

UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER RESOURCES DIVISION
GEOLOGICAL SURVEY

THE 1965 MISSISSIPPI RIVER FLOOD IN IOWA

By
Marlan H. Schwob
and
Richard E. Myers
Hydraulic Engineers
U. S. Geological Survey

Prepared in Cooperation with
THE IOWA GEOLOGICAL SURVEY

Open-file Report

65-145

Iowa City, Iowa
October 1965

UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER RESOURCES DIVISION
GEOLOGICAL SURVEY

THE 1965 MISSISSIPPI RIVER FLOOD IN IOWA

By
Harlan H. Schwob
and
Richard E. Myers
Hydraulic Engineers
U. S. Geological Survey

Prepared in Cooperation with
THE IOWA GEOLOGICAL SURVEY

Open-file Report

Iowa City, Iowa
October 1965

IOWA GEOLOGICAL SURVEY

H. Garland Hershey, Director and State Geologist

UNITED STATES DEPARTMENT OF INTERIOR

GEOLOGICAL SURVEY

William T. Pecora, Director

WATER RESOURCES DIVISION

L. B. Leopold, Chief Hydrologist
M. R. Williams, Chief, Surface Water Branch
S. W. Wiitala, Iowa District Engineer

CONTENTS

	Page
Abstract.....	1
Introduction.....	2
Purpose and scope.....	3
Acknowledgements.....	3
Other flood reports.....	4
Mississippi River gaging stations in Iowa.....	5
Description of the 1965 flood.....	7
Factors causing flood.....	7
Progress of peak discharge.....	7
Contributions of Iowa tributaries.....	8
Flood hydrographs.....	8
Discharge measurements at miscellaneous sites.....	10
Mississippi River profiles.....	10
Magnitude and frequency of Mississippi River floods.....	12
Gaging-station data.....	15
Explanation of data.....	15
Gaging station records.....	
Upper Iowa River at Decorah, Iowa.....	18
Paint Creek at Waterville, Iowa.....	19
Mississippi River at McGregor, Iowa.....	20
Wisconsin River at Muscoda, Wisconsin.....	21
Turkey River at Garber, Iowa.....	22
Little Maquoketa River near Durango, Iowa.....	23
Mississippi River at Dubuque, Iowa.....	24
Maquoketa River near Maquoketa, Iowa.....	26
Mississippi River at Clinton, Iowa.....	27
(Corps of Engineers Stage Station No. 34A)	
Mississippi River at Clinton, Iowa.....	29
Wapsipinicon River near De Witt, Iowa.....	30
Mississippi River at Davenport, Iowa.....	31
Rock River near Joslin, Illinois.....	33
Iowa River at Wapello, Iowa.....	34
Mississippi River at Burlington, Iowa.....	35
Skunk River at Augusta, Iowa.....	36
Mississippi River at Keokuk, Iowa.....	37
Des Moines River at Keosauqua, Iowa.....	39

ILLUSTRATIONS

	Follows Page
Plate 1. Map of Mississippi River along the eastern border of Iowa.....	4
2. Selected profiles of the Mississippi River floods mile 350 to mile 400 (graph).....	39
3. Selected profiles of the Mississippi River floods mile 400 to mile 450 (graph).....	39
4. Selected profiles of the Mississippi River floods mile 450 to mile 500 (graph).....	39
5. Selected profiles of the Mississippi River floods mile 500 to mile 550 (graph).....	39
6. Selected profiles of the Mississippi River floods mile 550 to mile 600 (graph).....	39
7. Selected profiles of the Mississippi River floods mile 600 to mile 650 (graph).....	39
8. Selected profiles of the Mississippi River floods mile 650 to mile 680 (graph).....	39
	Page
Figure 1. Date and reported time of peak at Mississippi River gages, 1965. (graph).....	6
2. Graph of 1965 flood discharges at McGregor, Clinton, and Keokuk, Iowa.....	9
3. Flood-frequency curves for the Mississippi River at three gaging stations (graph).....	13
4. Mississippi River annual peak discharge for selected recurrence intervals. (graph).....	14

TABLES

	Page
Table 1. Supplementary discharge measurements at sites on the Mississippi, Wisconsin, and Rock Rivers.....	11

THE 1965 MISSISSIPPI RIVER FLOOD IN IOWA

by

Harlan H. Schwob and Richard E. Myers

ABSTRACT

The great flood of 1965 on the Mississippi River, along the eastern border of the State, exceeded any flood known in 139 years. It caused damages probably in excess of ten millions of dollars in the State of Iowa. Studies now in progress will more thoroughly cover this and other phases of the flood.

The underlying cause of the flood was an abnormally cold winter which prevented the melting of an excessive snow cover in the upper reaches of the basin. Heavy rains late in March followed by rapid melting triggered the runoff which caused the floods. Peak discharges experienced ranged from 276,000 cfs (cubic feet per second) at McGregor near the northern boundary of the State to 327,000 cfs at Keokuk near the southern boundary. Tributary streams in Iowa were receding as the main-stem flood peak passed their mouths. The discharge they contributed was generally insignificant except for the larger streams.

Flood data compiled for the part of the River along the eastern border include flood discharges, flood elevations, and the frequency of floods of varying magnitudes. They also include the daily or more frequent stage and discharge data for both the Mississippi River and the downstream gaging stations on Iowa tributaries for the period March-May 1965. Sufficient data are presented to permit studies for preparation of plans for protective works and plans for zoning or for flood plain regulation.

INTRODUCTION

In 1965 the greatest flood in nearly $1\frac{1}{2}$ centuries occurred along the Mississippi River bordering eastern Iowa. Stages and discharges during the latter part of April and the first part of May were of record proportions. The exceptional flood of 1952 was exceeded in elevation by about four feet at many places in Iowa. Discharges were the greatest known in 92 years (1874-1965) in the reach from the northern border of Iowa nearly to Keokuk, Iowa. The historical flood of 1828 was the last reported flood of similar magnitude and it may have been exceeded by the flood of 1965.

Because of early and reasonably accurate forecasts by the Weather Bureau and other agencies, it was possible for individuals and public agencies to take action to prevent loss of life and minimize damages. However, it was impossible to protect all property against a flood of this magnitude and damages are roughly estimated to be more than ten millions of dollars in Iowa. Comprehensive surveys of damages presently being made by the Corps of Engineers and other agencies will be available at a later date. No deaths directly attributable to the flood are known to have occurred in the State.

As usual with large streams the peak was broad and the river remained above flood stage for many days. This seriously strained protective works, delayed clean-up and repair work, and postponed the reopening of factories and businesses. It also delayed the opening of navigation on the river, resulting in considerable economic loss. At the crest, and for a time prior to and following it, bridges at Dubuque, Davenport and Keokuk, Iowa, were the only vehicle crossings open. Bridges at seven other locations on the river had approaches flooded or were considered unsafe during the flood. The delays and extra travel required to cross the river represent an economic loss not easily evaluated.

As the need for labor to fight the flood developed, it was generously answered by many volunteers--particularly by young men and the teenagers of both sexes. These volunteers came from inland as well as the river valley and were credited with being a vital factor in the flood fight and the prevention of even greater losses.

Purpose and Scope

It is the purpose of this report to make public the data immediately available on the 1965 Mississippi River floods along the eastern border of Iowa. These data are limited to the period March 1 to May 31, 1965. Later a comprehensive report covering all phases of the flood in detail will be prepared by the U.S. Geological Survey. This latter report will require a considerable time to compile and publish. In the meantime, the present report will provide information now available on flood discharges, flood elevations, and flood frequencies in the specified area. As an interim report, the presentation will necessarily be limited to brief and incomplete treatment of causes and effects of the flood and the relationship between it and other historical floods. These will be covered in detail in the comprehensive report.

Information on the stage and discharge at the most downstream gaging station on the gaged tributaries in Iowa and on the Wisconsin and Rock Rivers is included. These data permit evaluation of the effect of tributary flow on the main-stem flood.

Limited additional data on previous floods are included. These data help to place the 1965 flood in proper perspective.

Acknowledgments

Data from many sources were required to prepare this report. Insofar as possible published data such as U. S. Weather Bureau reports and newspaper articles were used to prepare background material.

Technical material such as discharge measurements, gage readings, and information on high-water marks, furnished by the Corps of Engineers were particularly helpful and are gratefully acknowledged.

The collection and processing of the data required for this and other water resources reports in Iowa are made possible by cooperative programs with State, Federal, and local agencies. Among these are:

State Agencies

Iowa Geological Survey
Iowa Highway Commission
Iowa Natural Resources Council
Iowa Conservation Commission
Iowa Institute of Hydraulic Research
University of Iowa
Iowa State University

Federal Agencies

Corps of Engineers
Soil Conservation Service

Local Agencies

Linn County
Many cities and towns within the State

OTHER FLOOD REPORTS

The flood of 1952, the highest recorded prior to 1965 on part of the Upper Mississippi, was described by Oltman ^{1/}. That report contains a comprehensive discussion of historical floods in the Upper Mississippi River basin. Narrative and pictorial reports on the 1965 and other notable floods have been made by the State Historical Society of Iowa ^{2/} and a number of newspapers ^{3/}. The present report does not duplicate that material.

^{1/} Oltman, R. E., 1959, Floods of 1952 in the basins of the Upper Mississippi River and Red River of the North: U. S. Geological Survey Water Supply Paper 1260-C, 220 p.

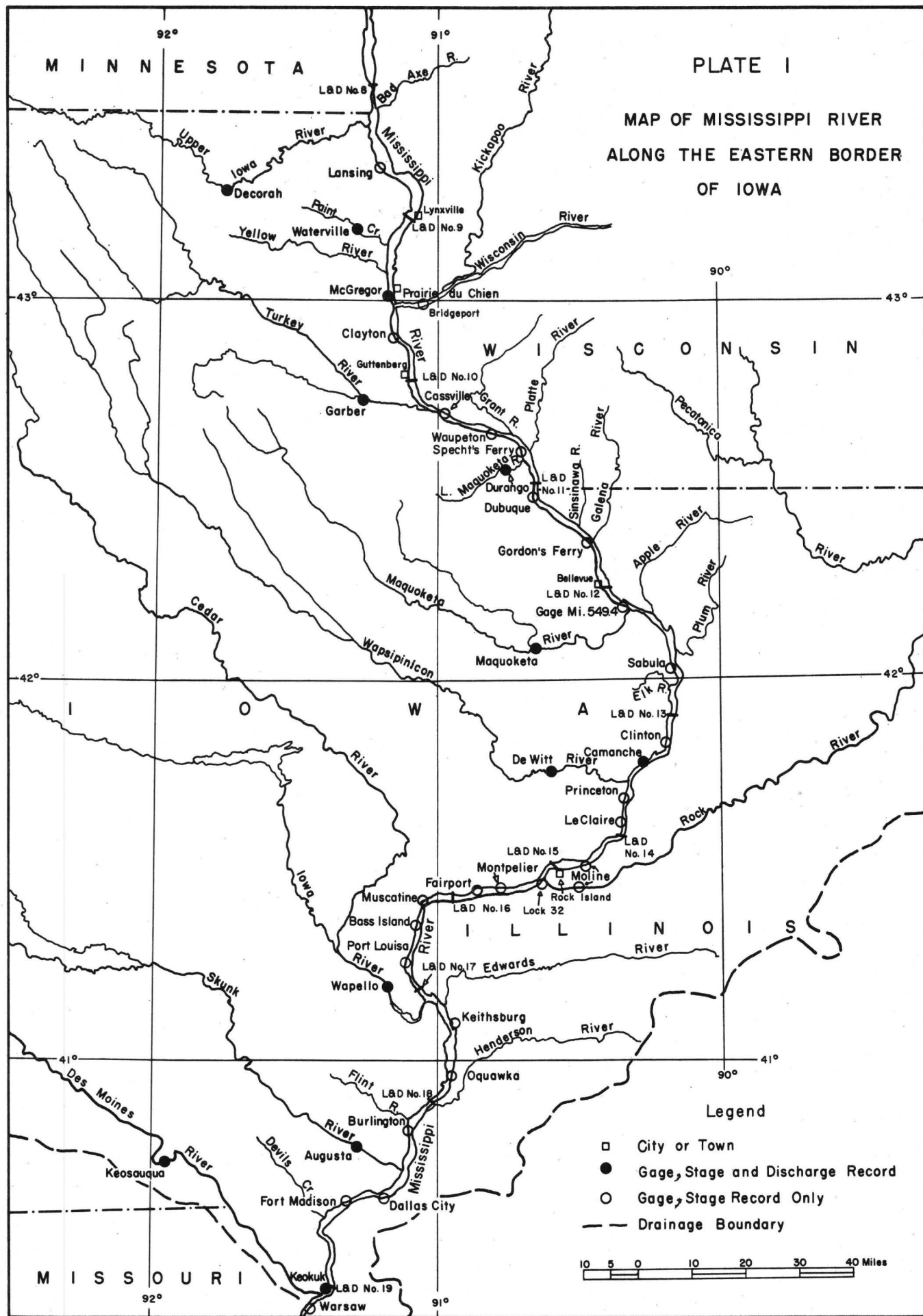
^{2/} Petersen, W. J., July 1965, Mississippi River Floods: The Palimpsest, vol. 46, no. 7, The State Historical Society of Iowa, 164 p.

^{3/} Des Moines Sunday Register, May 9, 1965; Burlington Hawkeye, May 2, 1965; Dubuque Telegraph-Herald, booklet, Flood of '65: Clinton Herald, Souvenir Book, May 9, 1965; Davenport Times-Democrat, May 1965; Special tabloid edition, the Great Flood of 1965.

