

# HYDROLOGIC DATA FOR FLOODS OF JULY 1978 IN SOUTHEAST MINNESOTA AND SOUTHWEST WISCONSIN



U. S. GEOLOGICAL SURVEY  
Open-File Report 79-1166



COVER PHOTOGRAPH

East Oakland Avenue and 4th Street SE, Austin, Minn. was under water by late Monday morning, July 17, 1978. The area, adjacent to the west bank of the Cedar River, was the first in the city to be inundated. (Photograph by courtesy of the Austin Daily Herald.)

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

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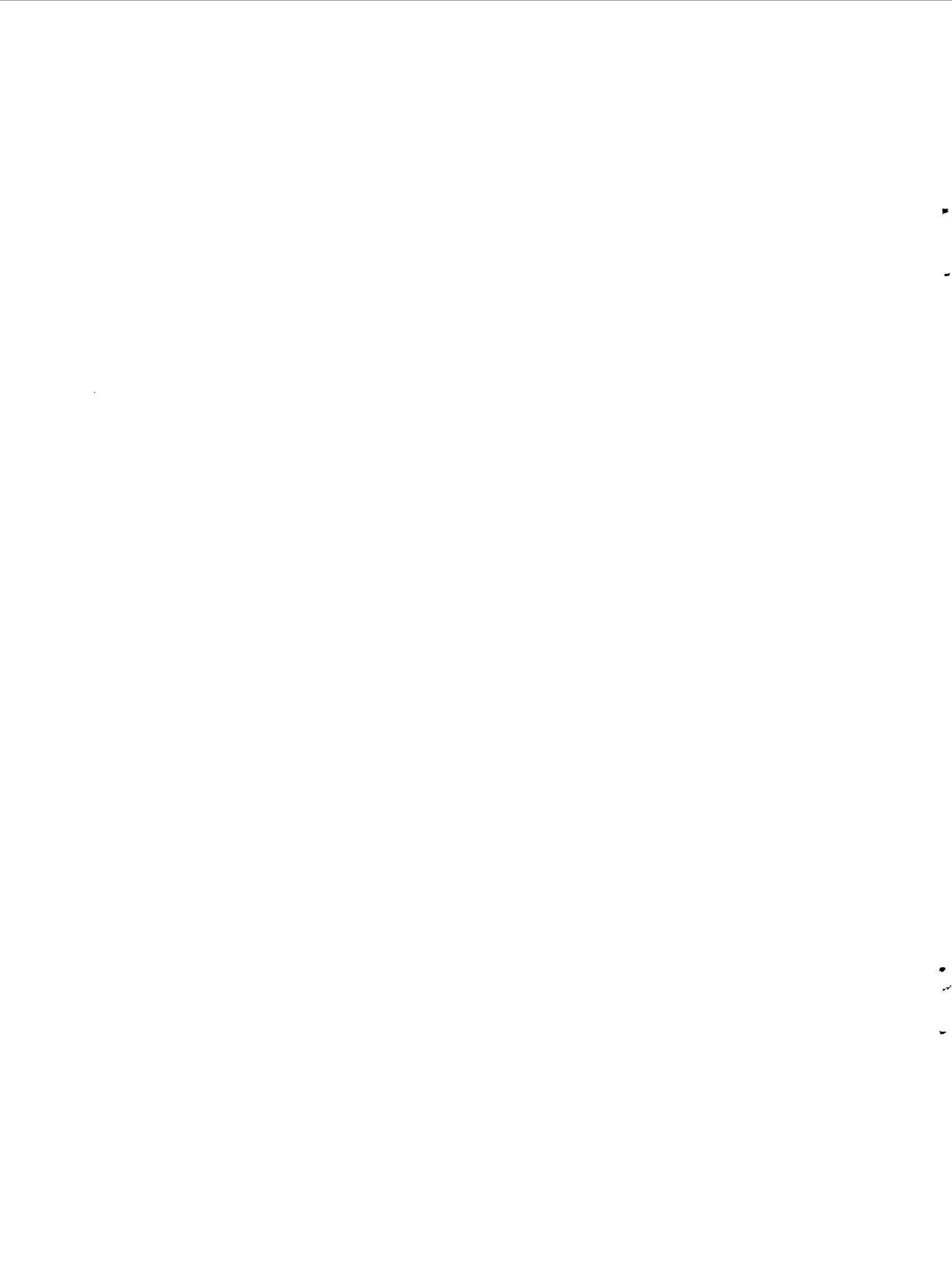
By V. J. Latkovich

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Open-File Report 79-1166

St. Paul, Minnesota

1979



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## CONVERSION FACTORS

For the convenience of those readers who prefer to use International System (metric) units rather than inch-pound units, the conversion factors for terms used in this report are listed below:

<u>Multiply</u> <u>inch-pound unit</u>	<u>By</u>	<u>To obtain</u>
inch (in)	25.40	millimeter (mm)
mile (mi)	1.609	kilometer (km)
square mile (mi <sup>2</sup> )	2.590	square kilometer (km <sup>2</sup> )
cubic foot per second (ft <sup>3</sup> /s)	0.02832	cubic meter per second (m <sup>3</sup> /s)
ton (short) per day	0.9072	megagram (Mg)

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## ABSTRACT

Intense storms of July 1978 caused floods of historical significance in southeast Minnesota and southwest Wisconsin. Local, State, and Federal officials need data and information to evaluate, coordinate, and manage programs concerned with floods and flood losses. Because of a need to document stream discharges, elevations, and sediment concentrations, current-meter and indirect measurements were made at 34 gaging stations during or immediately after the floods. This report summarizes some of the hydrologic data collected. Peak discharges of record occurred at 20 gaging stations. Frequency of peak discharge equaled or exceeded the 100-year recurrence interval at 11 stations. The Federal Benchmark gaging station on the North Fork Whitewater River was destroyed. Five people died as a result of the floods, and property damages were estimated to exceed \$114 million. Thirty-three counties were officially declared disaster areas.

