

UNITED STATES
GEOLOGICAL SURVEY



DATA SUMMARY OF JUNE-JULY 1975
FLOODS IN EASTERN NORTH DAKOTA
AND NORTHWESTERN MINNESOTA



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Open-File Report 75-565

ON THE COVER

Floodwaters at intersection of U.S. Highway 75 with a Clay County road near Kragnes, Minn. The photograph is by Colburn Hvidston III and appeared in the July 4, 1975 issue of the Fargo-Moorhead paper titled "The Forum".

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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FLOODS IN EASTERN NORTH DAKOTA
AND NORTHWESTERN MINNESOTA

By K. L. Lindskov

Open-File Report 75-565

Bismarck, North Dakota

and

St. Paul, Minnesota

September 1975

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CONVERSION FACTORS

The following factors may be used to convert the English units published herein to the International System of Units (SI).

Multiply English units	By	To obtain SI units
<u>Length</u>		
inches (in)	25.4	millimetres (mm)
	.0254	metres (m)
feet (ft)	.3048	metres (m)
miles (mi)	1.609	kilometres (km)
<u>Area</u>		
square miles (mi ²)	2.590	square kilometres (km ²)
<u>Volume</u>		
cubic feet (ft ³)	28.32	cubic decimetres (dm ³)
	.02832	cubic metres (m ³)
<u>Flow</u>		
cubic feet per second (ft ³ /s)	28.32	liters per second (l/s)
	28.32	cubic decimetres per second (dm ³ /s)
	.02832	cubic metres per second (m ³ /s)
cubic feet per second per square mile (ft ³ /s-mi ²)	.01093	cubic metres per second per square kilometre (m ³ /s-km ²)
<u>Mass</u>		
ton (short)	.9072	tonne (t)

INTRODUCTION

Torrential rains during late June and early July 1975, combined with wet antecedent conditions, caused severe flooding, mainly along the lower reaches of the Sheyenne and Maple Rivers and their tributaries in North Dakota, and in the Buffalo and Wild Rice River basins in Minnesota. The Red River of the North from the Fargo-Moorhead area to the Halstad, Minnesota area was also severely flooded. Because much of the region is extremely flat, large areas of the two States were inundated by flood waters. Damage, mostly agricultural, was widespread and damage estimates exceeded a quarter of a billion dollars.

Local, State, and Federal officials need factual information to evaluate, coordinate, and manage programs concerned with flood losses. The purpose of this report is to provide quickly a summary of some of the basic data collected on the June-July 1975 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 flow rates for 62 sites, measured sediment loads at 7 sites, and hydrographs of daily mean flow at 6 sites. Additional streamflow information associated with the floods will be provided subsequently in annual data releases of the Geological Survey. The report also describes availability of graphic or photographic data depicting the areal extent of inundation. Those data may be obtained from the Applications Assistance Branch, EROS Data Center, U.S. Geological Survey, Sioux Falls, S. Dak. 57198.

Only a minimal amount of rainfall data are summarized in this report to aid in documenting the flood event. These data were provided by the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, and by the Minnesota State Office of Climatology. This assistance in providing the data and in reviewing the form of its presentation is appreciated.

THE STORM

Two separate storms contributed to the June-July flooding. The first dumped more than 4 inches (102 millimetres) of rain during June 28-30 over an area extending from the Jamestown-La Moure area, North Dakota on the west, between Abercrombie and Fargo on the south and north, and to Detroit Lakes, Minn. on the east (fig. 1), about 6,000 square miles (16,000 square kilometres). Parts of La Moure, Barnes, Ransom, Cass, and Richland Counties in North Dakota, and Clay, Norman, Becker, and Otter Tail Counties in Minnesota received rainfall exceeding 10 inches (254 millimetres) for the 3-day period. An unofficial gage near Leonard, N. Dak. registered 20 inches