MINNESOTA

PLATE I

MAP OF MISSISSIPPI RIVER
ALONG THE EASTERN BORDER
OF IOWA



Legend

- City or Town
- Gage, Stage and Discharge Record
- Gage, Stage Record Only
- Drainage Boundary

10 5 0 10 20 30 40 Miles

MISSISSIPPI RIVER GAGING STATIONS IN IOWA

The U.S. Geological Survey maintains two gages on the Mississippi River in Iowa where records of stage and discharge are obtained and published. These gages are located at McGregor and at Camanche (published as "at Clinton"), Iowa. At Keokuk, discharges computed from powerplant records are furnished by the Union Electric Company. A description of the gages and the listing of records used in this report will be found in the section on gaging-station data.

In addition to these three gaging stations, stage gages maintained by other agencies are located at numerous points along the river (Plate 1). The Weather Bureau operates a recording gage at Dubuque, Iowa. The Corps of Engineers operates recording gages on both pool and tailwater at each of its navigation dams. The Corps also maintains nonrecording gages for navigation purposes at many other sites. In the river distance of a little over 310 miles, a total of 48 gages are operated to collect a record of Mississippi-river stages between the North and South Iowa borders. Eleven dams including the Union Electric Company dam are operated to assist navigation along this reach of the river.

All gages have been referenced to sea level datum (1912 general adjustment) by the Corps of Engineers. The Corps has also established benchmarks referenced to sea level datum at many locations along the river. Two Corps of Engineers' District Offices are involved in operating the gages and other facilities. The St. Paul office operates Lock and Dam No. 10 at Guttenberg, Iowa, and gages and dams upstream from this point. The Rock Island office operates all gages and dams from a point just below Lock and Dam No. 10 to Lock and Dam No. 22 near Saverton, Missouri.

DESCRIPTION OF THE 1965 FLOOD

Factors Causing Flood

The winter of 1964-65 was abnormally cold and snowy. Frost penetration was generally deeper than usual in areas to the north of Iowa. Snowfall was excessive throughout northern Iowa and in that part of the Mississippi basin upstream from the mouth of the Wisconsin River. There was little or no melting between snowfalls in these areas. Snowfall depths were about $1\frac{1}{2}$ times normal in parts of Minnesota and formed a heavy blanket over the ground. Near the end of March heavy rains fell over much of the snow-covered area. These were absorbed and held by the snow which already contained about 5" of moisture in the basin above, and including, the St. Croix River. When the rapid melting began in early April, the frozen ground prevented normal infiltration and the water entering the streams set the stage for extensive flooding.

In Iowa conditions were much the same as those farther north except that the moisture content of the snow was somewhat less. Also, the warming trends and rains occurred somewhat earlier so that some streams in the southern part of Iowa reached their peak flows in March. All major peaks on Iowa streams in the Mississippi River basin had occurred at the downstream gaging stations prior to the middle of April.

Progress of Peak Discharge

The date and time of the flood peak at the nonrecording gages were reported by the gage readers. All recording instruments at the locks and dams were removed to prevent their inundation. Nonrecording gages were read during the period near the flood crest. The date and time of the reported peak at the several gages have been plotted on figure 1. The average rate of travel of the flood peak in the McGregor-Camanche and the Camanche-Keokuk reaches are shown by the two straight lines on the graph. It is unlikely that the time of peak, on a flat crest such as occurred, could be determined precisely from a single nonrecording gage reading. Surge, wind action, and other temporary fluctuations probably caused the scattering of the plotted points representing the peak nonrecording gage readings on figure 1.

Contributions of Iowa Tributaries

In general, tributary flow downstream from the northern border of Iowa had a minor effect on the Mississippi River peak flow. Exceptions were the larger streams including the Wisconsin and Rock Rivers in the reach from Lansing to Muscatine. Both of these streams, while not exceptionally high, made a significant contribution to the peak discharge. Both were measured near the mouth at the time of the Mississippi River peak so that their contributions are known. The results of these measurements are shown in table 1. The presently available data for the downstream gaging stations on tributaries are shown in the section on gaging-station data.

The Iowa tributaries between Muscatine and Keokuk had experienced their major peak early in April. However, locally heavy rain fell on April 23 and secondary peaks occurred about April 26 at the downstream gaging stations. The flows were receding from the secondary peaks when the Mississippi River crest passed the tributary mouths. Their contributions, while adding to the peak flow, were comparatively small--inflow between Muscatine and Keokuk was equivalent to about 4 percent of the peak discharge at Muscatine.

The Des Moines River (below Keokuk) also experienced a secondary peak late in April. It also was receding at the time the Mississippi River peak passed the mouth. However, its contribution to that peak was significant as indicated by the records in the section on gaging-station data.

Flood Hydrographs

The data for plotting hydrographs, both the gage height and discharge are contained in the section on gaging-station data. These data are tabulated for the Mississippi River and for the downstream tributary gaging stations. Figure 2 shows crest segments of the flood discharge hydrograph at three Mississippi River gaging stations.

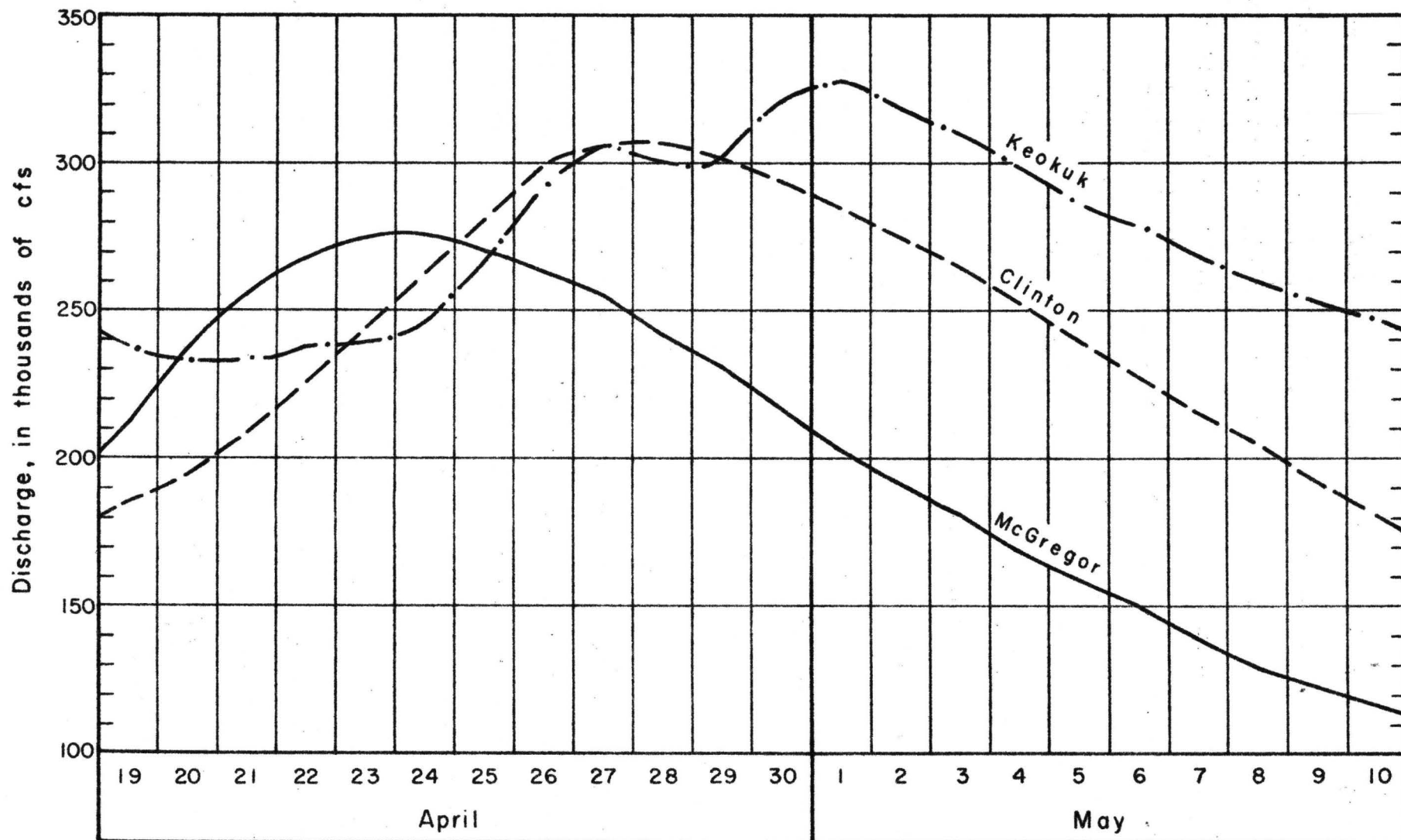


Figure 2. Graph of 1965 flood discharge at McGregor, Clinton, and Keokuk, Iowa

These data and similar tabulations for the 1952 flood in Water-Supply Paper 1960-C furnish information for several purposes at the gage sites. Important among these purposes will be the evaluation of the effect of establishing or removing encroachments in the flood plain. Other purposes will include determination of the duration of flow above critical stages or discharges, planning and designing of flood control works, the effect of tributary flows on Mississippi River flows, and the preparation of visual exhibits of the flood features. Runoff volume data can also be obtained from the tabulations.

Discharge Measurements at Miscellaneous Sites

The supplementary discharge measurements made at sites along the Mississippi River in Iowa are shown in table 1. Also shown are the discharge measurements at the mouths of the Wisconsin and Rock Rivers made at or near the peak on the Mississippi River. Discharges at regular gaging stations are shown in the section on gaging-station data.

Mississippi River Profiles

Profiles of the 1952 and 1965 floods along the Iowa border have been prepared from gage readings, high-water mark elevations, and river mileages (Plates 2-8). Low-water stages as affected by the navigation dams are also shown. Each of the two gages (pool and tailwater) located at navigation dams have the same zero elevation except at Keokuk.

These profiles can be used for several purposes. They indicate the elevation of the flood crest along the Mississippi River for two great floods. These elevations may become the basis for the design of protective works or for the zoning of areas to prevent loss of life, ~~property~~ damage, or encroachment on the required waterway of the river.

Table 1. Supplementary discharge measurements at sites on the Mississippi, Wisconsin and Rock Rivers.

Stream and location	River mile	Drainage Area (sq.mi.)	Date 1965	Elevation (feet) (msl)	Measured discharge (cfs)	Remarks
Mississippi R. at Lansing, Iowa	663.0	66,280	Apr. 22	634.6	272,000	Measured at Hwy 9 bridge. Elevation at gage.
Wisconsin R. at Bridgeport, Wisconsin	--	11,700	Apr. 15 19 24 May 1	--	20,100 44,600 32,500 26,300	Measured at Hwy 18 bridge. Mouth at river mile 631.0.
Mississippi R. at Rock Island, Illinois	482.8	88,500	Apr. 24 26 27 28 29 30 May 1 2 3 4 6 7 10	562.8 564.1 564.6 565.0 564.9 564.7 564.4 564.0 563.5 563.0 561.8 561.3 559.7	253,000 284,000 293,000 307,000 294,000 289,000 287,000 274,000 267,000 260,000 240,000 217,000 195,000	Referenced to tailwater gage Lock & Dam No. 15. Furnished by the Corps of Engineers.
Rock R. at Moline, Illinois	--	10,630	Apr. 25 26 27 28 29 30 May 1 2 3 4 5 6 7 10	a 11.16 a 11.84 a 12.24 a 12.53 a 12.57 a 12.39 a 12.07 a 11.69 a 11.12 a 10.58 a 10.09 a 9.60 a 9.34 a 9.54	13,600 14,400 14,400 14,400 15,600 13,600 12,400 11,600 10,200 9,550 9,350 8,870 10,800 12,300	Measured at U.S. Hwy 150 bridge, Moline, Illinois. Gage zero 551.84 (1912 GA). Mouth of river at mile 479.9. Furnished by the Corps of Engineers.

a Gage reading, in feet.

MAGNITUDE AND FREQUENCY OF MISSISSIPPI RIVER FLOODS

The methods used by the U.S. Geological Survey to prepare frequency curves have been described by Dalrymple ^{4/}. These methods were used in computing single-station frequency curves for the gaging stations at McGregor, Clinton (Camanche), and Keokuk. Annual peak flows available for the period 1874-1965 were used. Correlation was used to fill in gaps in the array of annual flood peaks. The curves for the three stations are shown on figure 3 for purposes of comparison.

Normally, frequency curves are not extended by the U.S. Geological Survey beyond a 50-year recurrence interval because of the relatively short records available. However, because the 1965 flood was the greatest known since 1828, except at Keokuk, its plotting position is computed to be 139 years at McGregor and Clinton by the formula $R.I. = \frac{n+1}{m}$ where:

R.I. = recurrence interval

n = number of years of record

m = order number in an array from high to low

Consequently, it has been plotted at this position and the curves extended as shown.

Interpolations for different locations can be made on the basis of drainage area. Approximate drainage area for places along the Mississippi River have been computed by the Corps of Engineers. These areas are shown on the profiles on plates 2-8. Figure 4 is a graph of discharges, for several selected recurrence intervals at the three gages, plotted against drainage areas. The drainage area at locations between gages can be used to obtain the discharge for each of the selected recurrence intervals from the curves on figure 4.

^{4/} Dalrymple, Tate, 1960, Flood-frequency analyses: Geological Survey Water-Supply Paper 1543-A, 74 p.

