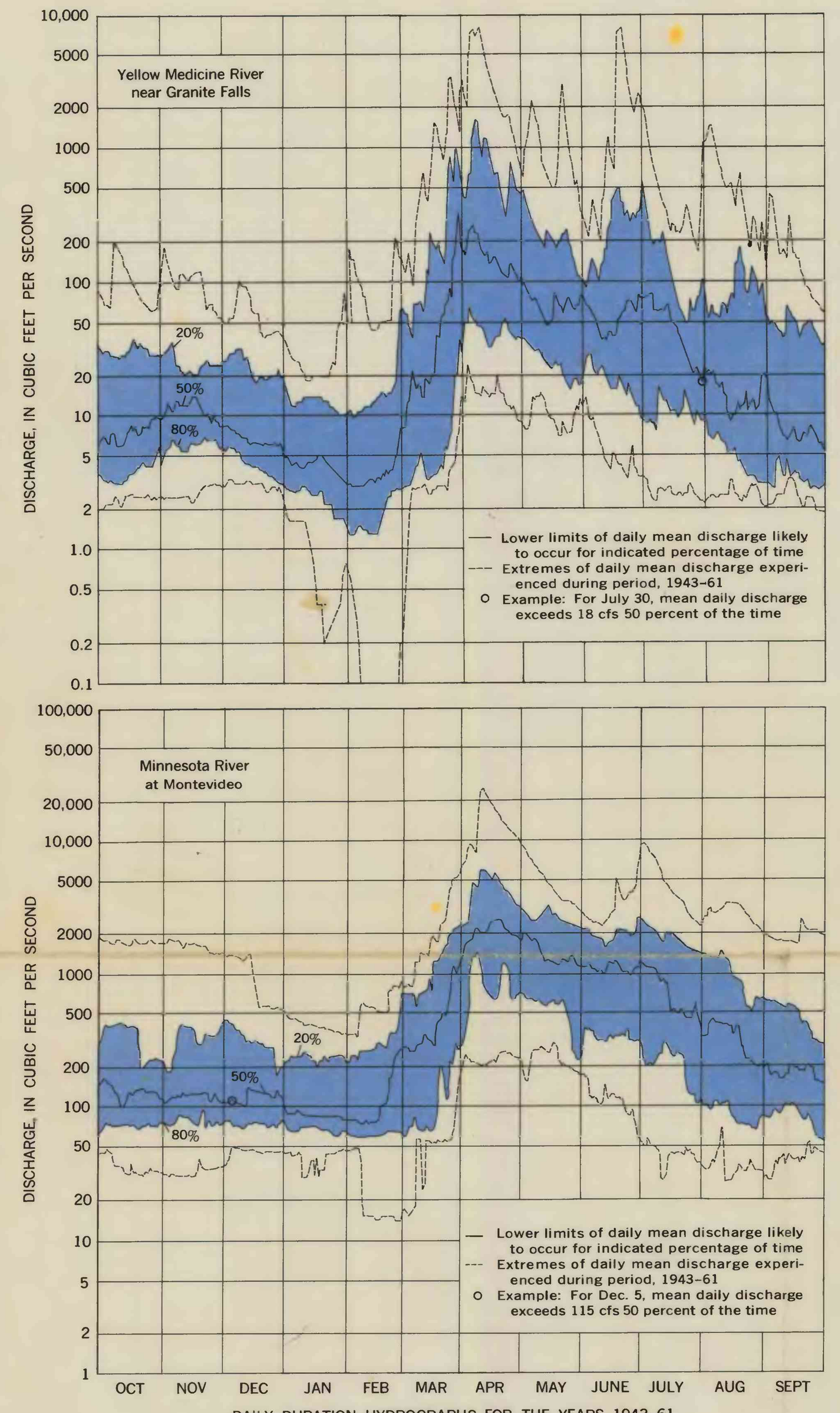
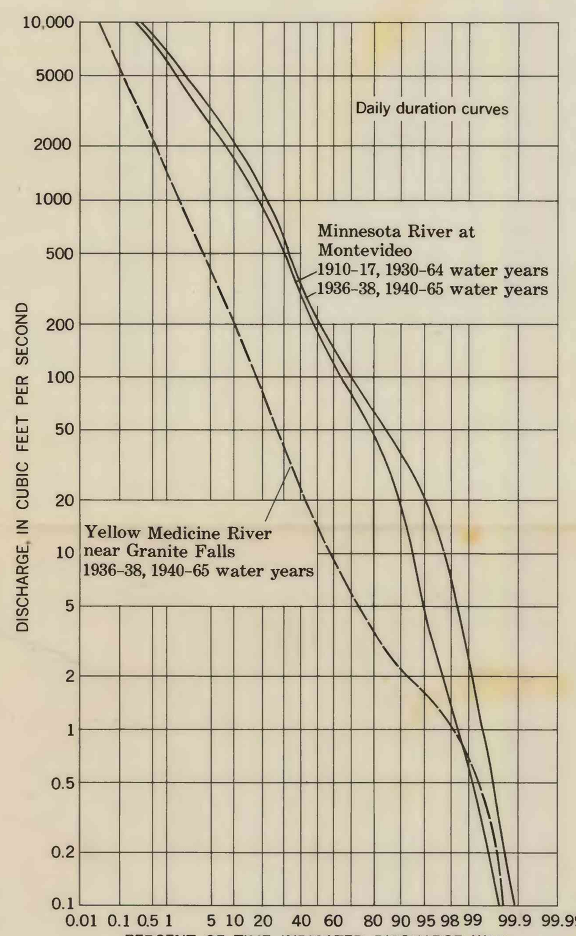
PREPARED IN COOPERATION WITH
THE MINNESOTA DEPARTMENT OF CONSERVATION
DIVISION OF WATERS, SOILS AND MINERALS