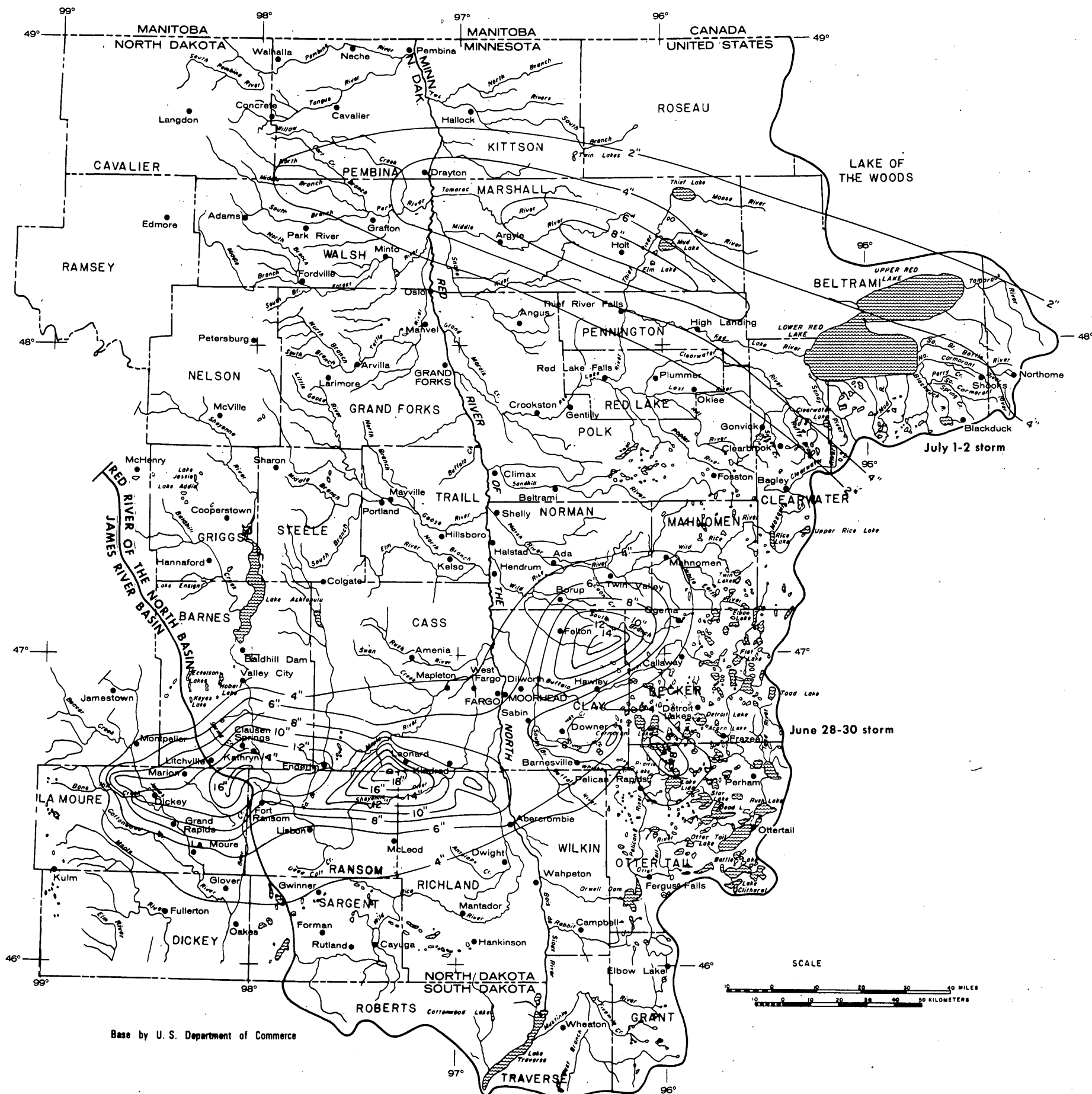


Figure 1.--Isohyetal map of total rainfall (in inches) during the periods June 28-30 and July 1-2, 1975 (Based on data provided by National Oceanic and Atmospheric Administration, U. S. Dept. of Commerce, and by Minnesota State Office of Climatology.)