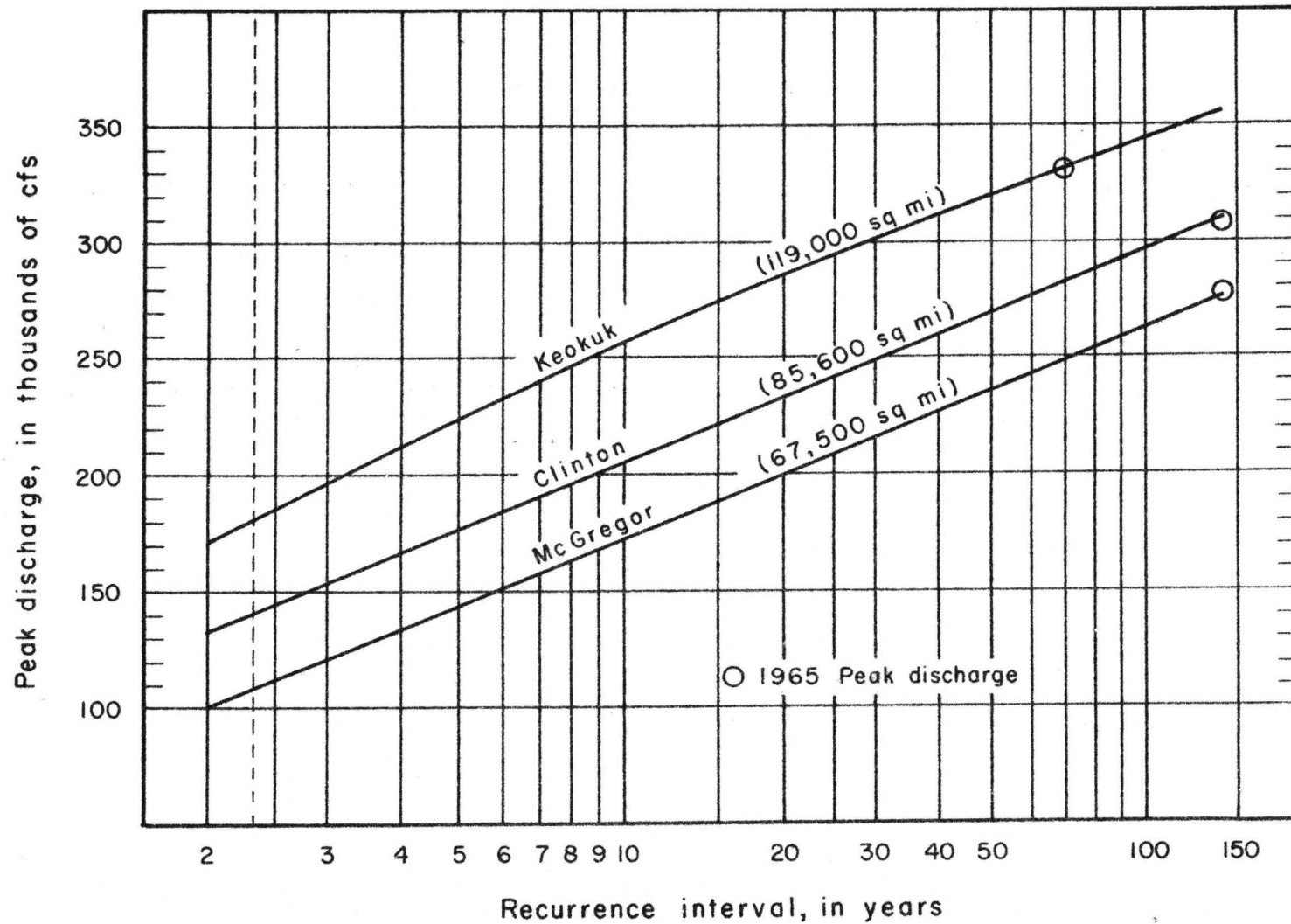


Figure 3. Flood frequency curves for the Mississippi River at three gaging stations. 5

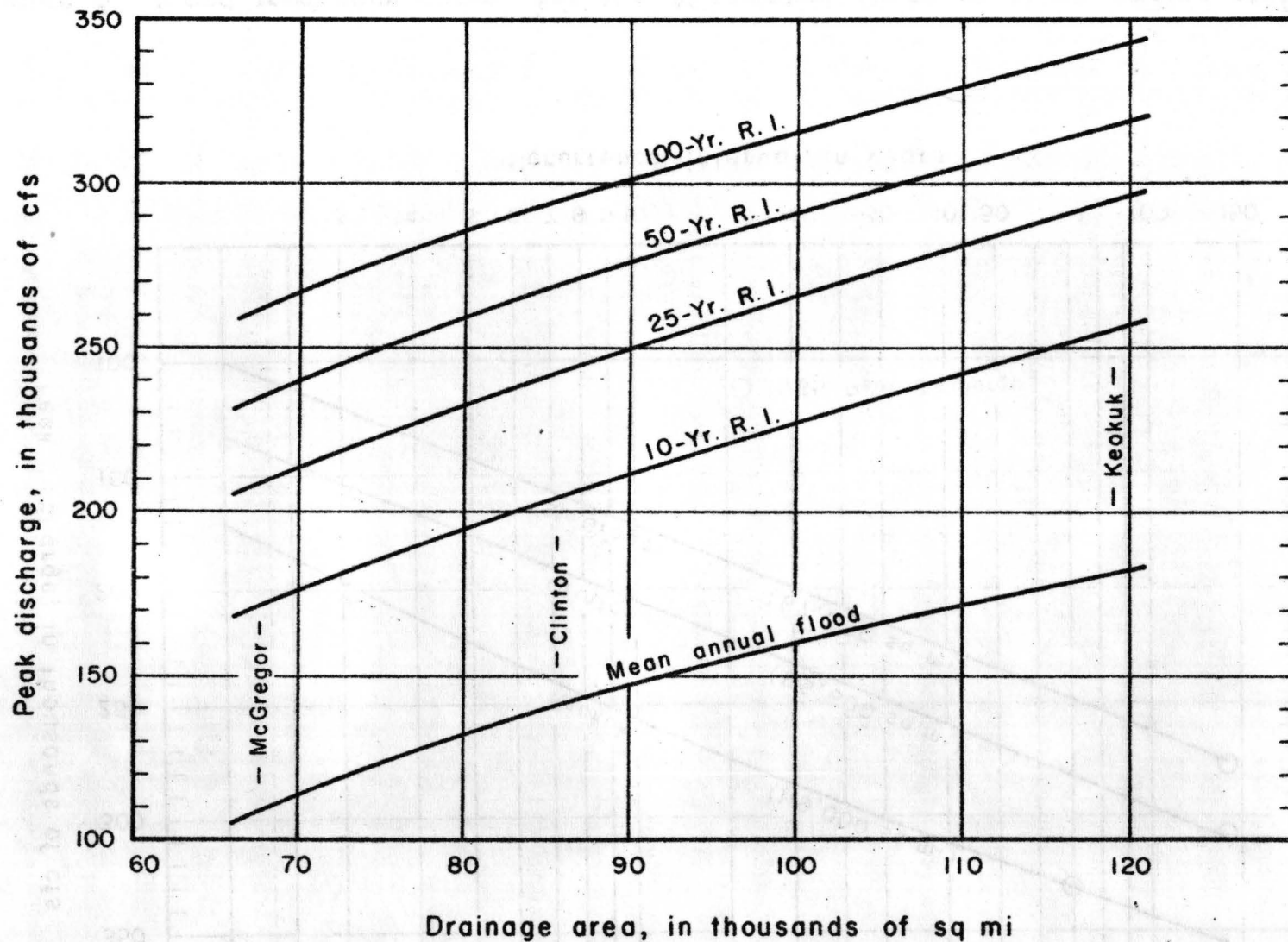


Figure 4. Mississippi River annual peak discharge for selected recurrence interval.

GAGING-STATION DATA

Explanation of Data

The following pages give detailed information on stage and discharge during floods of March-May 1965. The additional information given herein supplements the streamflow records published in the annual reports, "Surface Water Records of Iowa".

The systematic collection of basic data at a stream gaging station includes a record of stage, measurements of discharge, and other information pertinent to the determination of daily streamflow. In this report, the gage-height or stage records are determined from a continuous graph of the stage as recorded by an automatic water-stage recorder, supplemented at times of malfunction by observed gage readings, high-water marks, and other pertinent information. Measurements of discharge are generally made with a current meter at various stages and in sufficient numbers to define the stage-discharge relation through the range of stage experienced at any particular gaging station.

In general, the data on the following pages consist of a description paragraph for the gaging station, a table of daily mean discharge for the period March-May 1965, and a table of gage height and corresponding discharge at selected times during the major rises. Tables of annual peak stage and of discharge (if known) for the period of record are included for several Mississippi River gaging stations. In these tabulations a line across the table indicates a break in the continuity of the record. A line across the gage-height column indicates a change in the datum of the gage. A short dash is used to indicate that the value is unknown.

The description of the gaging station gives information concerning the location, the drainage area, the gage-height record, datum of gage, details of the discharge record, maxima, and pertinent remarks. The paragraph on the discharge records briefly explains the methods used to define the stage-discharge relation over the range of stage that occurred during the flood and identifies the periods when ice and other conditions affected the stage-discharge relation.

The maximum stage and discharge that occurred at each gaging station are given for the floods of March-May 1965, for the period of record at the site, and for any historical flood that occurred outside the period of record. The time of day is expressed in 24-hour time; for example, 12:30 a.m. is 0030 hrs, 1:30 p.m. is 1330 hrs.

The table of daily mean discharges gives data for the 3-month period, March to May 1965. This table not only covers the period of major flooding but also covers a length of time sufficient to show discharge during antecedent and recession periods. The monthly figures at the bottom of the table show monthly mean discharge, in cubic feet per second, runoff, in inches, and runoff, in acre-feet, for the area above the station.

The table of stage and discharge at selected times (24-hour time system) during the major rises lists sufficient data to plot accurate hydrographs of stage or discharge. The period of time covered is, in general, from the beginning of a major rise to an arbitrary cutoff point on the recession. For small streams, the cutoff point may be fairly well down the recession. For large streams, the cutoff point may be fairly high on the recession. Below the cutoff points, the discharge hydrograph can be defined by the daily mean discharge figures. These figures of stage and discharge should not be used to reconstruct a stage-discharge relation curve for use outside of this period. At many stations, shifts from the basic rating curve were used to compute discharge during periods when the stage-discharge relation could not be used directly.

The gage heights and time of day in the detailed tables of major rises were obtained from the continuous water-stage recorder graph. During periods of recording-gage malfunction, the gage heights were obtained from a reconstructed gage-height graph based on supplemental observed gage readings, high-water marks, and other pertinent data or observations.

In this report, the stations are arranged in a downstream order similar to that used in the Survey's annual streamflow reports. All stations on a tributary entering above a main-stem station are listed before that station. If a tributary enters between two main-stem stations, stations on it are listed between them. To indicate the rank of a stream on which a gaging station is located and the stream to which it is immediately tributary, each indention in the table of contents of this report represents one rank. This downstream order and system of indention shows which gaging stations are on tributaries between any two stations on a main stem and the rank of the tributary. The stations are also identified by a station number which precedes the station name in the tabulation.

5-3875. Upper Iowa River at Decorah, Iowa

Location.--Lat 43°18'20", long 91°48'05", in NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.16, T.98 N., R.8 W., on right bank 1,200 ft upstream from bridge on State Highway 52, 1,500 ft downstream from Dry Run cutoff, and 3 miles upstream from Trout Run.

Drainage area.--511 sq mi.

Gage-height record.--Water-stage recorder graph. Datum of gage is 850.00 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 20,000 cfs.

Maxima.--March-May 1965: Discharge, 9,570 cfs 0300 hrs Mar. 2 (gage height, 9.82 ft).
1951 to February 1965: Discharge, 20,200 cfs Mar. 27, 1961 (gage height, 13.08 ft).

Maximum flood known, probably since at least 1913, occurred May 29, 1941 at site of former gaging station near Decorah 4 miles downstream (discharge, 28,500 cfs).

Mean discharge, in cubic feet per second, 1965

Day	March	April	May	Day	March	April	May
1.....	5,700	2,140	243	16.....	136	501	200
2.....	8,310	2,420	226	17.....	136	432	170
3.....	1,770	2,460	214	18.....	94	366	238
4.....	648	4,490	200	19.....	118	315	203
5.....	462	5,460	196	20.....	121	285	176
6.....	402	7,910	192	21.....	118	260	163
7.....	402	7,470	617	22.....	106	238	151
8.....	320	6,430	456	23.....	121	234	151
9.....	243	5,240	285	24.....	111	226	142
10.....	203	2,880	230	25.....	127	275	190
11.....	182	3,010	206	26.....	104	355	2,090
12.....	166	3,440	189	27.....	98	420	522
13.....	163	2,360	176	28.....	89	372	390
14.....	151	832	170	29.....	86	300	315
15.....	148	620	163	30.....	98	265	275
				31.....	533		243
Monthly mean discharge, in cubic feet per second....					692	2,067	303
Runoff, in inches.....					1.56	4.51	0.68
Runoff, in acre-feet.....					41,780	123,000	18,610

Gage height, in feet, and discharge, in cubic feet per second, at indicated time

Hour	Gage height	Discharge	Hour	Gage height	Discharge	Hour	Gage height	Discharge
Feb. 28			Mar. 2			Apr. 8		
2400...	5.84	1,220	0300...	9.82	9,570	0500...	8.46	5,630
			0900...	9.48	8,470	0900...	7.63	3,840
Mar. 1			1300...	9.25	7,760	1100...	7.54	3,670
0200...	5.82	1,220	1800...	9.32	7,970	1300...	7.79	4,140
0400...	6.10	1,490	2100...	9.20	7,620	1500...	9.01	7,070
0530...	6.60	2,100	2300...	9.29	7,880	1700...	9.67	9,070
0700...	7.00	2,720	2400...	8.95	6,900	2000...	9.63	8,940
0800...	8.83	6,580				2100...	9.68	9,100
0900...	8.03	4,640	Mar. 3			2400...	9.44	8,310
1100...	8.90	6,770	0200...	7.50	3,590			
1300...	9.60	8,840	0400...	6.87	2,500	Apr. 9		
1500...	9.16	7,500	0700...	6.30	1,720	0600...	8.49	5,700
1800...	9.25	7,760	1200...	5.84	1,220	1100...	7.68	3,930
1900...	9.17	7,530	1800...	5.61	1,010	1300...	7.70	3,970
2100...	9.28	7,850	2400...	5.35	800	2000...	8.21	5,040
2300...	9.65	9,000				2400...	8.23	5,090
2400...	9.51	8,560	Apr. 7					
			2400...	8.84	6,610			

5-3885. Paint Creek at Waterville, Iowa

Location.--Lat 43°12'35", long 91°18'20", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.22, T.97 N., R.4 W., on right bank 20 ft downstream from bridge on State Highway 373 and 0.5 mile northwest of Waterville.