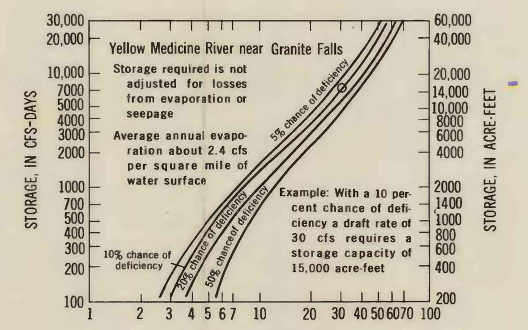
SURFACE WATER



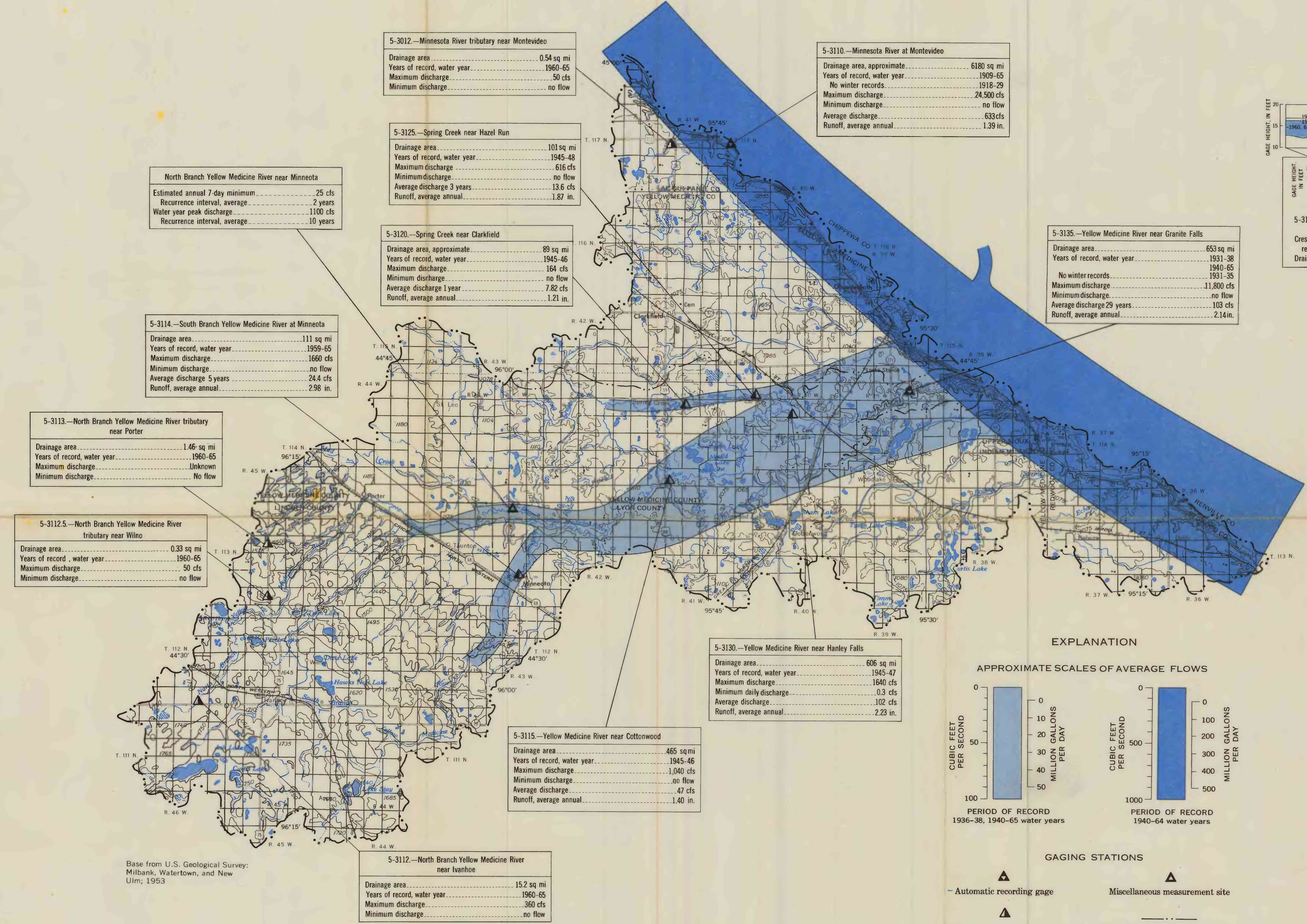
DAILY MEAN DISCHARGE, WHICH IS AFFECTED BY BASIN CHARACTERISTICS AND SEASONAL VARIABILITY OF CLIMATIC FACTORS, IS MORE VARIABLE IN THE YELLOW MEDICINE RIVER THAN IN THE MINNESOTA RIVER.—*The greatest range in discharge of the Yellow Medicine River occurs during the month of June, when local thunderstorms influence streamflow. The Minnesota River does not show such pronounced variability because of storage, and because the larger drainage area tends to dampen the effects of local storms. Minimum flows and smallest variation in discharge of both rivers occur during the winter months.*



THE DURATION CURVES FOR A COMMON PERIOD SHOW A RELATIVELY MODERATE SLOPE FOR THE MINNESOTA RIVER WHEN COMPARED WITH THE YELLOW MEDICINE RIVER.—*The moderate slope is an indication of storage in lakes, swamps, glacial deposits, and Marsh Lake and Lac qui Parle Reservoirs. The relatively steep slope of the duration curve for the Yellow Medicine River indicates a smaller storage capacity in the stream channel and in lakes and swamps. A moderation of the slope near the lower end of the curve is the result of discharge from storage in glacial deposits to the streamflow. The steepness of the extreme lower end of the curve is caused by winter freezeup, and does not indicate a depletion of ground-water storage.*