## INTRODUCTION

Intense storms of July 1978, combined with wet antecedent soil-moisture conditions of late June, caused floods of historical significance in the South Fork Zumbro, Whitewater, and Cedar River basins of southeast Minnesota, and the Kickapoo River basin of southwest Wisconsin. Five people died as a result of the floods, and total property damages were estimated by the States of Minnesota and Wisconsin to exceed \$114 million. Thirty-three counties were officially declared disaster areas. The Federal Benchmark gaging station on the North Fork Whitewater River near Elba, Minn., was destroyed by floodwaters that devastated the Whitewater State Park and Wildlife Area.

Local, State, and Federal officials need data and information to evaluate, coordinate, and manage programs concerned with floods and flood losses. The purpose of this report is to provide a summary of some of the hydrologic data collected during the July 1978 floods. Only a part of the information collected by the U.S. Geological Survey on the extent and

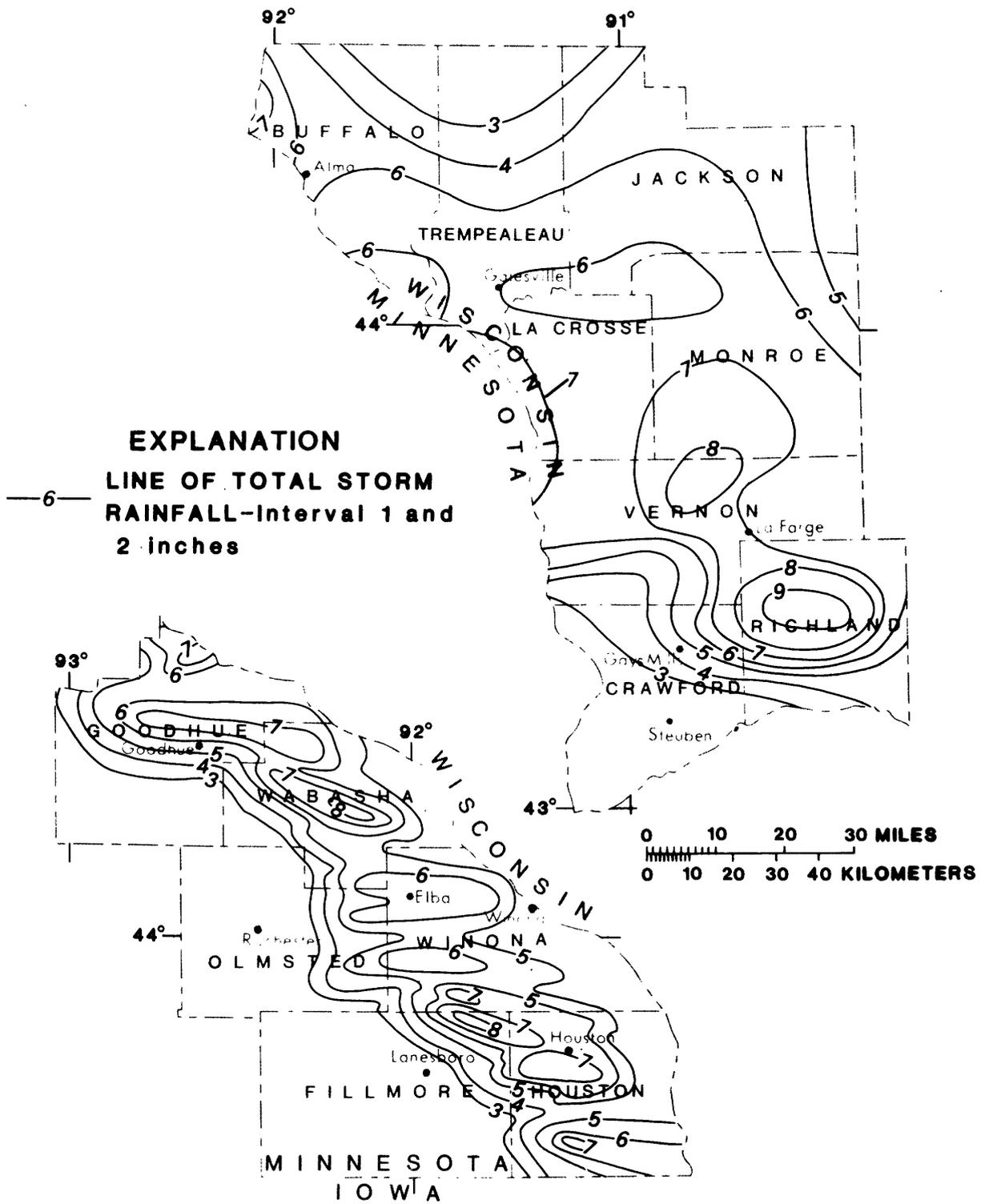
magnitude of the floods is presented. This information includes the magnitude and frequency of the instantaneous maximum stages (water-surface elevations) and discharges for 34 gaging stations, measured suspended-sediment loads at 4 stations, and hydrographs of daily mean discharge at 5 sites. Additional stream discharge information associated with the floods will be published in annual data releases of the Geological Survey. Photographic data depicting the areal extent of flooding can be viewed at the Geological Survey's Minnesota District Office in St. Paul.

Storm chronologies and rainfall data are summarized in this report to aid in documenting the floods. These data were provided by the Minnesota Department of Natural Resources (DNR), State Office of Climatology, and the Wisconsin Department of Natural Resources. The isohyetal maps (figs. 1 and 2) were provided by the Minnesota DNR and the Wisconsin DNR. Their assistance in providing the data is greatly appreciated.