Drainage area.--42.8 sq mi.

Gage-height record.--Water-stage recorder graph.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 3,000 cfs, extended to 9,100 cfs by logarithmic plotting and computed results of indirect measurement further downstream. Backwater from ice

Mar. 1-3, 12-26, 30, 31.

Maxima.--March-May 1965: Discharge, 1,920 cfs 2130 hrs Apr. 3; gage-height, 7.60 ft 1700 hrs Mar..1.

1952 to February 1965: Discharge, 3,250 cfs Mar. 28, 1962 (gage height, 8.46 ft).

Flood in August 1951 reached a stage of 17.35 ft (discharge, 9,100 cfs).

A higher stage may have occurred during the spring of 1949.

Mean discharge, in cubic feet per second, 1965

Day	March	April	May	Day	March	April	May
1.....	900	534	4.9	16.....	5.0	6.4	18
2.....	50	88	4.5	17.....	4.0	6.0	4.5
3.....	15	342	4.0	18.....	3.3	5.6	14
4.....	6.0	393	3.9	19.....	3.0	5.1	5.6
5.....	118	337	4.0	20.....	2.8	4.9	4.2
6.....	77	314	4.0	21.....	2.7	4.7	3.8
7.....	145	150	3.8	22.....	2.6	4.5	3.6
8.....	79	186	3.6	23.....	2.5	4.2	3.6
9.....	33	40	3.9	24.....	2.5	4.9	3.5
10.....	15	31	3.5	25.....	2.5	7.4	9.6
11.....	7.6	78	3.4	26.....	2.5	9.6	420
12.....	4.0	31	3.4	27.....	2.6	6.4	18
13.....	3.1	12	3.4	28.....	2.7	7.4	11
14.....	6.0	8.9	3.4	29.....	2.8	5.8	8.1
15.....	8.0	8.1	3.6	30.....	35	5.2	7.4
				31.....	350		6.4
Monthly mean discharge, in cubic feet per second.....					61.1	88.0	19.3
Runoff, in inches.....					1.65	2.29	0.52
Runoff, in acre-feet.....					3,760	5,240	1,190

Gage height, in feet, and discharge, in cubic feet per second, at indicated time

Hour	Gage height	Discharge	Hour	Gage height	Discharge	Hour	Gage height	Discharge
Apr. 2			Apr. 3-Con.			Apr. 4-Con.		
2400...	3.94	97	2000...	5.98	1,010	0730...	4.25	169
			2030...	6.40	1,190	0900...	4.12	136
Apr. 3			2100...	6.90	1,500	1100...	4.04	118
0330...	3.75	65	2130...	7.32	1,920	1230...	4.15	143
0800...	3.55	41	2300...	6.95	1,550	1330...	4.36	202
1030...	3.55	41	2400...	6.54	1,260	1400...	4.50	250
1200...	3.64	51				1500...	4.85	420
1330...	3.65	52	Apr. 4			1600...	5.05	540
1600...	3.77	68	0130...	6.00	1,020	1730...	5.13	588
1700...	3.92	93	0200...	5.64	870	2000...	4.88	438
1800...	4.28	177	0300...	5.20	630	2100...	4.68	330
1830...	4.55	270	0400...	4.87	432	2230...	4.48	243
1900...	4.88	438	0500...	4.63	305	2400...	4.28	177
1930...	5.30	690	0600...	4.43	226			

5-3895. Mississippi River at McGregor, Iowa

Location.--Lat 43°01'30", long 91°10'20", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.22, T.95 N., R.3 W., on right bank in city park at north end of Main Street in McGregor, 2.6 miles upstream from Wisconsin River, 4.3 miles downstream from Yellow River, and at mile 633.4 from Ohio River. Auxiliary gage located at site 14.1 miles upstream in tailwater of Dam 9.

Drainage area.--67,500 sq. mi, approximately.

Gage-height record.--Water-stage recorder graph, except Mar. 22-25. Datum of gage is 605.30 ft above mean sea level, adjustment of 1912, and auxiliary gage is 600.00 ft.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 276,000 cfs and is affected by backwater from Wisconsin River and Dam 10. Fall is used as a factor. Backwater from ice Mar. 1-31.

Maxima.--March-May 1965: Daily discharge, 276,000 cfs Apr. 24. Gage height, 25.38 ft 0400 hrs Apr. 24.

1936 to February 1965: Daily discharge, 197,500 cfs Apr. 22, 1952. Gage height, 20.89 ft Apr. 23, 1952.

Maximum stage known previous to April 1965, about 21.0 ft in June 1880.

Remarks.--Flow regulated by reservoirs and navigation dams.

Mean gage height, in feet, and discharge, in cubic feet per second, 1965

Day	March		April		May	
	Gage height	Discharge	Gage height	Discharge	Gage height	Discharge
1.....	7.47	24,700	8.11	23,100	22.08	203,000
2.....	8.82	41,000	8.49	33,200	21.42	191,000
3.....	10.08	56,900	8.85	39,500	20.70	181,000
4.....	11.29	63,300	9.30	46,800	19.91	169,000
5.....	12.53	59,800	9.74	54,600	18.94	159,000
6.....	13.35	59,300	10.39	64,600	18.08	150,000
7.....	13.48	56,200	11.24	74,400	17.38	139,000
8.....	13.40	52,500	12.22	87,000	16.76	129,000
9.....	13.15	47,700	13.48	109,000	16.10	123,000
10.....	12.81	43,000	14.94	121,000	15.38	117,000
11.....	12.35	39,000	16.03	132,000	14.70	110,000
12.....	11.70	35,400	16.78	140,000	14.17	106,000
13.....	11.01	33,600	17.25	146,000	13.82	101,000
14.....	10.49	31,400	17.72	153,000	13.62	98,800
15.....	9.88	23,500	18.33	165,000	13.55	99,000
16.....	9.18	23,000	19.02	173,000	13.58	101,000
17.....	8.75	19,100	19.88	185,000	13.55	99,000
18.....	8.87	18,100	20.80	196,000	13.50	100,000
19.....	8.70	18,700	21.92	211,000	13.42	97,200
20.....	8.51	19,100	23.27	238,000	13.37	96,100
21.....	8.27	16,200	24.31	256,000	13.45	95,900
22.....	7.95	16,300	24.98	268,000	13.62	95,500
23.....	7.94	16,700	25.32	275,000	13.78	96,000
24.....	7.94	16,700	25.36	276,000	13.82	94,900
25.....	7.94	16,600	25.21	270,000	13.70	96,300
26.....	7.98	16,400	24.88	264,000	13.58	95,500
27.....	8.05	16,500	24.39	255,000	13.42	96,100
28.....	8.08	17,200	23.89	242,000	13.18	93,400
29.....	8.11	18,000	23.27	231,000	12.83	89,000
30.....	8.02	16,100	22.71	216,000	12.67	87,100
31.....	7.84	17,100			12.60	84,300
Mean.....		30,620		164,800		115,900
Inches.....		0.52		2.72		1.98
Acre-feet.....		1,883,000		9,809,000		7,127,000

Mississippi River at McGregor, Iowa--Continued

Annual maximum stages and mean daily discharges, for indicated years

Year	Date	Gage height (feet)	Discharge (cfs)	Year	Date	Gage height (feet)	Discharge (cfs)
1826..	May	a26.0	--	1948..	Apr. 11	12.81	84,000
1880..	June 22	a21.5	196,000	1949..	Apr. 4, 13	11.42	73,100
1881..	Oct. 21	a19.0	--	1950..	May 17	15.26	123,300
1888..	May 13	a20.1	--	1951..	Apr. 22	20.83	185,700
1916..	May 1	a18.3	--	1952..	Apr. 22	20.89	197,500
1920..	Apr. 4, 5	a19.6	--	1953..	Jul. 3	d12.90	86,200
1922..	Apr. 19	a19.4	--	1954..	May 9	18.69	165,500
1937..	May 6, 9	16.68	54,700	1955..	Apr. 14	12.20	73,700
1938..	May 27	b23.75	101,400	1956..	Apr. 15, 16	14.88	105,000
1939..	Apr. 6	15.76	96,900	1957..	Jul. 8	12.80	95,800
1940..	Apr. 19	c10.50	52,100	1958..	Apr. 14	8.98	55,800
1941..	Apr. 20	14.66	102,800	1959..	Apr. 3	12.32	72,300
1942..	June 7	17.38	113,800	1960..	June 4, 5	e16.08	83,100
1943..	June 28	16.89	124,600	1961..	Mar. 29, 30	15.47	114,000
1944..	June 24	16.17	122,500	1962..	Apr. 18-20	15.12	104,000
1945..	Mar. 29	16.80	127,700	1963..	Apr. 1	11.84	72,000
1946..	Mar. 29	15.84	101,200	1964..	May 19	11.56	75,600
1947..	Apr. 21	13.70	85,500	1965..	Apr. 24	25.38	276,000

- a. At Prairie du Chien, Wisconsin. Zero of gage at elevation 605.4 ft above mean sea level, adjustment of 1912
- b. Occurred Sept. 18, 1938
- c. Occurred June 17, 1940
- d. Occurred Mar. 31, 1953
- e. Occurred May 14, 15, 1960

5-4070. Wisconsin River at Muscoda, Wisconsin

Location.--Lat 43°12'00", long 90°26'25", in sec.1, T.8 N., R.1 W. on left bank at bridge on State Highway 80, 0.5 miles upstream from Eagle Mill Creek and 1 mile north of Muscoda.

Drainage area.--10,300 sq mi, approximately.

Gage-height record.--Water-stage recorder. Datum of gage is 667.05 ft above mean sea level, datum of 1929.

Maxima.--April 1 to May 26, 1965: Discharge, 48,500 cfs 2300 hrs Apr. 18 (8.95 ft).
1902-03, 1913 to March 1965: Discharge, 80,800 cfs Sept. 16, 1938 (gage height, 11.48 ft).

Remarks.--Provisional data subject to revision.

Mean discharge, in cubic feet per second, 1965

Day	April	May	Day	April	May	Day	April	May
1.....	12,700	23,800	11.....	14,600	11,400	21.....	38,300	21,100
2.....	12,400	23,900	12.....	15,100	12,000	22.....	33,000	20,800
3.....	10,600	19,300	13.....	14,600	13,600	23.....	27,700	19,300
4.....	10,500	19,000	14.....	15,700	14,000	24.....	25,200	14,900
5.....	10,200	16,600	15.....	21,000	13,100	25.....	25,700	13,200
6.....	11,100	20,900	16.....	25,900	12,200	26.....	25,200	12,000
7.....	11,800	19,600	17.....	32,900	11,500	27.....	26,100	
8.....	12,400	15,700	18.....	46,100	11,800	28.....	25,900	
9.....	13,700	13,300	19.....	46,800	16,000	29.....	25,900	
10.....	14,400	10,900	20.....	41,900	20,000	30.....	24,600	

5-4125. Turkey River at Garber, Iowa

Location.--Lat 42°44'20", long 91°15'45", in NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.36, T.92 N., R.4 W., on left bank 10 ft downstream from highway bridge at Garber, 800 ft upstream from Wayman Creek, 2,000 ft downstream from Elk Creek, and 1 mile downstream from Volga River.

Drainage area.--1,545 sq mi.

Gage-height record.--Water stage recorder graph except Mar. 1-5, for which graph was reconstructed on basis of twice daily wire-weight gage readings. Datum of gage is 634.46 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 25,000 cfs. Backwater from ice Mar. 1-9, 19-28.

Maxima.--March-May 1965: Discharge, 13,800 cfs 1800 hrs Apr. 1 (gage height, 19.15 ft).

1913-16, 1919-27, 1929-30, 1932 to February 1965: Discharge, 32,300 cfs

Feb. 23, 1922 (gage height, 28.06 ft, from floodmark).

Maximum stage known since about 1890, that of Feb. 23, 1922.

Mean discharge, in cubic feet per second, 1965

Day	March	April	May	Day	March	April	May
1.....	10,000	12,600	660	16.....	800	1,220	358
2.....	7,000	8,460	602	17.....	670	1,070	334
3.....	5,000	6,240	556	18.....	348	935	358
4.....	3,500	8,020	522	19.....	330	830	410
5.....	4,200	9,820	496	20.....	310	755	366
6.....	3,600	10,000	475	21.....	290	730	327
7.....	3,200	9,390	458	22.....	270	630	327
8.....	3,800	6,960	458	23.....	260	597	341
9.....	1,500	6,230	450	24.....	250	602	317
10.....	1,140	5,830	434	25.....	240	700	310
11.....	875	4,080	407	26.....	230	850	3,760
12.....	695	3,780	384	27.....	230	1,000	3,830
13.....	805	3,910	362	28.....	225	1,020	2,250
14.....	925	2,720	344	29.....	221	850	1,310
15.....	1,020	1,540	334	30.....	448	750	996
				31.....	4,130		855
Monthly mean discharge, in cubic feet per second....					1,823	3,761	755
Runoff, in inches.....					1.36	2.72	0.56
Runoff, in acre-feet.....					112,100	223,800	46,400

Gage height, in feet, and discharge, in cubic feet per second, at indicated time

Hour	Gage height	Discharge	Hour	Gage height	Discharge	Hour	Gage height	Discharge
Mar. 30			Mar. 31-Con.			Apr. 2		
2400...	7.82	1,410	2400...	16.93	10,700	0300...	16.54	10,200
						0600...	15.54	8,880
Mar. 31			Apr. 1			0900...	15.04	8,250
0600...	8.57	1,910	0600...	18.00	12,200	1200...	14.77	7,920
0900...	9.26	2,430	1200...	18.39	12,700	1500...	14.55	7,660
1100...	9.36	2,510	1800...	19.15	13,800	1800...	14.49	7,590
1400...	9.46	2,590	1900...	19.14	13,700	2200...	14.46	7,550
1800...	13.00	5,910	2100...	18.87	13,400	2400...	14.29	7,350
2000...	15.31	8,590	2400...	17.78	11,900			

5-4145. Little Maquoketa River near Durango, Iowa

Location.--Lat 42°33'25", long 90°44'45", in NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.5, T.89 N., R.2 E., on left bank 10 ft upstream from highway bridge, $\frac{1}{2}$ miles east of Durango, 5 miles northwest of Dubuque, and 7.0 miles upstream from mouth.