(508 millimetres) of rain. The first storm was responsible for flooding along the Red River of the North from the Fargo-Moorhead area to Grand Forks, N. Dak.

During July 1-2, a second storm produced high rainfall along a wide band from Drayton, N. Dak. to Lower Red Lake, Minn. The July storm was not as severe as the June storm, although 8,000 square miles (21,000 square kilometres), mostly in Minnesota, received more than 2 inches (51 millimetres) of rain (fig. 1). Holt, Minn., located north of Thief River Falls, reported 8 inches (203 millimetres), the largest amount. The July storm caused significant flooding along tributaries entering the Red River of the North in the extreme northwestern part of Minnesota, including the Red Lake River basin.

SUMMARY OF FLOOD DATA

Peak stages and discharges

Peak stages and discharges were documented at 62 sites located in areas of significant flooding. Locations of the sites are shown on figure 2. The stream basins exclusively in North Dakota that drain to the Red River include the Wild Rice, lower Sheyenne, and lower Maple. A few sites are in the James River basin which drains to the Missouri River. The Minnesota stream basins are mainly the Buffalo, Wild Rice, Marsh, Sandhill, Red Lake, and Snake. All gaging stations on the main stem of the Red River of the North from Wahpeton to Drayton, N. Dak. are included.

A summary of maximum flood stages and discharges at 47 sites (fig. 2) in the regular stream-gaging network and at 15 miscellaneous sites on smaller drainage areas is presented in table 1 for both the maximum flood previously known and the maximum experienced during the June-July 1975 floods. The relative magnitude of the 1975 floods compared to the maximums previously known are shown in figure 3. The 1975 floods exceeded the maximums previously known at 18 of 47 sites having 10 or more years of record, largely on tributary streams. The Red River of the North at Halstad, Minn. was the only main-stem station where the June-July floods exceeded the maximum previously known. The discharges for the 1975 peaks exceeded the 100-year flood (the flood expected to be equaled or exceeded once every 100 years on the average) at three sites within the regular network.

In addition to inundation of large areas, the duration of flooding was long, magnifying the damage. The Red River of the North at Fargo and Grand Forks, N. Dak. and at Halstad, Minn. remained above flood stage for about 10 days, as shown on figure 4. The duration of flooding for smaller streams like the South Branch Buffalo River at Sabin, Minn. was about 3 days.