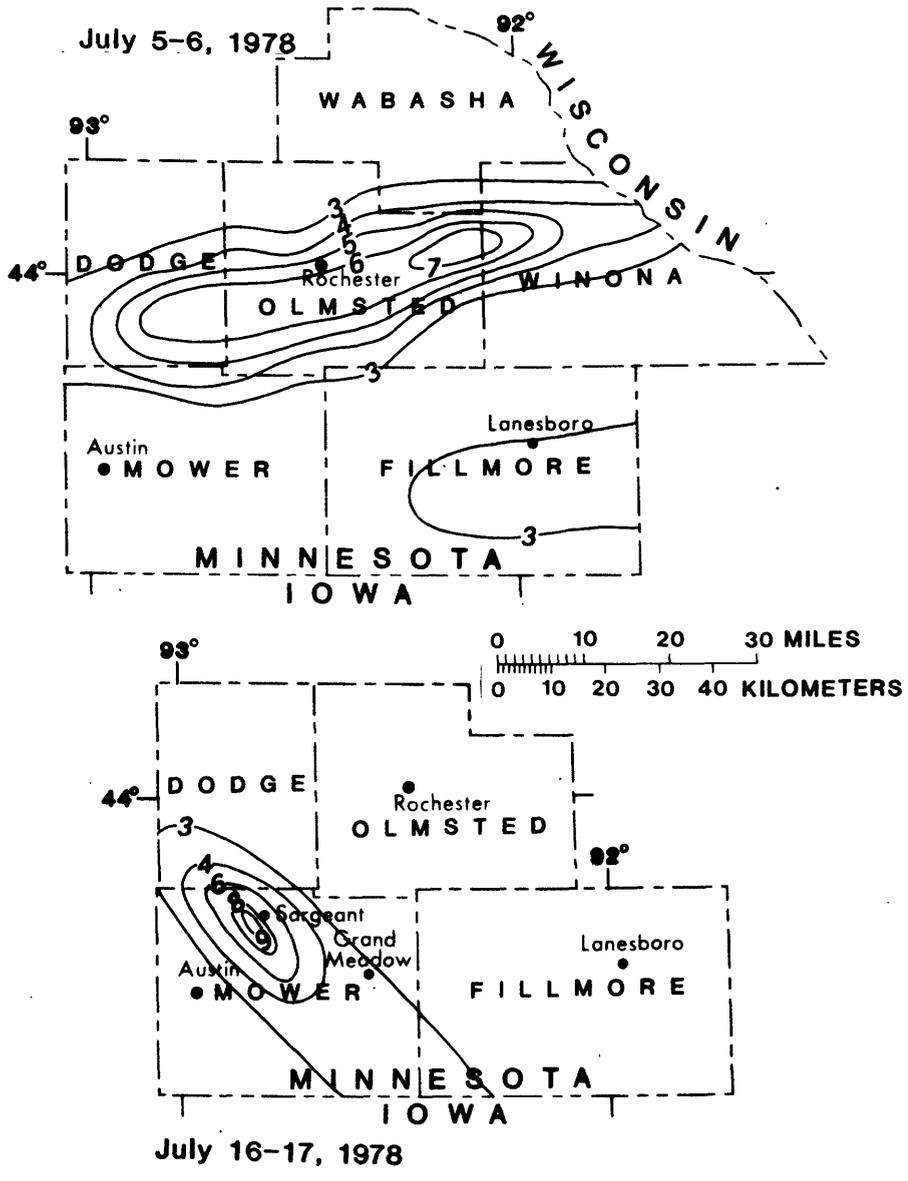
#### THE STORMS

The following accounts of the storms were provided by the Minnesota DNR, State Office of Climatology:

"Eastern and southeastern Minnesota experienced widespread flash flooding on June 30 and July 1, 1978. These floods differed from the usual flash flood pattern. A typical pattern has only one localized area of high-intensity precipitation, generally from a single cell. Seven to nine separate areas in eastern and southeastern Minnesota had over 6 inches of precipitation on June 30-July 1 from several storm cells forming during a 14-hour period. Numerous heavy thunderstorms moved east to southeast from a 140-mile-long line extending from western Ramsey County (the Twin Cities) to western Houston County (25 miles west of the Iowa-Minnesota-Wisconsin border). Portions of Wabasha, Olmsted, Winona, Fillmore, and Houston Counties received over 6 inches of precipitation. A 6 or more inch rainfall is a 100-year or greater storm for this area. Greater than 8 inches of precipitation was reported in Mount Pleasant and Highland Townships in Wabasha county and in Arendahl and Rushford Townships in Fillmore County. The largest recorded amount was 8.68 inches. A 2,850 square mile area received greater than 4 inches of precipitation in Minnesota. Generally, the heaviest and most extensive rainfalls were across Wabasha, Winona, and Houston Counties."



**Figure 1.--Total storm isohyetal maps for June 30-July 2, 1978**



**EXPLANATION**

**LINE OF TOTAL STORM**

—3— **RAINFALL-Interval 1 and 2 inches**

**Figure 2.--Total storm isohyetal maps for July 5-6, 1978 and July 16-17, 1978**

"The flash flood for Rochester, Minn. occurred from heavy rains of 6 inches or more. The storm began at Rochester airport at 05:35 P.M. CDST on July 5, 1978 and ended at 01:50 A.M. CDST on July 6, 1978. The National Weather Service weighing rain gage recorded in a 3-hour period (05:53 P.M. CDST to 08:53 P.M. CDST) 4.99 inches of rain, which is well above the 100-year return period. The heaviest amount, 7.30 inches, occurred in Quincy Township in eastern Olmsted County. The 4-inch or more rainfall band was about 12-15 miles wide and 75 miles long and covered an area of 700 square miles. The line oriented east-northeast began 25 miles west-southwest of Rochester and ended 50 miles east on the Minnesota-Wisconsin border."

"The flash flood at Austin, Minn. occurred from heavy rains of 8 inches or more. The rain began at approximately 9:00 P.M. CDST on July 16 and ended during the early morning hours of July 17. This was the second flash flood to occur in the headwaters of the Cedar River, north of Austin, in 11 days. Both floods resulted in record breaking flood levels at Austin. The largest amount of rain reported was 9.50 inches in Watham Township (2 miles southwest of Sargeant) in northwestern Mower County. The 4-inch or greater rainfalls were oriented northwest to southeast and covered an area of 160 square miles."