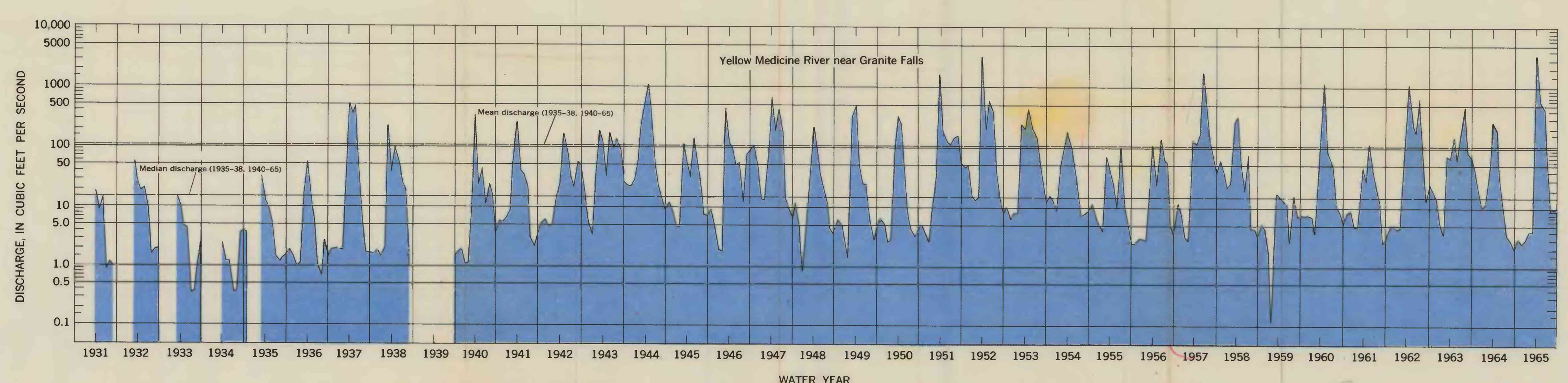
STORAGE OF STREAMFLOW IS REQUIRED TO MAINTAIN SPECIFIED DRAFT RATES WITH A SELECTED CHANCE OF DEFICIENCY.—*Low streamflow would be augmented by use of water stored during periods of high flow.*