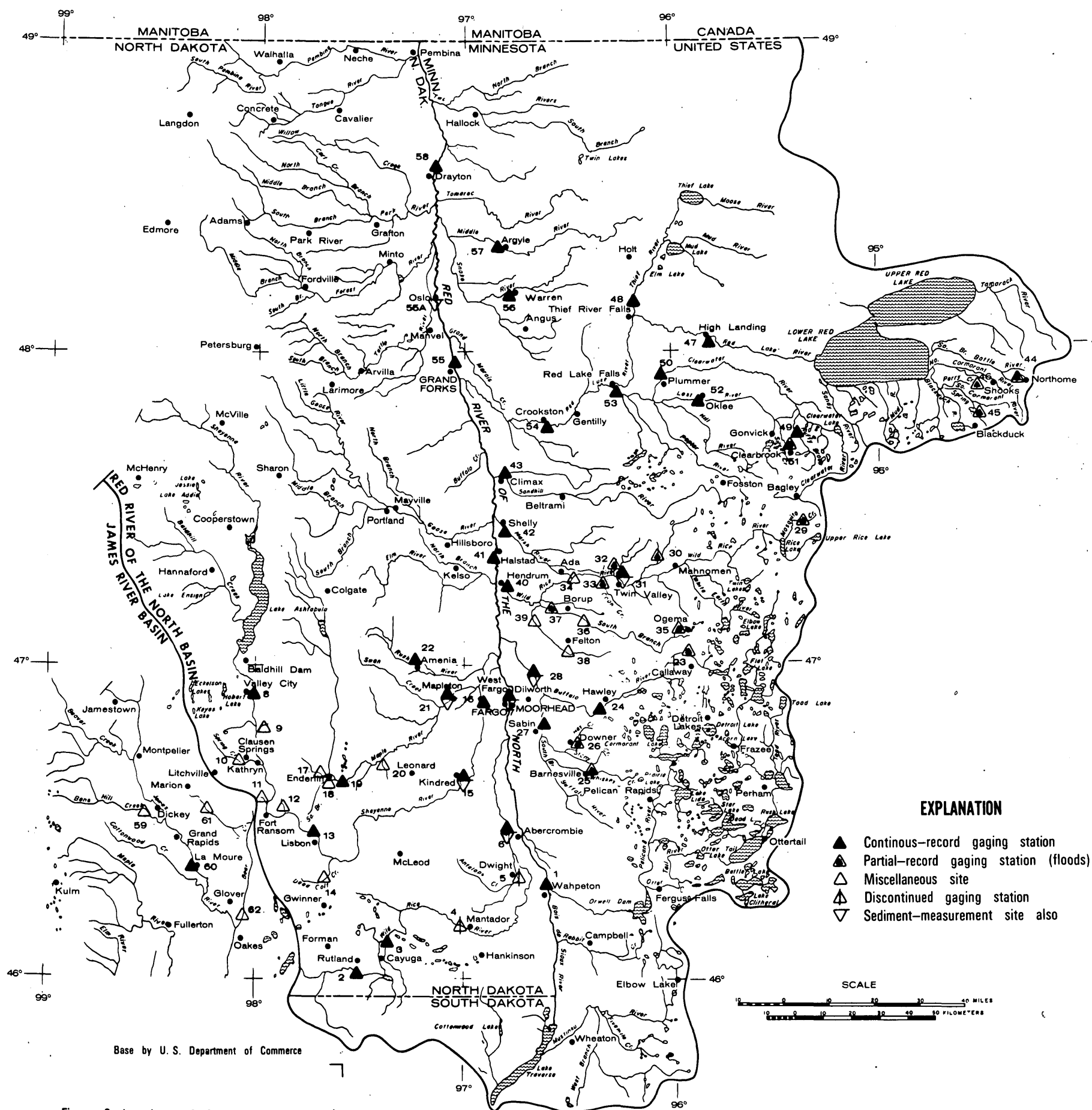


Table 1.--Summary of flood stages and discharges

Site No. Station on fig- ure 2	Stream and place of determination	Contrib- uting drainage area (mi ²)	Period of known floods	Maximum flood previously known			Maximum during June-July 1975 floods			Recur- rence interval (years)		
				Date	Gage height (ft)	Discharge ft ³ /s	Date	Gage height (ft)	Discharge ft ³ /s			
Red River of the North basin												
1 05051500	Red River of the North at Wahpeton, N. Dak.	4,010	1897, 1942-74	1897 4-10-69	17.0 16.34	-- 9,200	-- 2.3	July 4	10.80	3,800	0.9	4
2 05051600	Wild Rice River near Rutland, N. Dak.	296	1960-74	4- 8-69	a8.78	1,270	4.3	June 30	4.40	130	0.4	3
3 05051700	Wild Rice River near Cayuga, N. Dak.	565	1957-74	4- 7-69 4-12-69	a10.90 9.32	-- 1,710	-- 3.0	July 1	7.71	470	0.8	4
4 05052000	Wild Rice River near Mantador, N. Dak.	790	1944-73	4-13-69	10.88	2,360	3.0	July 2	9.70	1,100	1.4	10
5 05052500	Antelope Creek at Dwight, N. Dak.	278	1944-47, 1949-73	4-10-69	17.82	9,000	32.4	July 3	15.00	1,800	6.5	7
6 05053000	Wild Rice River near Abercrombie, N. Dak.	1,490	1897, 1932-74	1897 4-11-69	27.5 24.58	-- 9,540	-- 6.4	July 4	19.16	3,600	2.4	9
7 05054000	Red River of the North at Fargo, N. Dak.	6,800	1882, 1897, 1902-74	1897 4-15-69	39.1 37.34	b25,000 25,300	-- 3.7	July 4	33.36	13,200	1.9	22
8 05058500	Sheyenne River at Valley City, N. Dak.	2,110	1919, 1938-74	4-28-48 4-19-69	17.51 17.62	4,580 4,520	2.2 --	June 30	10.27	2,040	1.0	c
9 d464702 097585600	Sheyenne River tributary near Kathryn, N. Dak.	3.0	e	--	--	--	--	June 30	--	420	140	--
10 d464058 098032300	Spring Creek at Clausen Springs, N. Dak.	87.0	e	--	--	--	--	June 29	--	540	6.2	--
11 d463254 097560200	Sheyenne River tributary near Ft. Ransom, N. Dak.	14.2	e	--	--	--	--	June 29	--	5,300	373	--
12 d463233 097505100	Sheyenne River tributary No. 2 near Ft. Ransom, N. Dak.	7.0	e	--	--	--	--	June 29	--	2,840	406	--
13 05058700	Sheyenne River at Lisbon, N. Dak.	2,490	1957-74	4-24-69	16.54	4,380	1.8	July 1	19.07	5,700	2.3	c