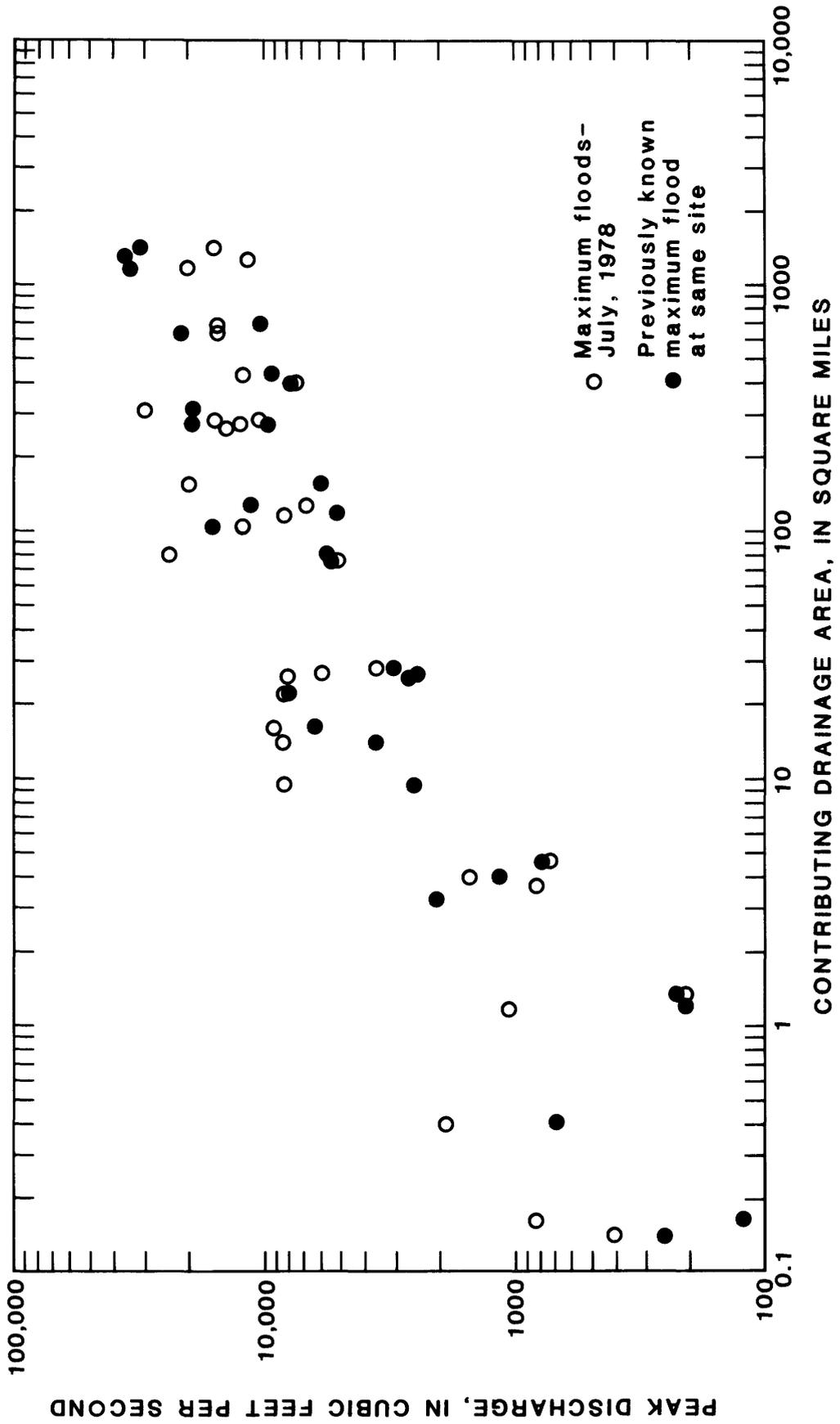
## SUMMARY OF FLOOD DATA

### Peak Stages and Discharges

Peak stages and discharges were obtained and documented by current-meter and indirect measurement methods at 34 gaging stations in Minnesota and Wisconsin. Locations of the stations are shown in figure 3.

A summary of the peak stages and discharges at 16 continuous-record and 18 crest-stage partial-record stations (fig. 3) is presented in table 1. Data presented are for both the maximum flood previously known and the maximum during the July 1978 floods. The relative magnitude of the 1978 floods compared with that of previous floods is shown in figure 4. Periods of record range from 9 to 70 years. At 20 stations the 1978 floods exceeded the previous maximums. At 11 of the 20 stations, maximums equaled or exceeded the 100-year recurrence interval. The recurrence interval is the average interval of time within which a given flood will be exceeded once; that is, a flood expected to be equaled or





**Figure 4.--Comparison of the July 1978 floods with maximum floods previously determined at the same site**

Table 1.--Summary of peak stages and

[+ = number for location purpose in  
 = greater than; \* = peak discharge  
 measurement (affected by backwater  
 approximately; < = less than; a =  
 measurement.]

+No.	WRD station number	Stream and place of determination	Drainage area (mi <sup>2</sup> )	Period of known floods
1	05252700	Turtle Creek tributary No. 2 near Pratt.....	1.26	1960-78
2	05372800	South Fork Zumbro River on Beltline at Rochester.....	155	1969-78
3	05372930	Bear Creek on Beltline at Rochester.....	80.0	1969-78
4	05372950	Silver Creek at Rochester.....	17.3	1969-78
5	05372990	Cascade Creek at Rochester.....	37	1969-78
6	05373000	South Fork Zumbro River near Rochester.....	304	1855, 1908-78
7	05373350	Zumbro River tributary near South Troy.....	0.16	1962-78
8	05373900	Trout Brook tributary near Goodhue.....	0.40	1960-78
9	05374000	Zumbro River at Zumbro Falls...	1130	1909-17, 1930-78
10	05374400	Long Creek near Potsdam.....	4.46	1966-78
11	05374900	Zumbro River at Kellogg.....	1400	1938-78
12	05376000	North Fork Whitewater River near Elba.....	101	1939-78

discharges for selected stations

this report only, see figure 3; > estimated based on current-meter from South Fork Zumbro River); = provisional record; b = discharge