Drainage area.--130 sq mi.

Gage-height record.--Water-stage recorder graph. Datum of gage is 612.03 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 6,300 cfs, extended to 25,000 cfs by logarithmic plotting and results of three slope-area measurements. Backwater from ice Mar. 9-11, 18-29.

Maxima.--March-May 1965: Discharge, 4,340 cfs 2000 hrs Mar. 31 (gage height, 12.52 ft).

1934 to February 1965: Discharge, 23,000 cfs June 13, 1947 (gage height, 21.33 ft).

Maximum stage known, about 22.1 ft June 15, 1925 (discharge, about 25,000 cfs, computed by Corps of Engineers).

Mean discharge, in cubic feet per second, 1965

Day	March	April	May	Day	March	April	May
1.....	1,100	1,220	54	16.....	94	62	37
2.....	996	283	48	17.....	62	68	31
3.....	339	326	42	18.....	33	58	27
4.....	68	566	39	19.....	28	50	24
5.....	358	811	43	20.....	25	46	22
6.....	261	734	41	21.....	23	43	20
7.....	271	177	36	22.....	22	40	21
8.....	260	170	32	23.....	21	37	39
9.....	100	113	35	24.....	20	53	28
10.....	68	102	33	25.....	20	186	23
11.....	56	354	29	26.....	19	134	45
12.....	47	127	28	27.....	19	89	113
13.....	91	81	25	28.....	21	95	46
14.....	139	70	24	29.....	25	74	36
15.....	122	73	25	30.....	425	63	34
				31.....	1,530		30
Monthly mean discharge, in cubic feet per second...					215	210	35.8
Runoff, in inches.....					1.91	1.80	0.32
Runoff, in acre-feet.....					13,220	12,510	2,200

Gage height, in feet, and discharge, in cubic feet per second, at indicated time

Hour	Gage height	Discharge	Hour	Gage height	Discharge	Hour	Gage height	Discharge
Mar. 29			Mar. 31			Apr. 1		
2400...	3.14	47	0500...	5.67	592	0300...	6.83	982
			1000...	4.67	322	0600...	6.40	827
Mar. 30			1230...	4.54	292	1000...	6.90	1,010
0200...	3.41	82	1400...	4.98	397	1400...	7.23	1,140
0500...	3.48	92	1500...	7.00	1,050	1700...	8.59	1,740
1000...	3.40	81	1600...	8.10	1,520	1800...	8.72	1,810
1500...	3.69	124	1700...	10.20	2,650	1900...	8.72	1,810
1600...	3.97	173	1900...	12.34	4,180	2000...	8.45	1,680
1700...	4.80	353	2000...	12.52	4,340	2300...	6.78	962
1800...	5.70	601	2100...	12.35	4,180	2400...	6.27	784
1900...	6.60	895	2200...	11.10	3,220			
2000...	7.95	1,450	2400...	8.70	1,800			
2130...	8.35	1,630						
2400...	7.76	1,360						

Mississippi River at Dubuque, Iowa

Location.--Lat 42°29', long 90°38', on right bank at the foot of Fourth Street in Dubuque, adjacent to and on the downstream side of the right abutment of the Illinois Central Railroad Bridge and at mile 579.9 above the Ohio River.

Drainage area.--81,600 sq mi, approximately.

Gage-height record.--Water-stage recorder graph. Datum of gage is 584.95 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements and analysis of gate operation procedure at Dam 12. Relation only applicable for standard gate operation procedures and discharges above 100,000 cfs.

Maxima.--April-May 1965: Discharge, 304,000 cfs 0030 hrs Apr. 26 (gage height, 26.71 ft).

1865 to February 1965: Gage height, 22.7 ft Apr. 22, 1951 and Apr. 25, 1952.

Remarks.--Current-meter measurements for 1944-65 and annual maximum gage heights prior to 1965 furnished by Corps of Engineers. Gage-height record furnished by U.S. Weather Bureau.

Mean gage height, in feet, and discharge, in cubic feet per second, 1965

Day	April		May		Day	April		May	
	Gage height	Discharge	Gage height	Discharge		Gage height	Discharge	Gage height	Discharge
1			24.59	266,000	16	19.29	178,000	14.67	111,000
2			23.96	254,000	17	20.04	190,000	14.57	110,000
3			23.34	244,000	18	20.84	202,000	14.55	110,000
4			22.66	232,000	19	21.78	217,000	14.47	109,000
5			21.90	219,000	20	22.88	236,000	14.43	108,000
6			21.06	206,000	21	24.12	257,000	14.40	108,000
7			20.17	192,000	22	25.18	276,000	14.48	109,000
8			19.37	180,000	23	25.95	290,000	14.61	110,000
9			18.61	168,000	24	26.42	299,000	14.82	113,000
10	14.70	111,000	17.87	157,000	25	26.67	304,000	14.97	115,000
11	15.97	129,000	17.07	145,000	26	26.64	303,000	14.91	114,000
12	16.70	140,000	16.25	133,000	27	26.40	299,000	15.00	115,000
13	17.46	151,000	15.42	121,000	28	26.08	293,000	14.60	110,000
14	18.12	161,000	14.97	115,000	29	25.64	285,000	14.26	106,000
15	18.72	170,000	14.73	112,000	30	25.12	275,000		

Annual maximum gage heights for indicated years

Year	Date	Gage height (feet)	Year	Date	Gage height (feet)
1866.....	May	20.17	1884.....	Oct 16	13.6
1869.....	--	15.02	1885.....	May 6, 7	11.5
1870.....	Apr. 20	21.83	1886.....	Apr. 29	14.4
1874.....	May 13-17	10.4	1887.....	Apr. 25-27	14.0
1875.....	Apr. 26	15.5	1888.....	May 12, 13	21.4
1876.....	May 27-29	15.4	1889.....	Apr. 1-3, May 30	6.4
1877.....	July 18-19	7.7	1890.....	June 26	13.2
1878.....	Aug. 1	5.4	1891.....	Apr. 30, May 1, 2	12.9
1879.....	May 30	9.7	1892.....	June 24	17.6
1880.....	June 23, 24	21.7	1893.....	May 11-14	15.7
1881.....	Oct. 24, 25	20.2	1894.....	May 29	15.5
1882.....	Apr. 20	15.7	1895.....	June 24-26	6.3
1883.....	Apr. 27-29	15.7	1896.....	May 29	13.9

Mississippi River at Dubuque, Iowa--Continued

Annual maximum gage heights for indicated years--Continued

Year	Date	Gage height (feet)	Year	Date	Gage height (feet)
1897.....	Apr. 15	17.9	1931.....	Dec. 3-4	7.6
1898.....	June 21-23	9.4	1932.....	Apr. 20, '21	13.1
1899.....	June 22-24	14.8	1933.....	Apr. 11	11.9
1900.....	Oct. 17	14.6	1934.....	Apr. 17	12.0
1901.....	Apr. 20	11.0	1935.....	Apr. 3-5	16.2
1902.....	May 24	12.6	1936.....	Apr. 5	16.8
1903.....	Sept. 27	17.4	1937.....	Mar. 8	12.2
1904.....	June 8, 9	11.7	1938.....	Sept. 21	20.6
1905.....	June 18-19	17.4	1939.....	Apr. 6	17.5
1906.....	Apr. 21-25	16.6	1940.....	June 18	11.4
1907.....	Apr. 9, 10	16.1	1941.....	Apr. 23	16.4
1908.....	July 19	14.9	1942.....	June 12	19.3
1909.....	Apr. 20	13.2	1943.....	June 29	18.9
1910.....	Apr. 2, 3	9.1	1944.....	June 27	19.0
1911.....	Oct. 19	14.6	1945.....	Mar. 29, 30	18.9
1912.....	Apr. 4	12.2	1946.....	Mar. 27	17.8
1913.....	Mar. 25	12.6	1947.....	June 14	15.5
1914.....	July 12	14.4	1948.....	Mar. 31, Apr. 1	14.2
1915.....	Apr. 21, 22	12.1	1949.....	Apr. 4-11, 15	12.4
1916.....	May 3	19.8	1950.....	May 20	16.7
1917.....	Apr. 18, 19	15.5	1951.....	Apr. 22	22.7
1918.....	June 11, 12	13.6	1952.....	Apr. 25	22.7
1919.....	Apr. 22, 23	16.6	1953.....	Apr. 1, 2, 4	14.0
1920.....	Apr. 7	21.0	1954.....	May 12	20.2
1921.....	May 10	10.7	1955.....	Apr. 14, 15	13.3
1922.....	Apr. 21	21.0	1956.....	Apr. 19	16.0
1923.....	May 3, 4	12.4	1957.....	July 13	13.7
1924.....	May 8	11.7	1958.....	Apr. 16, 17	10.0
1925.....	June 25	11.1	1959.....	Apr. 2	14.3
1926.....	Oct. 5	11.3	1960.....	May 17	17.5
1927.....	Mar. 28	15.6	1961.....	Mar. 31	16.7
1928.....	Apr. 7, 8	14.0	1962.....	Apr. 19	16.3
1929.....	Apr. 17	17.0	1963.....	Apr. 2-4	12.5
1930.....	June 26, 27	11.0	1964.....	May 18-21	12.20
			1965.....	Apr. 26	26.71

5-4185. Maquoketa River near Maquoketa, Iowa

Location.--Lat 42°05'05", long 90°37'55", in SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.17, T.84 N., R.3 E., on right bank 500 ft upstream from bridge on State Highway 62, 1,200 ft upstream from Prairie Creek, 2.0 miles northeast of Maquoketa, and 2.2 miles downstream from North Fork.

Drainage area.--1,553 sq mi.

Gage-height record.--Water-stage recorder graph, except May 12-24, where graph was reconstructed with the use of wire-weight readings and recorder record. Datum of gage is 636.52 ft above mean sea level, adjustment of 1912.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 45,000 cfs. Backwater from ice Mar. 1-4, 18-29.

Maxima.--March-May 1965: Discharge, 9,880 cfs 1100 hrs Apr. 1 (gage height, 12.45 ft).

1913 to February 1965: Discharge, 48,000 cfs June 27, 1944 (gage height, 24.70 ft).

Mean discharge, in cubic feet per second, 1965

Day	March	April	May	Day	March	April	May
1.....	4,000	9,000	796	16.....	1,870	958	563
2.....	4,500	8,210	756	17.....	1,660	864	508
3.....	5,000	3,960	683	18.....	900	814	494
4.....	2,500	3,450	519	19.....	550	707	515
5.....	1,510	4,490	603	20.....	520	627	431
6.....	2,390	6,320	635	21.....	480	695	466
7.....	3,280	3,720	575	22.....	460	659	434
8.....	4,240	1,940	591	23.....	440	627	473
9.....	4,710	1,720	591	24.....	430	691	599
10.....	2,380	1,400	583	25.....	420	760	571
11.....	1,630	2,070	555	26.....	410	954	919
12.....	774	1,690	480	27.....	400	976	1,900
13.....	1,090	1,340	535	28.....	400	1,030	1,850
14.....	1,340	1,120	498	29.....	900	1,010	1,220
15.....	1,590	1,010	494	30.....	4,140	901	1,070
				31.....	7,130		962
Monthly mean discharge, in cubic feet per second....					2,001	2,124	705
Runoff, in inches.....					1.49	1.53	0.52
Runoff, in acre-feet.....					123,100	126,400	43,380

Gage height, in feet, and discharge, in cubic feet per second, at indicated time

Hour	Gage height	Discharge	Hour	Gage height	Discharge	Hour	Gage height	Discharge
Mar. 31			Apr. 2			Apr. 3--Con.		
2400...	10.79	7,870	0100...	11.56	8,770	0900...	6.48	3,630
			0900...	11.18	8,320	1000...	5.18	2,680
Apr. 1			1600...	11.12	8,240	1100...	5.51	2,910
0400...	11.73	8,980	2400...	10.16	7,180	1200...	5.91	3,190
0800...	12.19	9,550				1500...	5.61	2,980
1100...	12.45	9,880	Apr. 3			1800...	5.51	2,910
2400...	10.97	8,070	0200...	9.62	6,580	2000...	5.35	2,800
			0400...	8.86	5,760	2200...	5.51	2,910
			0800...	7.44	4,400	2400...	5.90	3,180

Mississippi River at Clinton, Iowa
(Corps of Engineers Gage No. 34A)

Location.--Lat 41°50'10", long 90°11'05", 5 ft downstream from the pivot pier of Chicago and Northwestern Railroad bridge in Clinton, and at mile 518.0 upstream from Ohio River.

Drainage area.--85,600 sq mi, approximately.

Gage-height record.--Annual maximum stages from floodmarks prior to 1865, from staff gage readings since 1865. Datum or zero of several gages in the vicinity was the low-water mark of 1864, or in ft above mean sea level, adjustment of 1912. 1865 to February 1893, low-water mark of 1864; February 1893, to May 1, 1909, low-water of 1864, or 566.63 ft; since May 2, 1909, 566.29 ft.

Discharge record.--Annual maximum discharges computed on the basis of stage-discharge relation for gage at Le Claire 25.4 miles downstream prior to October 1939, since then on the basis of the Camanche gage. Records are equivalent.

Maxima.--April-May 1965: Daily discharge, 307,000 cfs Apr. 28. Gage height, 24.85 ft Apr. 28.

1828: Gage height, 23.4 ft (discharge unknown).

1874-1964: Daily discharge, 250,000 cfs June 25, 1880 (gage height, 21.0 ft).