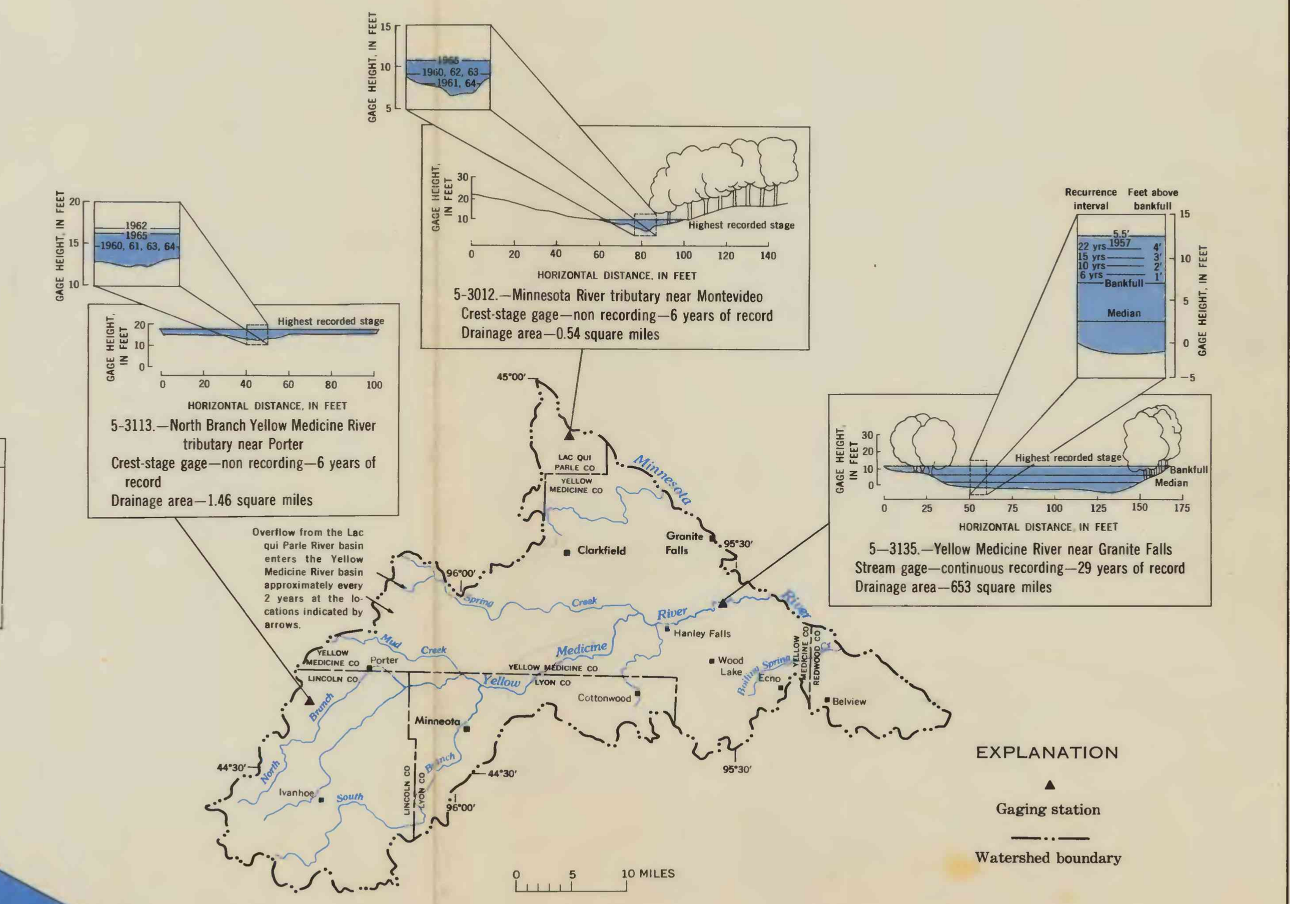
SCALE 1:250 000

CONTOUR INTERVAL 50 FEET
DASHED SUPPLEMENTAL CONTOURS 25 FEET
DATUM IS MEAN SEA LEVEL

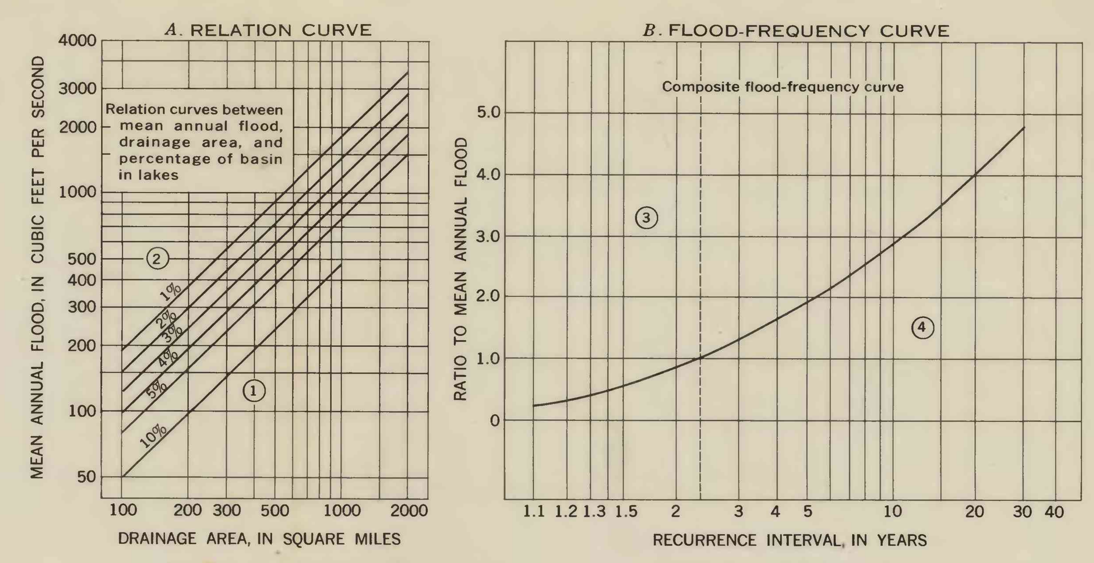
THE AVERAGE DISCHARGE IS THE THEORETICAL MAXIMUM RATE OF WATER WHICH THE STREAM COULD SUSTAIN *Natural streamflow is variable, and provision for a constant supply requires storage of high flows. Water losses in transmission, increased evaporation losses from reservoir surfaces, and lack of suitable reservoir sites prevent utilization of the total streamflow.*