Maximum flood previously known			Maximum during present flood				Recur- rence interval (years)
Date	Stage (ft)	Discharge (ft <sup>3</sup> /s)	Date	Stage (ft)	Discharge (ft <sup>3</sup> /s) (ft <sup>3</sup> /s) /mi <sup>2</sup>		
MINNESOTA							
5-31-61	19.79	220	July 17	20.48	211	167	15
3-10-73	1001.78	6,020	July 6	1005.97	20,500	132	>100
6-21-74	1003.39	5,800	July 6	1007.87	24,900	311	>100
6-21-74	1015.65	6,580	July 6	1016.18	9,290	537	>100
6-21-74	983.52	2,050	July 6	986.21	*1,000	---	---
3- 1-65	19.12	19,600	July 6	23.36	30,500	100	>100
6-20-74	12.72	122	July 7	14.07	138	862	25
5-28-70	13.84	592	July 1	13.98	759	1,900	100
7-22-51	30.80	35,900	July 7	24.26	20,800	18.4	8
			July 1	15.53	7,800	6.9	
6-20-74	26.50	773	July 17	22.10	574	129	15
7-22-51	---	May have exceeded 30,000	July 2	12.70	14,400	10.3	---
			July 8	13.70	16,800	12.0	
6-21-74	16.32	16,100	July 1	10.27	4,720	46.7	
			July 5	15.57	12,800	127	22

Table 1.--Summary of peak stages and dis

+No.	WRD station number	Stream and place of determination	Drainage area (mi <sup>2</sup> )	Period of known floods
13	05376500	South Fork Whitewater River near Altura.....	76.8	1939-78
14	05376800	Whitewater River near Beaver...	271	1939-78
15	05378300	Straight Valley Creek near Rollingstone.....	5.16	1959-78
16	05383720	Mill Creek near Chatfield.....	22.4	1962-78
17	05383850	South Fork Bear Creek near Grand Meadow.....	14.0	1962-78
18	05384000	Root River near Lanesboro.....	615	1910-17, 1940-78
19	05384300	Big Springs Creek near Arendahl	0.14	1959-78
20	05384400	Pine Creek near Arendahl.....	28.1	1959-78
21	05384500	Rush Creek near Rushford.....	129	1942-78
22	05385000	Root River near Houston.....	1270	1907-17, 1930-78,
23	05385500	South Fork Root River near Houston.....	275	1953-78
24	05457000	Cedar River near Austin.....	425	1909-14, 1944-78
25	05457080	Rose Creek tributary.....	1.17	1962-78

charges for selected stations--Continued

Maximum flood previously known			Maximum during present flood				Recur- rence interval (years)
Date	Stage (ft)	Discharge (ft <sup>3</sup> /s)	Date	Stage (ft)	Discharge (ft <sup>3</sup> /s)	Discharge (ft <sup>3</sup> /s) /mi <sup>2</sup>	
6-21-74	10.84	5,620	July 1	8.55	3,440	44.8	25
			July 5	10.83	5,610	73.0	
6-21-74	13.00	19,200	July 1	12.09	10,300	38.0	30
			July 6	12.88	15,400	56.8	
6-26-59	17.28	1,200	July 1	17.04	1,110	215	40
			July 5	18.10	1,500	291	
6-21-74	17.51	7,900	July 6	17.68	8,580	383	75
3-28-62	21.18	3,730	July 17	23.18	8,500	607	>100
3-29-62	16.11	22,100	July 1	10.16	6,700	10.9	4
			July 7	15.41	14,400	23.4	
			July 18	13.25	10,900	17.7	
6-20-74	11.61	256	July 1	11.09	56.7	405	8
6-21-74	14.85	3,100	July 1	15.58	4,150	134	40
3-26-50	13.54	11,600	July 1	11.20	7,930	61.5	7
4-11-52	13.90	37,000	July 1	12.20	12,200	9.6	2.5
			July 8	11.97	11,800	9.3	
6-21-74	13.81	11,000	July 1	13.79	11,000	40.0	33
			July 6	13.62	10,200	37.1	
3-29-62	17.18	9,530	July 7	18.06	10,100	24.0	25
			July 17	20.35	12,400	29.2	
7- 9-65	10.31	201	July 17	11.82	1,090	932	>100

Table 1.--Summary of peak stages and dis

+No.	WRD station number	Stream and place of determination	Drainage area (mi <sup>2</sup> )	Period of known floods
26	05378200	Eagle Creek near Fountain City.	26.8	1961-78
27	05283000	LaCrosse River near West Salem.	398	1913-70
28	05386300	Mormon Creek near LaCrosse.....	25.5	1961-78
29	05387000	Coon Creek near Stoddard.....	119	1934-40
30	05408000	Kickapoo River at LaFarge.....	266	1938-78
31	05409870	Nederlo Creek at Utica Town Hall near Gays Mills.....	6.7	---
32	05409890	Nederlo Creek near Gays Mills..	9.46	1967-78
33	05410500	Kickapoo River at Steuben.....	690	1933-78
34	05410700	Kickapoo River at Wauseka.....	768	---

charges for selected stations--Continued

Maximum flood previously known			Maximum during present flood				Recur- rence interval (years)
Date	Stage (ft)	Discharge (ft <sup>3</sup> /s)	Date	Stage (ft)	Discharge (ft <sup>3</sup> /s)	Discharge (ft <sup>3</sup> /s) /mi <sup>2</sup>	
WISCONSIN							
8-20-68	17.11	2,460	July 7	18.35	6,000	224	100
8- 6-35	12.2	8,200	July 2	12.82	7,600	19.1	100
8- 3-77	15.48	2,640	July 2	20.60	8,140	319	55
8- 6-35	10.70	5,160	July 2	662.53	7,900	73.9	<100
2- 9-66	13.67	9,910	July 1	14.92	14,300	53.8	>100
---	---	---	July 1	17.6	a5,700	a851	---
6-23-68	17.06	2,600	June 30	18.65	a8,500	a899	---
3-28-61	12.33	10,800	July 3	14.81	a15,500	a22.5	>100
---	---	---	July 3	---	b18,300	23.8	---

exceeded once every 100 years on the average. The U.S. Army Corps of Engineers estimated the flood stage and discharge for Bear Creek at Rochester, Minn., to approximate the 500-year recurrence interval. The duration of flooding was 2 to 3 days as shown in figure 5. Figures 6-18 are a series of photographs taken by Geological Survey and local newspaper photographers during and after the floods.