Annual maximum stages and mean daily discharges, for indicated years

Year	Date	Gage height (feet)	Discharge (cfs)	Year	Date	Gage height (feet)	Discharge (cfs)
1785..	--	20.5	--	1889..	May 30-June 1	5.3	64,300
1826..	--	--	--	1890..	June 28, 29	12.2	142,000
1828..	--	23.4	--	1891..	May 2, 3	12.5	130,000
1837..	--	23.1	--	1892..	June 26	20.0	238,000
1844..	--	20.7±	--	1893..	May 12-15	14.8	174,000
1851..	--	20.0±	--	1894..	May 30, 31	14.3	157,000
1858..	--	21.1	--	1895..	Mar. 2	7.0	70,000
1859..	May 16	18.8	--	1896..	May 28, 29	13.5	148,000
1865..	--	15.6	--	1897..	Apr. 17, 18	16.8	198,000
1866..	--	14.93	--	1898..	June 24-27	8.7	88,800
1867..	--	16.78	--	1899..	June 24-26	13.9	149,000
1868..	--	16.08	--	1900..	May 3, 4	--	100,000
1869..	--	18.18	--	1901..	Oct. 20, 1900	13.3	142,000
1870..	Apr. 27	19.73	--	1902..	May 26, 27	11.7	123,000
1871..	Apr. 15	18.50	--	1903..	Sept. 29, 30	15.6	176,000
1874..	Mar. 17	17.2	98,400	1904..	Oct. 1, 1903	--	174,000
1875..	Apr. 29, 30	--	167,000	1905..	June 21, 22	15.7	172,000
1876..	May 7-10, 30-31	--	165,000	1906..	Apr. 22-25	15.3	169,000
	June 1, 2			1907..	Apr. 11-13	14.8	171,000
1877..	Apr. 3	--	104,000	1908..	July 20	13.9	134,000
1878..	June 5	7.0	80,800	1909..	Apr. 22	12.5	123,000
1879..	June 1	8.5	96,800	1910..	Mar. 25	8.6	73,100
1880..	June 25	21.0	250,000	1911..	Feb. 18	--	84,000
1881..	May 12	--	174,000	1912..	Oct. 21, 22, 1911	12.9	120,000
1882..	Oct. 26, 27, '81	19.5	237,000	1913..	Mar. 27	12.5	123,000
1883..	May 1	14.8	174,000	1914..	July 13-15	12.6	111,000
1884..	Mar. 27, 28	--	144,000	1915..	Apr. 23, 24	10.5	92,000
	Sept. 27, 28			1916..	May 5	18.0	195,000
1885..	Oct. 18, 1884	11.3	146,000	1917..	Apr. 21	14.1	142,000
1886..	May 1, 2	13.4	157,000	1918..	June 13, 14	12.3	123,000
1887..	Apr. 28	12.9	149,000	1919..	Apr. 25	15.4	166,000
1888..	May 14-16	20.5	248,000				

Mississippi River at Clinton, Iowa--Continued

Annual maximum stages and mean daily discharges, for indicated years

Year	Date	Gage height (feet)	Discharge (cfs)	Year	Date	Gage height (feet)	Discharge (cfs)
1920..	Apr. 9	19.0	222,000	1942..	June 13	17.8	169,600
1921..	May 11-13	9.4	85,300	1943..	June 30	17.1	158,700
1922..	Apr. 23	18.9	212,000	1944..	June 28	18.5	168,500
1923..	Apr. 7, 8	11.2	106,000	1945..	Mar. 31	17.6	164,400
1924..	Aug. 23	11.0	106,000	1946..	Mar. 28	16.6	144,800
1925..	June 19, 20	10.7	93,900	1947..	June 15	15.4	125,500
1926..	Sept. 26, 27	--	83,600	1948..	Mar. 21	14.2	108,300
1927..	Mar. 31- Apr. 1	14.5	133,000	1949..	Apr. 7	11.7	85,300
1928..	Apr. 9, 10	13.2	116,000	1950..	May 22	15.4	129,900
1929..	Apr. 2, 3, 19-21	15.7	146,000	1951..	Apr. 26	20.70	221,500
1930..	June 28	9.8	83,600	1952..	Apr. 27	20.92	225,400
1931..	July 6-11	--	40,700	1953..	Apr. 5	13.2	104,100
1932..	Apr. 22, 23	11.7	97,500	1954..	May 14	18.2	175,900
1933..	Apr. 8-13	10.9	92,100	1955..	Apr. 25	12.8	96,900
1934..	Apr. 19, 20	10.4	81,400	1956..	Apr. 20	14.6	127,000
1935..	Apr. 7	14.3	123,000	1957..	July 14	13.1	103,000
1936..	Apr. 7	15.5	133,000	1958..	Apr. 15-17	9.2	64,500
1937..	Mar. 8, 9	11.7	95,800	1959..	Apr. 3	14.1	112,000
1938..	Sept. 23	18.3	167,400	1960..	May 18	16.3	151,000
1939..	Apr. 9	15.8	144,900	1961..	Apr. 2	15.4	143,000
1940..	June 19	10.6	74,100	1962..	Apr. 21	15.2	138,000
1941..	Apr. 25	15.2	128,200	1963..	Apr. 2	11.9	90,900
				1964..	May 19, 20	11.5	84,000
				1965..	Apr. 27	24.85	307,000

5-4205. Mississippi River at Clinton, Iowa

Location.--Lat 41°46'50", long 90°15'07", in NW¼ sec.34, T.81 N., R.6 E., on right bank at foot of Eighth Avenue in Camanche, 5.0 miles upstream from Wapsipinicon River, 6.4 miles downstream from Clinton, 10.6 miles downstream from Dam 13, and at mile 511.8 upstream from Ohio River.

Drainage area.--85,600 sq mi, approximately, at Fulton-Lyons Bridge (formerly U.S. Highway 30) where discharge measurements are made.

Gage-height record.--Water-stage recorder graph. Datum of gage is 562.68 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 307,000 cfs. Backwater from ice Mar. 1-6, 9-27.

Maxima.--March-May 1965: Daily discharge, 307,000 cfs Apr. 28. Gage height, 24.65 0600 hrs Apr. 28.

1873 to February 1965: Daily discharge, 250,000 cfs June 25, 1880; gage height, 14.5 ft June 25, 1880, site and datum then in use.

Mean gage height, in feet, and discharge, in cubic feet per second, 1965

Day	March		April		May	
	Gage height	Discharge	Gage height	Discharge	Gage height	Discharge
1.....	9.30	28,000	11.22	60,800	23.90	284,000
2.....	9.93	40,000	11.95	71,600	23.53	275,000
3.....	10.36	50,000	11.99	72,900	23.10	264,000
4.....	11.04	56,000	11.68	69,300	22.66	252,000
5.....	11.18	60,000	11.93	74,300	22.13	240,000
6.....	10.96	58,000	13.00	88,800	21.57	228,000
7.....	10.97	62,800	13.33	91,700	20.93	216,000
8.....	11.65	73,200	13.41	91,900	20.31	205,000
9.....	12.68	82,000	13.51	93,400	19.63	192,000
10.....	12.96	84,000	13.83	95,900	18.92	180,000
11.....	12.66	75,000	14.67	112,000	18.21	170,000
12.....	12.07	70,000	15.22	125,000	17.52	157,000
13.....	11.87	66,000	15.81	134,000	16.83	147,000
14.....	11.67	62,000	16.59	143,000	16.12	135,000
15.....	11.26	56,000	17.13	155,000	15.54	126,000
16.....	11.11	51,000	17.61	162,000	15.20	121,000
17.....	10.69	47,000	17.97	169,000	14.92	117,000
18.....	10.85	43,000	18.37	176,000	14.61	112,000
19.....	10.30	30,500	18.89	186,000	14.47	111,000
20.....	10.44	33,000	19.47	195,000	14.42	110,000
21.....	10.70	36,000	20.18	209,000	14.41	110,000
22.....	10.58	34,000	21.10	226,000	14.45	110,000
23.....	10.32	32,000	22.03	245,000	14.47	111,000
24.....	10.15	31,000	22.82	263,000	14.51	112,000
25.....	10.12	30,000	23.63	280,000	14.59	113,000
26.....	10.16	31,000	24.24	300,000	14.75	116,000
27.....	10.14	32,000	24.55	305,000	14.94	118,000
28.....	9.98	32,900	24.63	307,000	14.96	118,000
29.....	9.76	34,400	24.49	300,000	14.90	116,000
30.....	10.01	40,800	24.26	294,000	14.63	112,000
31.....	10.47	48,200			14.30	107,000
Mean.....		48,700		169,900		157,600
Inches.....		0.66		2.21		2.12
Acre-feet.....		2,995,000		10,110,000		9,689,000

5-4220. Wapsipinicon River near De Witt, Iowa

Location.--Lat 41°45'55", long 90°32'00", in SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.6, T.80 N., R.4 E., on left bank 15 ft downstream from bridge on U. S. Highway 61, 3 miles south of De Witt, 6.2 miles upstream from Brophy Creek, and 15.1 miles upstream from mouth.

Drainage area.--2,330 sq mi (includes that of Silver Creek).

Gage-height record.--Water-stage recorder graph except March 20-24. Datum of gage is 598.81 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 25,000 cfs. Backwater from ice Mar. 1-19.

Maxima.--March-May 1965: Discharge, 10,200 cfs 2230 hrs Apr. 14 (gage height, 11.05 ft).

1934 to February 1965: Discharge, 26,000 cfs June 27, 1944 (gage height, 12.07 ft).

Mean discharge, in cubic feet per second, 1965

Day	March	April	May	Day	March	April	May
1.....	1,400	4,170	2,010	16.....	4,800	8,650	891
2.....	1,500	3,470	1,850	17.....	5,200	7,640	918
3.....	1,600	3,590	1,740	18.....	3,500	6,420	852
4.....	2,000	4,430	1,590	19.....	1,900	4,990	798
5.....	2,400	5,470	1,560	20.....	1,600	4,320	750
6.....	2,700	7,480	1,400	21.....	1,400	3,430	705
7.....	3,100	8,750	1,320	22.....	1,300	2,680	680
8.....	3,500	8,900	1,290	23.....	1,250	2,210	814
9.....	4,000	8,650	1,480	24.....	1,200	2,270	962
10.....	4,500	8,160	1,340	25.....	1,160	2,870	858
11.....	5,000	8,400	1,210	26.....	1,080	2,700	918
12.....	5,600	9,200	1,110	27.....	1,050	2,410	1,280
13.....	6,400	9,780	1,040	28.....	1,020	2,600	1,760
14.....	6,800	9,960	979	29.....	1,700	2,550	1,890
15.....	6,000	9,720	946	30.....	4,480	2,230	2,050
				31.....	4,480		1,910
Monthly mean discharge, in cubic feet per second,...					3,020	5,603	1,255
Runoff, in inches.....					1.49	2.68	0.62
Runoff, in acre-feet.....					185,700	333,400	77,160

Gage height, in feet, and discharge, in cubic feet per second, at indicated time

Hour	Gage height	Discharge	Hour	Gage height	Discharge	Hour	Gage height	Discharge
Apr. 11			Apr. 13			Apr. 15		
2400...	10.80	8,850	1200...	11.00	9,900	1200...	10.97	9,720
			2400...	11.00	9,900	2400...	10.88	9,250
Apr. 12			Apr. 14			Apr. 16		
1200...	10.87	9,200	1200...	11.00	9,900	1200...	10.77	8,700
2400...	10.94	9,550	2230...	11.05	10,200	2400...	10.63	8,120
			2400...	11.04	10,100			

Mississippi River at Davenport, Iowa

Location.--Lat 41°31'10", long 90°33'55", in center wall of Lock 15 about 15 ft upstream from pivot pier of Government bridge at Davenport, 500 ft upstream from Dam 15, and at mile 482.9 upstream from Ohio River.

Drainage area.--88,500 sq mi, approximately.

Gage-height record.--Peak stages only from water-stage recorder and staff gage readings. Datum of gage is 542.50 ft above mean sea level, adjustment of 1912, and prior to Sept. 2, 1864, at datum 0.6 ft higher. Prior to Sept. 6, 1872, several staff gages at old bridge site 2,300 ft upstream, and Sept. 7, 1872, to Feb. 8, 1933, staff gage at site 15 ft downstream on pier of Government bridge.

Maxima.--March-May 1965: Gage height, 22.48 ft Apr. 28.

1860-64: Gage height, 18.63 ft Apr. 28, 1952.

Remarks.--Stage records furnished by Corps of Engineers.

Annual maximum gage heights, for indicated years

Year	Date	Gage height (feet)	Year	Date	Gage height (feet)
1860.....	June 21	12.6	1890.....	July 1	11.9
1861.....	Apr. 27-29	14.2	1891.....	May 3-5	10.3
1862.....	May 4-7	15.2	1892.....	June 27	19.4
1863.....	May 1-5	8.0	1893.....	Mar. 13	15.1
1864.....	Feb. 27	7.7	1894.....	May 31	12.3
1865.....	Mar. 4	11.1	1895.....	Mar. 4	8.9
1866.....	May 4	15.7	1896.....	May 28-30	12.0
1867.....	June 27, 28	14.3	1897.....	Apr. 17	15.1
1868.....	Mar. 10	*22.0	1898.....	Feb. 14	9.9
1869.....	Oct. 9-10	12.9	1899.....	June 25, 26	11.85
1870.....	Apr. 25	16.8	1900.....	Mar. 13	13.1
1871.....	May 14-16	12.8	1901.....	Mar. 16	9.6
1872.....	May 28	9.1	1902.....	May 29	10.5
1873.....	May 8	12.9	1903.....	Oct. 1	13.65
1874.....	Mar. 9	15.6	1904.....	Mar. 22	13.2
1875.....	Apr. 29	12.9	1905.....	June 21	14.3
1876.....	Apr. 16	13.8	1906.....	Apr. 22-26	13.9
1877.....	Apr. 4, 5	9.9	1907.....	Apr. 13	13.6
1878.....	July 17	7.1	1908.....	July 21	12.25
1879.....	June 1	7.8	1909.....	Dec. 25	13.7
1880.....	June 26	18.4	1910.....	Jan. 1	11.9
1881.....	Oct. 27	17.7	1911.....	Oct. 22, 23	11.2
1882.....	Apr. 23	14.1	1912.....	Mar. 30	12.7
1883.....	May 2	13.3	1913.....	Mar. 28, 29	12.8
1884.....	Mar. 28, 29	11.9	1914.....	July 14, 15	10.65
1885.....	May 8	10.1	1915.....	June 3-5, 7	9.5
1886.....	May 1-3	12.5	1916.....	May 5	15.9
1887.....	Feb. 12	12.9	1917.....	Apr. 21	12.35
1888.....	May 16	18.6	1918.....	June 14	10.35
1889.....	Mar. 12	7.8	1919.....	Apr. 25	13.7

* Ice gorge-raised 5 ft in one day.