STREAMFLOW IN THE YELLOW MEDICINE RIVER IS VARIABLE AND IS INFLUENCED BY VARIATION OF TEMPERATURE AND PRECIPITATION *The extreme low in 1959 is the result of several days of no flow caused by winter freezeup. Winter freezeup is the most common cause of extended periods of low flow in normal years. During the drought years of the 1930's, lowest flows occurred during the summer months, and were the result of deficient precipitation. The highest flows usually occur in the spring as a result of snowmelt. However, the high flow of 1957 occurred in the summer as a result of excess precipitation.*



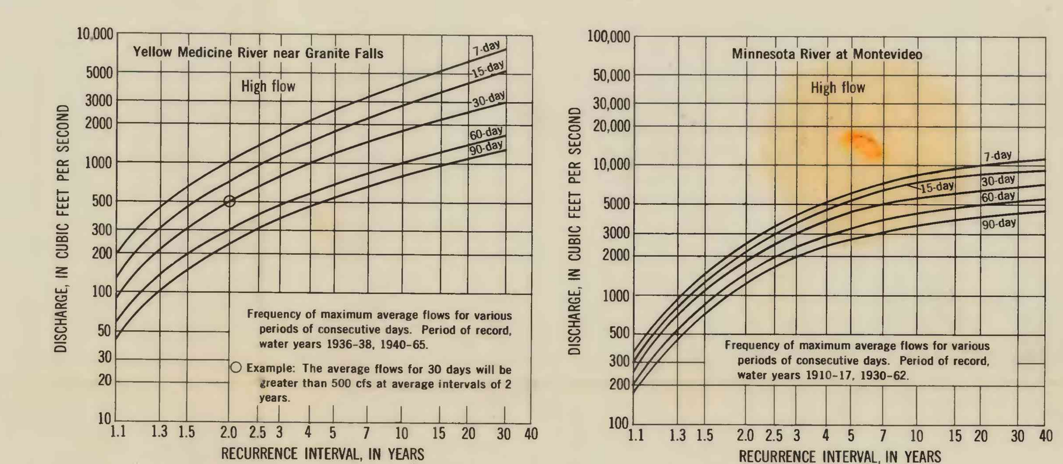
KNOWLEDGE OF STAGE-FREQUENCY CHARACTERISTICS IS NECESSARY IN THE PROPER MANAGEMENT OF AGRICULTURAL LANDS AND THE SAFE DESIGN OF BUILDINGS AND STRUCTURES TO PREVENT FREQUENT LOSSES FROM FLOOD DAMAGE.—*High river stages, which usually occur in the spring, are the result of increased flows from snowmelt and early spring precipitation. Ice jams in the stream channel occasionally cause temporary damming, with higher resultant stages. Significant stages also occur during the summer as a result of excessive precipitation.*