#### Sediment Concentrations

Suspended-sediment data were collected at four stations in Minnesota during the floods. A summary of the data is presented in table 2.

#### Aerial Photography

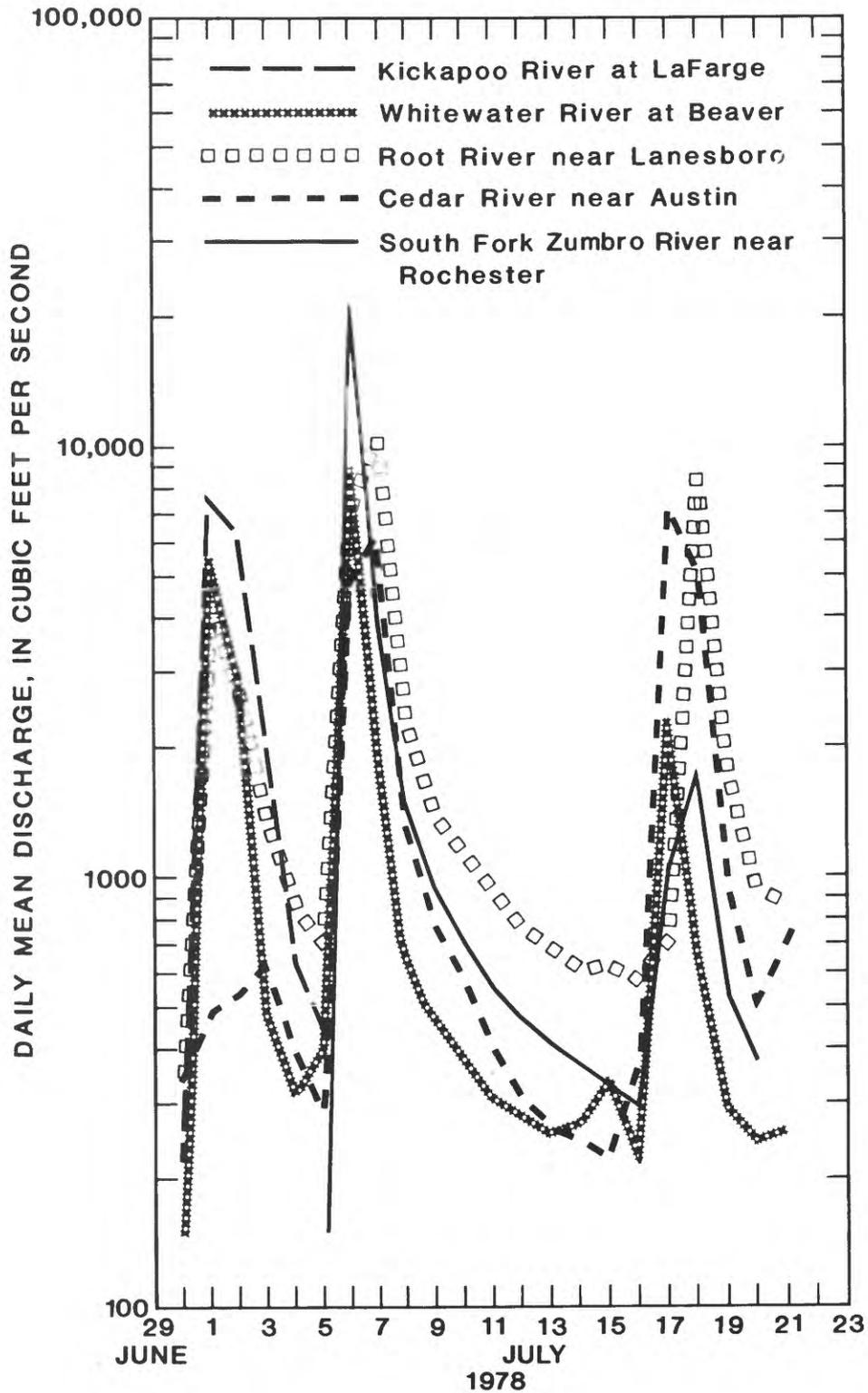
The Geological Survey, through a contractor, obtained contracted aerial photographs of the flooding in and around Rochester on July 6. The photographs were taken from an altitude of 1,800 feet, producing a photo scale of 1 inch = 300 feet. Time of the photography coincided with the peak stage and discharge of the South Fork Zumbro River.