Mississippi River at Davenport, Iowa--Continued

Annual maximum gage heights, for indicated years

Year	Date	Gage height (feet)	Year	Date	Gage height (feet)
1920.....	Apr. 9	17.1	1943.....	Apr. 16-19	14.2
1921.....	Jan. 18	10.1	1944.....	June 29	16.4
1922.....	Apr. 23	17.1	1945.....	Mar. 31	15.0
1923.....	Apr. 8	10.4	1946.....	Mar. 28-30	14.4
1924.....	Aug. 23	10.9	1947.....	June 17	13.1
1925.....	June 20	8.6	1948.....	Mar. 22	13.7
1926.....	Oct. 6, 7	9.7	1949.....	Mar. 9, Apr. 6	9.8
1927.....	Mar. 31	12.2	1950.....	Apr. 30	13.5
1928.....	Apr. 10	11.45	1951.....	Apr. 28, 29	18.3
1929.....	Apr. 20, 21	14.2	1952.....	Apr. 28	18.63
1930.....	June 28, 29	8.4	1953.....	Apr. 4, 5	11.1
1931.....	Dec. 1-3	7.0	1954.....	May 15	15.54
1932.....	Apr. 23, 24	10.2	1955.....	Apr. 25-27	10.8
1933.....	Apr. 10	10.3	1956.....	Apr. 21	12.1
1934.....	Apr. 20	8.5	1957.....	July 14	10.4
1935.....	Apr. 6-8	12.1	1958.....	Apr. 17	7.2
1936.....	Apr. 7-9	13.0	1959.....	Apr. 4	13.1
1937.....	Mar. 9	12.2	1960.....	Apr. 3	15.3
1938.....	Sept. 24	15.8	1961.....	Apr. 3-4	13.7
1939.....	Apr. 9	13.2	1962.....	Apr. 7	13.9
1940.....	Apr. 18	7.9	1963.....	Mar. 27	10.0
1941.....	Apr. 23-26	12.6	1964.....	May 20	9.40
1942.....	June 14, 15	15.2	1965.....	Apr. 28	22.48

5-4465. Rock River near Joslin, Illinois

Location.--Lat 41°33'35", long 90°10'55", in NE $\frac{1}{4}$ sec.18, T.18 N., R.3 E., on right bank at downstream side of bridge on State Highway 92, 1-3/4 miles east of Joslin, 12 miles downstream from Rock Creek, and 27 miles upstream from mouth.

Drainage area.--9,520 sq mi, approximately.

Gage-height record.--Digital recorder tape. Datum of gage is 564.06 ft above mean sea level, datum of 1929 (levels of Corps of Engineers).

Maxima.--April 1 to May 22, 1965: Discharge, 21,700 cfs 0945 hrs Apr. 8 (gage height, 13.12 ft).

1939 to March 1965: Discharge, 46,200 cfs Mar. 28, 1948. Gage height 16.23 ft Mar. 3, 1948.

Maximum stage known since 1892, that of Mar. 3, 1948.

Remarks.--Records are provisional and subject to revision.

Mean discharge, in cubic feet per second, 1965

Day	April	May	Day	April	May	Day	April	May
1.....	12,300	10,200	11.....	18,300	9,140	21.....	11,100	3,730
2.....	16,900	9,240	12.....	17,600	8,790	22.....	10,300	3,690
3.....	19,800	8,570	13.....	17,200	8,000	23.....	9,720	
4.....	18,800	8,010	14.....	16,600	6,970	24.....	9,580	
5.....	19,400	7,700	15.....	16,300	5,800	25.....	10,100	
6.....	19,800	8,100	16.....	15,900	5,430	26.....	10,700	
7.....	21,200	9,420	17.....	15,300	4,890	27.....	11,200	
8.....	21,500	9,660	18.....	14,200	3,380	28.....	11,600	
9.....	20,700	10,300	19.....	12,900	3,520	29.....	11,500	
10.....	19,200	9,640	20.....	12,000	4,090	30.....	10,700	

5-4655. Iowa River at Wapello, Iowa

Location.--Lat 41°10'40", long 91°10'55", in NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.27, T.74 N., R.3 W., on right bank 30 ft downstream from bridge on State Highway 99 at east edge of Wapello, 13.0 miles downstream from Cedar River, and at mile 15.4.

Drainage area.--12,499 sq mi.

Gage-height record.--Water-stage recorder graph, except May 6-9, for which graph was reconstructed on basis of daily wire-weight gage readings. Datum of gage is 548.98 ft above mean sea level, adjustment of 1912.

Discharge record.--Stage discharge relation defined by current-meter measurements below 70,000 cfs. Backwater from ice March 1-31. Backwater from Mississippi River April 29 to May 9.

Maxima.--March-May 1965: Discharge, 70,800 cfs 0900 hrs Apr. 13 (gage height, 17.25 ft).

1914 to February 1965: Discharge, 94,000 cfs June 18, 1947 (gage height, 16.14 ft).

Mean discharge, in cubic feet per second, 1965

Day	March	April	May	Day	March	April	May
1.....	5,600	16,900	11,300	16.....	15,000	58,300	10,900
2.....	5,400	19,000	10,400	17.....	19,000	50,500	11,100
3.....	8,000	19,000	9,400	18.....	20,000	46,600	10,500
4.....	11,000	20,200	8,530	19.....	15,000	44,800	10,100
5.....	14,000	22,600	8,150	20.....	10,000	39,000	9,860
6.....	13,000	28,200	8,790	21.....	8,000	32,700	9,840
7.....	12,000	36,000	10,500	22.....	6,500	27,700	9,910
8.....	11,000	45,100	11,100	23.....	5,800	24,200	10,100
9.....	17,000	47,400	13,800	24.....	5,200	24,800	14,100
10.....	33,000	51,100	14,000	25.....	4,800	35,000	10,400
11.....	27,000	63,700	13,200	26.....	4,500	37,200	10,700
12.....	18,000	68,200	12,600	27.....	4,300	30,900	11,800
13.....	15,000	70,300	12,100	28.....	4,100	21,400	15,200
14.....	14,000	67,300	11,600	29.....	6,000	15,000	14,000
15.....	14,000	63,400	11,200	30.....	11,000	12,700	14,200
				31.....	15,000		15,400
Monthly mean discharge, in cubic feet per second....					12,010	37,970	11,440
Runoff, in inches.....					1.11	3.39	1.06
Runoff, in acre-feet.....					738,200	2,260,000	703,700

Gage height, in feet, and discharge, in cubic feet per second, at indicated time

Hour	Gage height	Discharge	Hour	Gage height	Discharge	Hour	Gage height	Discharge
Apr. 10			Apr. 12			Apr. 14		
2400...	15.18	56,700	0600...	16.65	66,600	0600...	16.95	68,600
			0900...	16.68	66,800	1200...	16.77	67,400
Apr. 11			1500...	16.95	68,600	1800...	16.57	65,900
0600...	15.72	60,100	1800...	17.05	69,400	2400...	16.46	65,200
1200...	16.26	63,800	2400...	17.16	70,100			
1800...	16.87	68,100				Apr. 15		
2100...	17.00	69,000	Apr. 13			0600...	16.28	64,000
2400...	16.87	68,100	0900...	17.25	70,800	1200...	16.18	63,300
			1800...	17.17	70,200	1800...	16.09	62,600
			2400...	17.08	69,600	2400...	15.96	61,900

Mississippi River at Burlington, Iowa

Location.--Lat 40°48'10", long 91°05'30", on pivot pier of Chicago Burlington and Quincy Railroad bridge at Burlington, and at mile 403.1 upstream from Ohio River.

Drainage area.--114,000 sq mi, approximately.

Gage-height record.--Peak stages only from staff gage readings. Datum of gage is 511.45 ft above mean sea level, adjustment of 1912.

Maxima.--March-May 1965: Gage height, 21.0 ft Apr. 30, May 1.

1851 to February 1965: Gage height, 18.9 ft in June 1851.

Remarks.--Stage records furnished by Corps of Engineers.

Annual maximum gage heights, for indicated years

Year	Date	Gage height	Year	Date	Gage height	Year	Date	Gage height
1851..	June	18.9	1904..	Mar. 29	10.8	1935..	Apr. 11	11.7
1869..	Oct. 12, 13	11.8	1905..	June 25	12.2	1936..	Apr. 10	12.6
1870..	Apr. 26-28	15.0	1906..	Apr. 24-26	12.3	1937..	Mar. 10-12	13.8
1871..	May 21	12.1	1907..	Apr. 15, 16	11.4	1938..	Sept. 25, 26	15.0
1872..	June 7, 8	9.6	1908..	June 9	11.25	1939..	Apr. 11, 12	13.1
1873..	June 18-20	11.2	1909..	May 5, 6	11.7	1940..	Apr. 19, 20	9.3
1874..	Mar. 27	7.7	1910..	Mar. 22	8.35	1941..	Apr. 27, 28	13.0
1879..	July 15	7.07	1911..	Feb. 20	10.2	1942..	June 16, 17	15.5
1880..	June 28	15.8	1912..	Apr. 5, 6	13.35	1943..	Apr. 18, 19	14.1
1881..	Oct. 31	16.53	1913..	Mar. 29, 30	11.7	1944..	May 27	17.1
1882..	Apr. 25	13.3	1914..	June 23	9.32	1945..	Apr. 1, 2	15.4
1883..	May 5	11.8	1915..	June 7, 8	10.4	1946..	Jan. 11	17.1
1884..	Mar. 30, 31	13.8	1916..	May 9	14.2	1947..	June 20, 21	17.0
1885..	May 10	9.78	1917..	June 17	11.62	1948..	Mar. 23	16.4
1886..	May 7	12.0	1918..	June 12	12.95	1949..	Mar. 12	12.2
1887..	Feb. 14	9.78	1919..	May 8	13.79	1950..	Apr. 26	13.8
1888..	May 18, 19	17.55	1920..	Apr. 11	14.79	1951..	Apr. 29	18.1
1889..	May 24, 25	6.00	1921..	May 13	9.42	1952..	Apr. 28	17.85
1890..	June 30	11.62	1922..	Apr. 24, 25	15.42	1953..	Apr. 3-6	12.3
1891..	May 5, 6	9.70	1923..	Apr. 10	11.18	1954..	May 16-18	14.8
1892..	June 8-30	17.5	1924..	Aug. 25	12.16	1955..	Apr. 27	13.2
1893..	May 16	12.47	1925..	June 23	9.4	1956..	Apr. 21	12.2
1894..	June 3, 4	10.4	1926..	Oct. 6-9	11.53	1957..	July 15	11.1
1895..	Mar. 2, 3	5.3	1927..	Apr. 3	12.88	1958..	June 13	9.8
1896..	June 3	10.25	1928..	Dec. 28	14.09	1959..	Apr. 5, 6	14.5
1897..	Apr. 27-29	13.2	1929..	Mar. 23	15.82	1960..	Apr. 4	18.7
1898..	Mar. 15	6.8	1930..	June 18	11.8	1961..	Apr. 5	16.3
1899..	June 28-30	10.3	1931..	Dec. 3	9.5	1962..	Apr. 7	16.7
1900..	Oct. 23, 24	9.0	1932..	Mar. 9	11.4	1963..	Mar. 22	12.1
1901..	Mar. 24	9.4	1933..	Apr. 10	12.4	1964..	May 21-23	10.4
1902..	July 21	10.8	1934..	Dec. 12	11.5	1965..	Apr. 30-May 1	21.0
1903..	June 5, 6	14.9						

5-4740. Skunk River at Augusta, Iowa

Location.--Lat 40°45'10", long 91°16'30", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.26, T.69 N., R.4 W., on left bank 300 ft upstream from bridge on State Highway 394 at Augusta, 2 miles upstream from Long Creek, at mile 12.5.

Drainage area.--4,303 sq mi.

Gage-height record.--Water-stage recorder graph, except Mar. 19-20, for which graph was reconstructed on basis of daily wire-weight gage readings. Datum of gage is 521.24 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 50,000 cfs. Backwater from ice Mar. 1-18, 22-26. Backwater from Mississippi River Apr. 14-30, May 1-14.

Maxima.--March-May 1965: Discharge, 20,300 cfs 0230 hrs Mar. 18 (gage height, 16.99 ft).

1913, 1914 to February 1965: Discharge, 51,000 cfs Apr. 3, 1960 (gage height, 25.00 ft).

Flood of June 1, 1903, reached a stage of about 21 ft (discharge, about 45,000 cfs).

