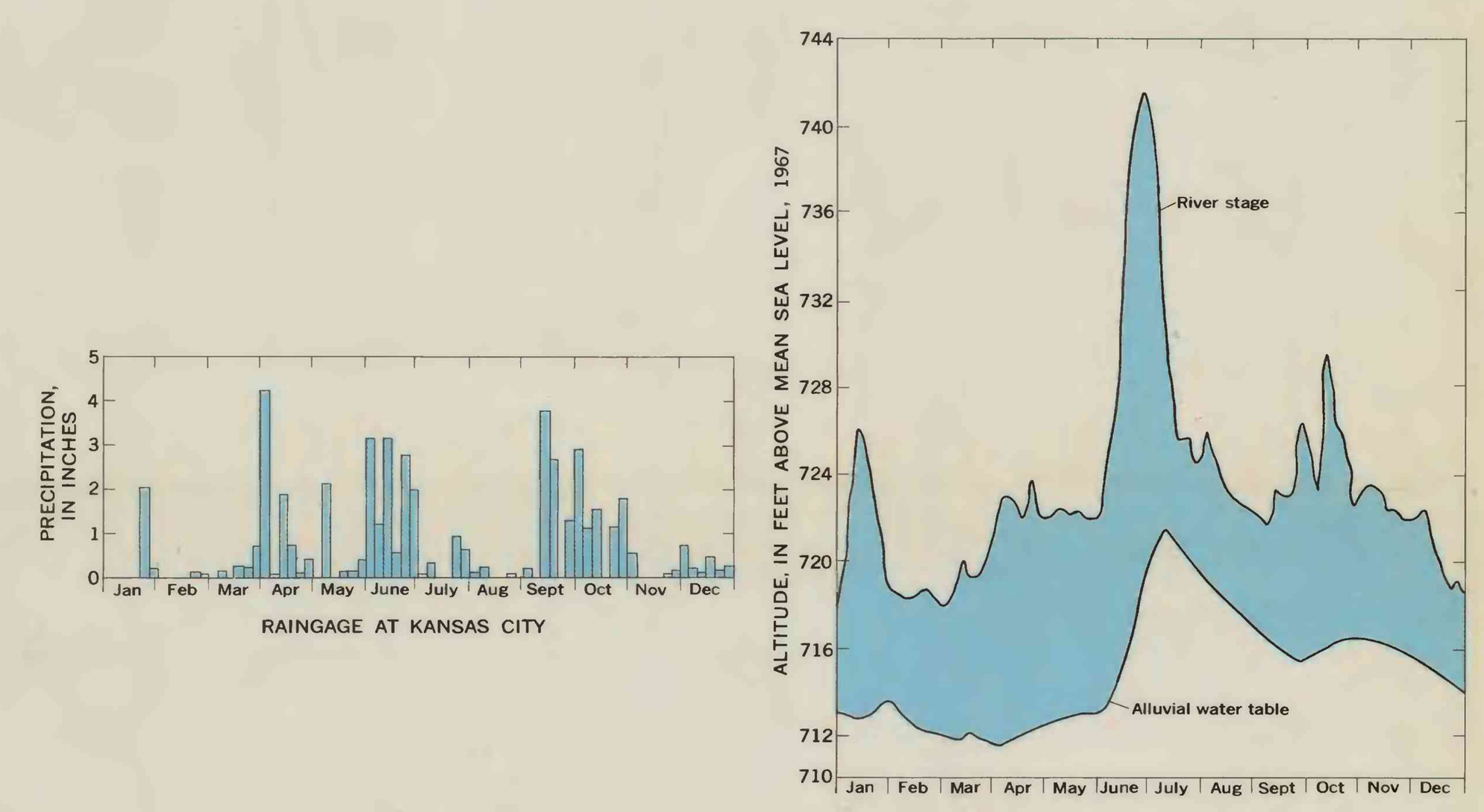


RUNOFF
R avg.=6.5 inches

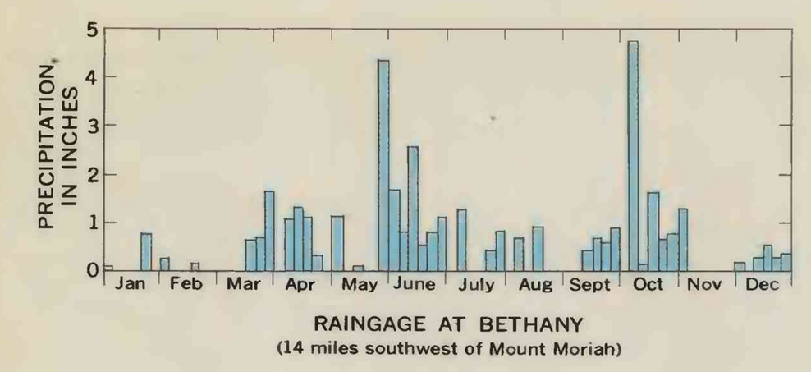


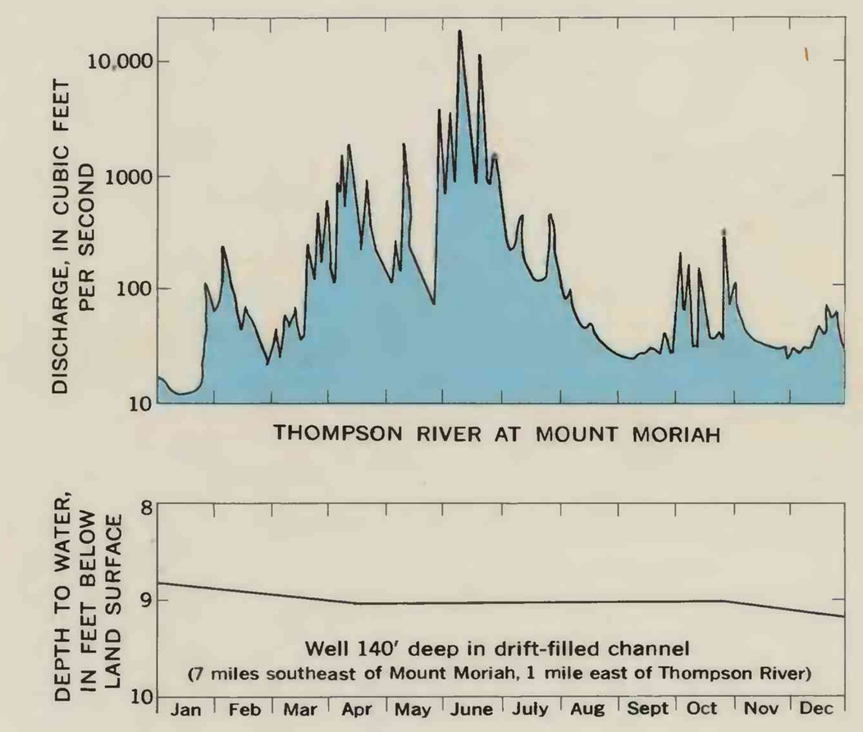
WATER LOSS
P avg.– R avg.=27.2 inches

HYDROLOGIC RELATIONSHIPS



THE PRECIPITATION-RIVER STAGE-WATER TABLE RELATIONSHIP, SHOWN FOR THE MISSOURI RIVER AT KANSAS CITY, INDICATES THAT THE RIVER IS A SOURCE OF RECHARGE TO THE ALLUVIAL AQUIFER.—*Heavy pumpage in the vicinity of an observation well in North Kansas City has lowered the water table below the river level, a condition which favors locally induced recharge from the river. In rural areas where the alluvial aquifer is not heavily pumped, the aquifer generally discharges to the river during periods of low flow. Similar relationships probably exist along other streams in northwestern Missouri where extensive alluvial deposits may be hydraulically connected to the stream.*





THE LACK OF RESPONSE OF THE PIEZOMETRIC SURFACE TO PRECIPITATION AND STREAMFLOW IS INDICATED BY THE HYDROGRAPH OF A WELL IN A DRIFT-FILLED, BURIED CHANNEL IN NORTHWESTERN GRUNDY COUNTY.—*A very poor hydraulic connection exists between the buried channel aquifer and the Thompson River at this site. However, better hydraulic connections between the buried channel aquifers and the surface may exist at other sites in northwestern Missouri.*

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WATER RESOURCES OF NORTHWESTERN MISSOURI

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1973

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