Photographs include:

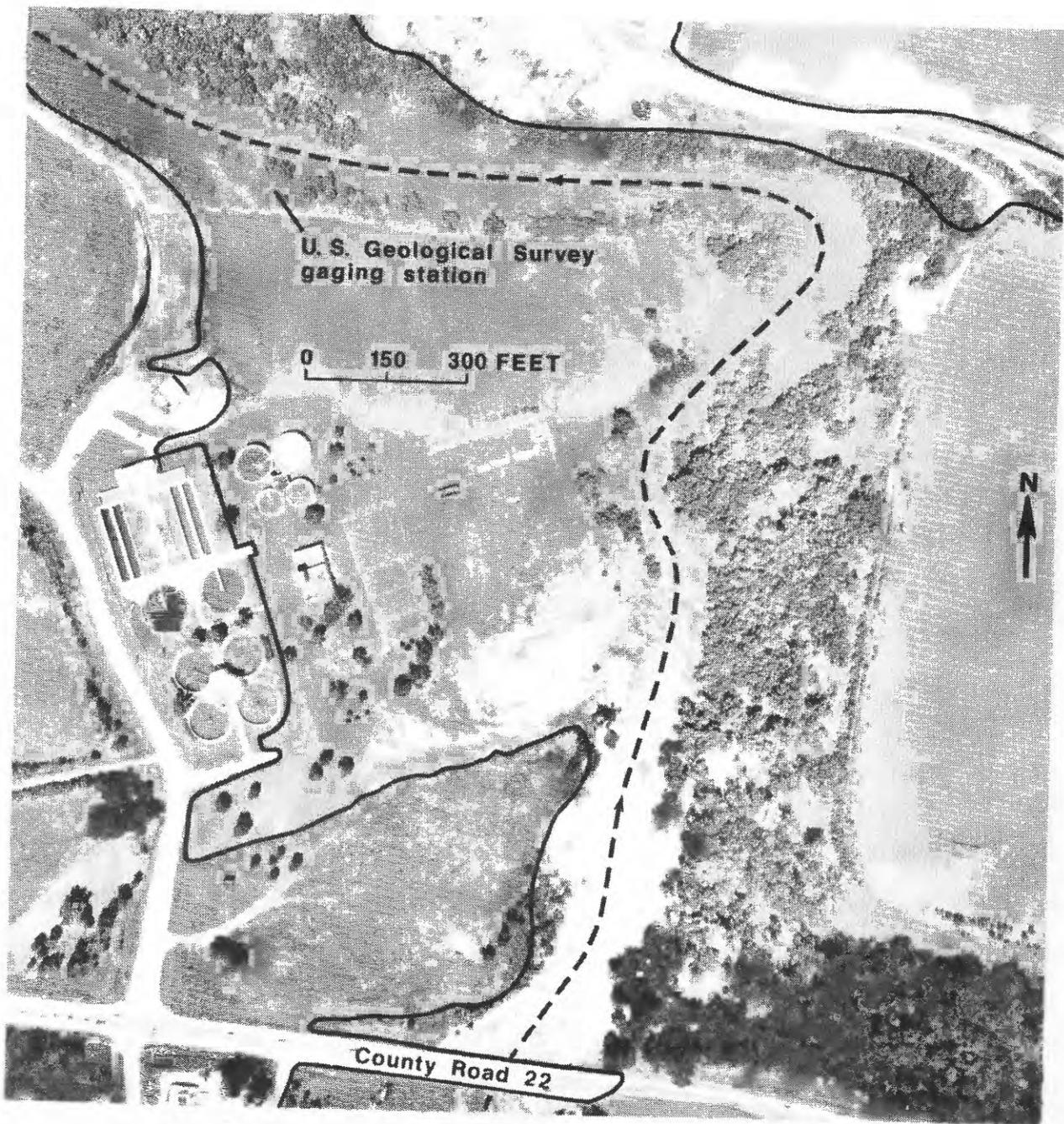
1. South Fork Zumbro River--from 5 miles south to 5 miles north of Rochester.
2. Bear Creek--from 5 miles east to South Fork Zumbro River.
3. Cascade Creek--from 4 miles west to South Fork Zumbro river.
4. Silver Creek--from 2 miles east to South Fork Zumbro river.

The photographs can be viewed at the Geological Survey District office in St. Paul.

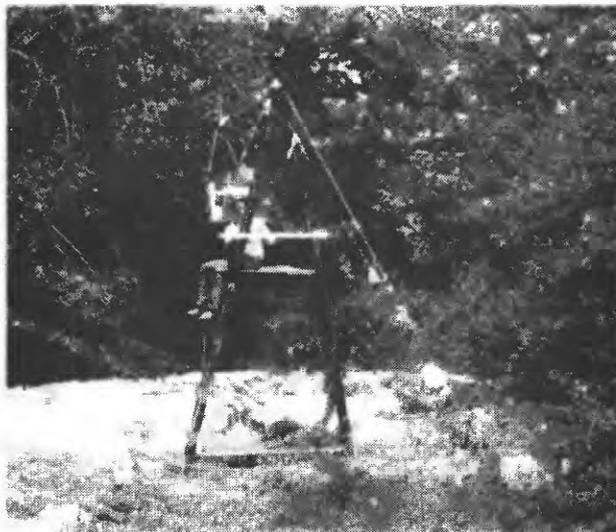
The Wisconsin Department of Natural Resources obtained aerial photographs of flooding in the Kickapoo River basin; they can be viewed at the WDNR Madison office.



**Figure 5.--Hydrographs of daily mean flow for selected stations**



**Figure 6.--South Fork Zumbro River at the Rochester Minn. sewage-treatment plant and U. S. Geological Survey gaging station. at the crest elevation (flow did breach County Road 22). Continuous line approximates the lateral extent of flooding. Dashed line approximates the low-flow channel of the river. Photograph taken about noon on July 6, 1978 by Mark Hurd Aerial Surveys, Inc., Minneapolis, Minn.**



***Figure 7.--U. S. Geological Survey gaging station on the South Fork Zumbro River near Rochester, Minn. (below the sewage treatment plant). Horizontal rod is at the July 6, 1978, crest elevation of the river at the instrument shelter and cableway.***