Mean discharge, in cubic feet per second, 1965

Day	March	April	May	Day	March	April	May
1.....	3,000	6,140	8,000	16.....	5,000	7,100	1,820
2.....	5,000	5,990	7,000	17.....	16,000	6,100	1,560
3.....	7,000	5,990	5,900	18.....	19,000	5,000	1,520
4.....	6,500	6,380	5,200	19.....	17,400	4,200	1,350
5.....	5,000	8,000	4,800	20.....	14,000	3,700	1,180
6.....	3,500	14,800	4,500	21.....	9,250	3,200	1,080
7.....	3,000	15,800	4,300	22.....	7,400	2,800	979
8.....	2,500	17,100	4,000	23.....	6,000	2,800	907
9.....	2,200	17,700	3,900	24.....	4,500	3,000	840
10.....	2,000	16,800	3,800	25.....	3,500	6,000	808
11.....	1,700	18,200	3,500	26.....	2,800	8,700	970
12.....	1,600	19,100	3,100	27.....	2,410	9,100	1,130
13.....	1,500	17,300	2,800	28.....	2,000	8,200	1,660
14.....	2,200	13,200	2,500	29.....	3,820	8,500	3,350
15.....	3,500	10,000	2,150	30.....	8,890	8,900	4,570
				31.....	7,190		4,110
Monthly mean discharge, in cubic feet per second....					5,786	9,327	3,009
Runoff, in inches.....					1.55	2.42	0.81
Runoff, in acre-feet.....					355,800	555,000	185,000

Gage height, in feet, and discharge, in cubic feet per second, at indicated time

Hour	Gage height	Discharge	Hour	Gage height	Discharge	Hour	Gage height	Discharge
Mar. 16			Mar. 19-Con.			Apr. 11		
2400...	11.58	--	1200...	15.44	17,400	0600...	15.70	17,900
			1800...	15.08	16,700	1200...	16.00	18,400
Mar. 17			2400...	14.73	16,100	1800...	16.14	18,700
0400...	13.63	--				2400...	16.22	18,800
1000...	15.70	--	Mar. 20					
1300...	16.41	--	0600...	14.33	15,500	Apr. 12		
1700...	16.70	--	1200...	13.49	14,100	0600...	16.36	19,100
2000...	16.87	--	1800...	12.55	12,700	1400...	16.45	19,300
2400...	16.95	--	2400...	11.59	11,300	1800...	16.41	19,200
						2400...	16.22	18,800
Mar. 18			Mar. 21					
0230...	16.99	20,300	0600...	10.65	10,000	Apr. 13		
1200...	16.87	20,100	1200...	9.87	8,920	0600...	15.84	18,100
2400...	16.22	18,800	1800...	9.46	8,360	1200...	15.39	17,300
			2400...	9.27	8,110	1800...	14.88	16,400
Mar. 19						2400...	14.60	15,900
0600...	15.82	81,100	Apr. 10					
			2400...	15.18	16,900			

Location.--Lat 40°23'35", long 91°22'25", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.30, T.65 N., R.4 W., near right bank in tailwater at downstream end of new lock below dam and powerplant of Union Electric Co. at Keokuk, 2.8 miles upstream from Des Moines River and at mile 364.2 upstream from Ohio River.

Drainage area.--119,000 sq mi, approximately.

Gage-height record.--Water-stage recorder. Datum of gage is 477.41 ft above mean sea level, datum of 1929 (levels by Corps of Engineers); 477.83 ft above mean sea level, adjustment of 1912; 477.34 ft above mean gulf level; and 484.65 ft above Memphis datum. Jan. 1, 1878, to May 1913, staff gage at Galland (formerly Nashville), 8 miles upstream; zero of gage was set to low-water mark of 1864, or 497.94 ft above mean sea level, adjustment of 1912.

Discharge record.--Records furnished by Union Electric Company except for period of Apr. 21 to May 11 which were computed by the U.S. Geological Survey on basis of backwater rating of the tailwater gage. Furnished records computed from records of turbine operation at power plant and openings of spillway gates in dam.

Maxima.--April-May 1965: Daily discharge, 327,000 cfs May 1; gage height, 22.14 ft. May 1.

1878 to February 1965: Daily discharge, 314,000 cfs May 18, 1888 (gage height, 12.0 ft, site and datum then in use; 19.6 ft present site and datum).

Flood of June 6, 1851, reached a stage of 21.0 ft, present site and datum; estimated as 13.5 ft at Galland (discharge, 360,000 cfs).

Remarks.--Discharge records furnished by Union Electric Company except for period Apr. 21 to May 11. Annual peak stages furnished by Corps of Engineers.

Mean gage height, in feet, and discharge, in cubic feet per second, 1965

Day	March		April		May	
	Gage height	Discharge	Gage height	Discharge	Gage height	Discharge
1.....	--	48,900	--	82,700	22.09	327,000
2.....	--	60,600	--	97,600	21.75	318,000
3.....	--	64,400	--	111,600	21.41	310,000
4.....	--	77,300	--	122,200	20.97	298,000
5.....	--	77,300	--	133,200	20.48	286,000
6.....	--	108,800	--	146,200	20.02	279,000
7.....	--	116,600	--	157,600	19.51	269,000
8.....	--	115,000	--	173,600	19.03	260,000
9.....	--	117,700	--	184,500	18.62	253,000
10.....	--	123,300	--	191,000	18.20	246,000
11.....	--	136,300	18.07	191,500	17.77	238,000
12.....	--	138,800	19.02	200,000	17.07	223,400
13.....	--	126,900	19.57	213,900	16.32	211,600
14.....	--	116,100	20.05	223,100	15.49	198,200
15.....	--	116,000	20.59	235,700	14.67	185,400
16.....	--	121,700	20.82	244,700	--	174,400
17.....	--	130,100	20.60	250,500	--	161,900
18.....	--	134,000	20.06	247,200	--	151,500
19.....	--	110,800	19.31	239,300	--	142,400
20.....	--	76,200	18.80	234,400	--	134,600
21.....	--	60,500	18.67	234,000	--	129,900
22.....	--	62,300	18.60	238,000	--	128,100
23.....	--	62,600	18.62	239,000	--	126,200
24.....	--	54,200	18.79	246,000	--	125,400
25.....	--	48,200	19.71	267,000	--	129,000
26.....	--	46,500	21.10	292,000	--	126,900
27.....	--	44,600	21.64	305,000	--	128,100
28.....	--	50,000	21.43	300,000	--	130,000
29.....	--	56,200	21.34	302,000	--	133,200
30.....	--	75,000	21.97	321,000	--	135,800
31.....	--	81,700	--	--	--	136,000
Mean.....		89,000		214,200		196,600
Inches.....		0.86		2.01		1.91
Acre-feet.....		5,472,000		12,740,000		12,090,000

Mississippi River at Keokuk, Iowa--Continued

Annual maximum stages and mean daily discharges, for indicated years

Year	Date	Gage height (feet)	Discharge (cfs)	Year	Date	Gage height (feet)	Discharge (cfs)
1851..	June 6	21.0	360,000	1916..	May 9	--	213,000
1868..	May 8	14.6	--	1917..	June 17	--	163,000
1869..	July 16	14.7	--	1918..	June 12	16.7	192,000
1870..	Apr. 27	16.4	--	1919..	May 8	17.15	205,000
1871..	May	12.2	--	1920..	Apr. 10-11	--	230,000
1872..	June 7	12.1	--	1921..	May 12-13	--	108,000
1873..	June 14-15	12.5	--	1922..	Apr. 24,25	17.45	240,000
1874..	Mar. 12	8.8	--	1923..	Apr. 9,10	12.0	148,000
1875..	July 9	12.9	--	1924..	Aug. 24,25	--	160,000
1876..	Apr. 17	16.5	--	1925..	June 23	10.3	112,000
1877..	Apr. 9-10	11.6	--	1926..	Sept. 28	--	146,000
1878..	June 11	--	150,000	1927..	Apr. 3	--	175,000
1879..	June 2,3	8.45	110,000	1928..	Apr. 12	--	150,000
1880..	June 29	17.5	271,000	1929..	Mar. 23	19.3	247,000
1881..	Apr. 23,24	--	241,000	1930..	June 18	13.9	163,000
1882..	Oct. 31, '81	18.9	293,000	1931..	July 4	--	52,500
1883..	May 18	15.4	201,000	1932..	Apr. 24,25	10.2	106,000
1884..	Apr. 1	16.7	236,000	1933..	Apr. 9	14.5	160,000
1885..	Oct. 9,10	--	170,000	1934..	Apr. 22	--	83,500
	'84			1935..	Apr. 11,12	--	138,000
1886..	May 6	15.95	212,000	1936..	Apr. 9,10	12.3	148,000
1887..	May 4	--	156,000	1937..	Mar. 10	16.1	190,000
1888..	May 18	19.6	314,000	1938..	Sept. 26	16.4	193,800
1889..	Apr. 20	--	84,200	1939..	Oct. 1, 1938	--	159,100
	June 8,18			1940..	Apr. 19	6.4	81,700
1890..	July 1	12.6	178,000	1941..	Apr. 27	12.3	154,400
1891..	May 3	--	141,000	1942..	June 16	15.80	200,900
1892..	June 29	19.25	306,000	1943..	Apr. 18	--	174,000
1893..	May 15-17	14.85	203,000	1944..	May 27,28	20.85	256,000
1894..	June 4	11.3	158,000	1945..	Mar. 26	16.80	203,300
1895..	Mar. 11	--	59,200	1946..	Jan. 11	16.95	223,300
1896..	June 3	11.9	161,000	1947..	June 21	20.2	245,700
1897..	Apr. 28,29	18.4	230,000	1948..	Mar. 23	18.9	233,600
1898..	Mar. 20	--	108,000	1949..	Mar. 12	13.3	150,700
1899..	June 29	--	159,000	1950..	Apr. 25,26	--	175,900
1900..	Apr. 5,6	--	124,000	1951..	Apr. 29	--	265,100
1901..	Mar. 24-26	11.3	150,000	1952..	Apr. 27	--	253,800
1902..	July 21,22	15.5	181,000	1953..	Apr. 1,2	12.5	137,200
1903..	June 6	19.6	270,000	1954..	May 17	--	181,400
1904..	Oct. 7, 1903	--	186,000	1955..	Apr. 25	12.7	156,600
1905..	June 10	18.5	212,000	1956..	Apr. 22	10.2	131,500
1906..	Apr. 26-28	14.0	192,000	1957..	July 15	8.70	106,000
1907..	Apr. 17-18	--	178,000	1958..	June 13	8.29	99,000
1908..	June 9	--	178,000	1959..	Apr. 5	14.17	182,000
1909..	May 5-7	13.9	181,000	1960..	Apr. 4	21.83	289,500
1910..	Mar. 20-23	10.1	124,000	1961..	Apr. 5	17.11	208,400
1911..	Feb. 21	12.3	156,000	1962..	Apr. 7	18.58	224,100
1912..	Apr. 6,7	17.7	220,000	1963..	Mar. 22	10.76	128,700
1913..	Mar. 29	13.5	169,000	1964..	May 21	7.96	96,400
1914..	June 24	11.2	122,000	1965..	May 1	22.14	327,000
1915..	Feb. 28	--	142,000				

Note.--Annual peak stages referenced to tailwater gage, datum 477.83 feet, adjustment of 1912.

5-4905. Des Moines River at Keosauqua, Iowa

Location.--Lat 40°43'45", long 91°57'45", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.36, T.69 N., R.10 W., on right bank 10 ft upstream from bridge on State Highway 1 at Keosauqua, 4.0 miles downstream from Chequest Creek, and at mile 50.6.

Drainage area.--14,038 sq mi.

Gage-height record.--Water-stage recorder graph. Datum of gage is 557.36 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 125,000 cfs. Backwater from ice Mar. 1-18.

Maxima.--March-May 1965: Discharge, 79,800 cfs 0400 hrs Apr. 12 (gage height, 19.35 ft).

1903-6, 1910 to February 1965: Discharge, 146,000 cfs June 1, 1903 (gage height, 27.85 ft, from floodmark).

Flood of June 1, 1851, reached a stage of 24 ft (discharge not determined).

Mean discharge, in cubic feet per second, 1965

Day	March	April	May	Day	March	April	May
1.....	2,700	15,000	16,100	16.....	12,000	63,000	8,100
2.....	5,000	20,700	14,500	17.....	25,000	53,400	8,010
3.....	7,500	24,700	13,300	18.....	36,000	44,800	7,790
4.....	9,500	26,700	12,200	19.....	38,200	38,100	7,560
5.....	12,000	30,200	11,600	20.....	38,200	32,800	8,240
6.....	15,000	43,400	11,500	21.....	33,300	27,900	8,880
7.....	17,000	43,400	10,100	22.....	19,100	23,400	8,990
8.....	15,000	53,300	9,270	23.....	14,100	19,900	8,260
9.....	11,000	59,900	9,080	24.....	9,950	18,200	8,120
10.....	9,000	61,800	10,800	25.....	7,120	24,000	8,070
11.....	7,000	74,600	10,700	26.....	6,050	31,100	8,290
12.....	5,500	79,200	8,740	27.....	5,320	28,100	9,720
13.....	5,000	77,400	8,180	28.....	5,070	20,800	12,300
14.....	6,000	73,800	8,350	29.....	9,240	19,400	16,400
15.....	8,000	72,500	8,380	30.....	11,200	17,900	19,100
				31.....	11,400		20,500
Monthly mean discharge, in cubic feet per second....					13,430	40,650	10,680
Runoff, in inches.....					1.10	3.23	0.88
Runoff, in acre-feet.....					826,000	2,419,000	656,800

Gage height, in feet, and discharge, in cubic feet per second, at indicated time

Hour	Gage height	Discharge	Hour	Gage height	Discharge	Hour	Gage height	Discharge
Apr. 9			Apr. 11-Con.			Apr. 13		
2400...	15.39	58,100	1200...	18.52	75,000	1200...	19.00	77,700
			1800...	19.00	77,700	2400...	18.70	76,000
Apr. 10			2400...	19.30	79,400			
0600...	15.62	59,300				Apr. 14		
1200...	15.99	61,200	Apr. 12			1200...	18.27	73,600
1800...	16.43	63,700	0400...	19.36	79,800	2000...	18.01	72,200
2400...	17.20	67,800	1200...	19.30	79,400	2400...	18.22	73,300
			2400...	19.13	78,400			
Apr. 11						Apr. 15		
0600...	17.99	72,000				0400...	18.49	74,800
						1200...	18.21	73,300
						2400...	17.35	68,600