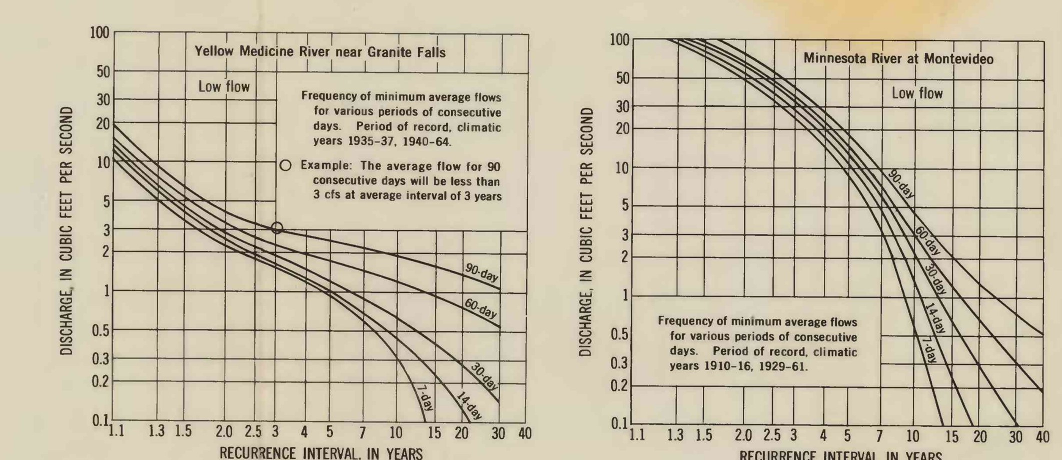
Example: Find the recurrence interval of a 1,200 cfs flood on a drainage area of 330 sq mi, having 3 percent of basin in lakes.

(1)	Determine drainage area at selected site. (Drainage areas at stream gaging sites, shown on average discharge map, may be used as a guide).	D.A.=330 sq mi
(2)	Determine magnitude of mean annual flood from relation curve (*A*), using drainage area size and percentage of the basin in lakes.	Lake=3% M.A.F.=400 cfs
(3)	Compute ratio to mean annual flood.	1200/400=3.00
(4)	From flood-frequency curve (*B*), determine recurrence interval of flood of selected magnitude or magnitude of flood at specified recurrence interval.	R.I.=11 yrs

FREQUENCY AND MAGNITUDE OF FLOODING IS RELATED TO DRAINAGE AREA AND PERCENTAGE OF BASIN IN LAKES.—*Small drainage basins with little surface storage allow rapid runoff, resulting in relatively high peak flows of short duration. Larger basins with greater storage provided by lakes and swamps retard surface runoff, resulting in peak flows of lower magnitude and longer duration. Curves from Prior and Hess (1961).*



HIGH FLOWS ON THE MINNESOTA RIVER ARE SUSTAINED FOR LONGER PERIODS THAN THOSE ON THE YELLOW MEDICINE RIVER.—*High flows are from storms or snowmelt and are influenced by size, shape, and topography of the basin. Most of the maximum flows in the Yellow Medicine and Minnesota Rivers are from snowmelt, augmented at times by rainfall. However, summer floods which damage crops result in the greatest economic losses. Losses resulting from high water are affected by height, duration, and frequency of floods. These factors are also considerations in the design of flood-control reservoirs.*



LOW FLOWS ON THE MINNESOTA RIVER ARE SUSTAINED FOR LONGER PERIODS THAN THOSE ON THE YELLOW MEDICINE RIVER.—*Low flows are largely discharge from ground-water sources. Low flows in the Minnesota River are augmented by ground-water storage and by discharge from upstream reservoirs. Seasonal frequency curves would differ from those shown. (Seasonal frequency data may be obtained from the "daily duration hydrographs"). The steepness at the low end of the curves is a result of the 1930 drought years. Low flows in the Yellow Medicine River are primarily the result of discharge from ground-water storage, and the steepness at the low ends of the curves is a result of winter freezeup.*

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WATER RESOURCES OF THE YELLOW MEDICINE RIVER WATERSHED, SOUTHWESTERN MINNESOTA

By
R. P. Novitzki, W. A. Van Voast, and L. A. Jerabek

1969