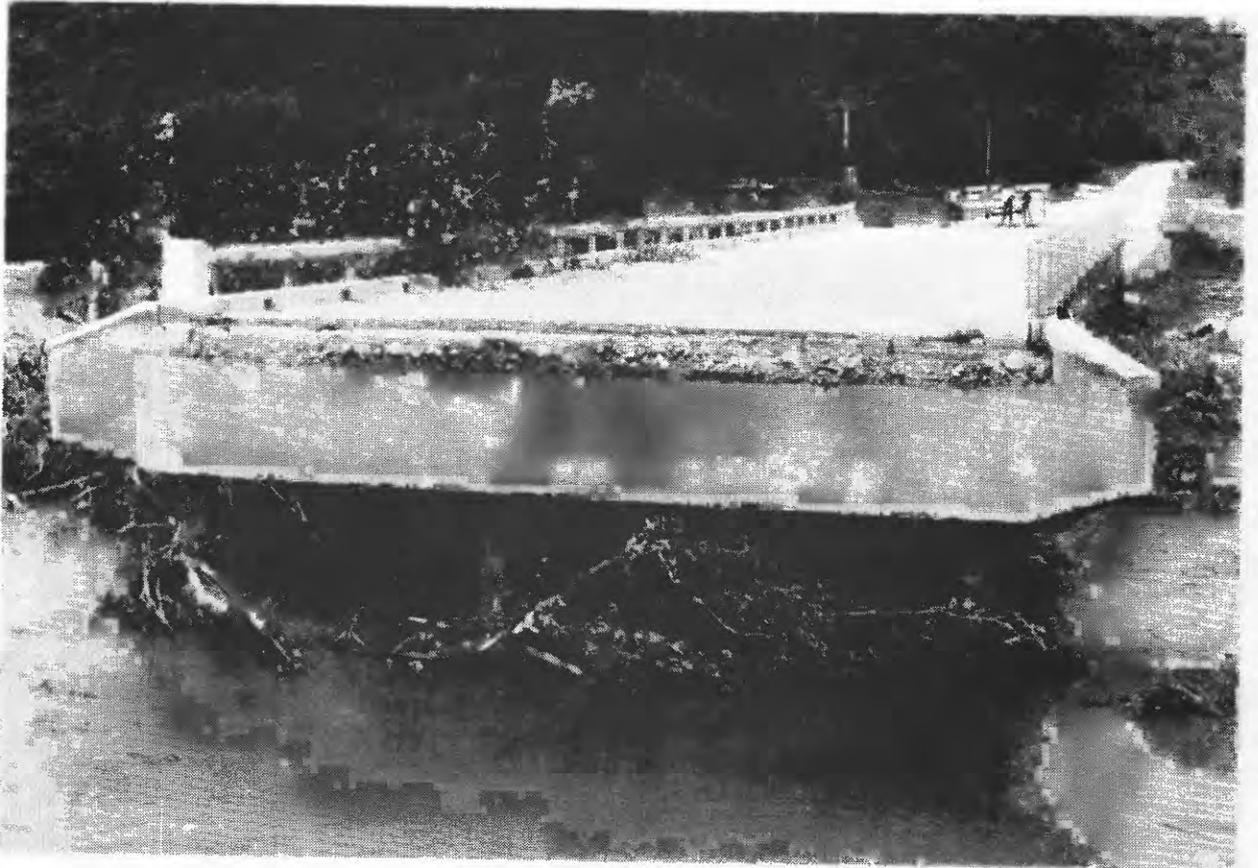
**Figure 8.--City power plant on the South Fork Zumbro River,  
Rochester, Minn. (Rochester Post-Bulletin, July 6, 1978)**



**Figure 9.--Shopping center, Rochester, Minn. (Rochester Post-Bulletin, July 6, 1978)**



**Figure 10.--Third Avenue SE and the Beltline, Rochester, Minn.  
(Rochester Post-Bulletin, July 6, 1978)**



**Figure 11.--Winona County Road 39 bridge over the Whitewater River near Whitewater State Park, Minn. (Rochester Post-Bulletin, July 6, 1978)**



**Figure 12.--East Oakland Avenue and 4th Street SE on the Cedar River,  
Austin, Minn. (Austin Daily Herald, July 17, 1978)**



**Figure 13.--Cedar River below the 4th Avenue NE bridge, Austin, Minn.  
(Austin Daily Herald, July 17, 1978)**



**Figure 14.--Flooded home in Wildwood Park, Austin, Minn. (Austin Daily Herald, July 17, 1978)**



**Figure 15.--The Kickapoo River, Gays Mills, Wis., July 1, 1978 (Jorgensen Photo, Gays Mills, Wisc.)**



**Figure 16.--Main Street, Gays Mills, Wis., July 1, 1978 (Jorgensen Photo, Gays Mills, Wis.)**



**Figure 17.--Kickapoo River, Soldiers Grove, Wis., July 1, 1978 (Boscobel Dial, Boscobel, Wis.)**



***Figure 18.--Kickapoo River, Steuben, Wis., July 1, 1978 (Boscobel Dial, Boscobel, Wis.)***

Table 2.--Summary of suspended-sediment data for Minnesota

Station number	Location number on figure 3	Stream and place of determination	Date	Time	Water temperature (°C)	Discharge (ft <sup>3</sup> /s)	Concentration (mg/L)	Sediment discharge (tons per day)	Percent finer than 0.062 mm sieve
05374900	11	Zumbro River at Kellogg	7-02-78	1830	21.5	8,320	1,380	31,000	---
05374900	11	do	7-07-78	2250	----	12,400	1,030	34,500	75
05376800	14	Whitewater River near Beaver	7-02-78	1415	20.5	1,510	1,330	5,420	---
05376800	14	do	7-06-78	1215	21.5	8,800	2,190	52,000	92
05376800	14	do	7-17-78	0900	20.0	1,850	12,500	62,400	99
05385000	22	Root River near Houston	7-01-78	2000	23.0	12,000	3,430	111,000	---
05385000	22	do	7-07-78	1600	23.5	11,000	2,370	70,400	86
05385000	22	do	7-18-78	2110	----	6,920	3,260	60,900	77
05457000	24	Cedar River near Austin	7-07-78	1030	22.0	8,050	318	6,910	---
05457000	24	do	7-17-78	1545 <sup>a</sup>	24.0	12,000	1,190	38,600	---
05457000	24	do	7-17-78	1950 <sup>b</sup>	24.0	12,000	735	23,800	99

<sup>a</sup>Before peak discharge.

<sup>b</sup>After peak discharge.