Table 1.--Summary of flood stages and discharges--Continued

Site No. Station on figure 2	Stream and place of determination	Contributing drainage area (mi ²)	Period of known floods	Maximum flood previously known			Maximum during June-July 1975 floods			Recur- rence interval (years)	
				Date	Gage height (ft)	Discharge ft ³ /s	Date	Gage height (ft)	Discharge ft ³ /s		
Red River of the North basin--Continued											
14	d461832 097392300 Dead Colt Creek near Gwinner, N. Dak.	34.3	e	--	--	--	June 30	--	3,890	113	--
15	05059000 Sheyenne River near Kindred, N. Dak.	3,020	1947 or 48, 1950-74	1947 or 48 4-15-69	22.1 21.03	3,600 4,690	July 6	21.66	4,700	1.6	c
16	05059500 Sheyenne River at West Fargo, N. Dak.	3,090	1903-06, 1919, 1930-74	4-4-66 4-16-69	-- 21.70	3,110 --	July 3 July 5	21.75 22.25	2,850 --	0.9 --	c
17	d463917 097404700 Maple River tributary near Enderlin, N. Dak.	42.4	e	--	--	--	June 29	--	3,210	75.7	--
18	d463634 097361500 South Branch Maple River at Enderlin, N. Dak.	36.6	e	--	--	--	June 29	--	6,390	175	--
19	05059700 Maple River near Enderlin, N. Dak.	796	1957-74	4-11-69	13.55	5,750	June 30	15.41	7,800	9.8	25
20	d464119 097231200 Maple River tributary near Leonard, N. Dak.	32.4	e	--	--	--	June 30	--	2,120	65.4	--
21	05060000 Maple River near Mapleton, N. Dak.	1,379	1944-74	4-11-69	14.00	7,000	July 2	15.03	11,600	8.4	50
22	05060500 Rush River at Amenia, N. Dak.	116	1947-74	3-23-66 4-10-69	12.15 11.41	-- 1,690	July 1	9.12	450	3.9	3
23	05060800 Buffalo River near Callaway, Minn.	94.5	1960-74	4-10-69	15.11	446	June 29	15.68	620	6.6	20
24	05061000 Buffalo River near Hawley, Minn.	322	1921, 1945-74	1921 4-9-69	11.3 9.07	-- 1,880	July 1	9.76	2,050	6.4	30
25	05061200 Whisky Creek at Barnesville, Minn.	25.3	1961-74	4-9-69	6.85	570	June 29	6.97	610	24.1	>30

Table 1.--Summary of flood stages and discharges--Continued

Site No. Station on figure 2	Stream and place of determination	Contrib- uting drainage area (mi ²)	Period of known floods	Maximum flood previously known				Maximum during June-July 1975 floods					
				Date	Gage height (ft)	Discharge ft ³ /s	ft ³ /s-mi ²	Date	Gage height (ft)	Discharge ft ³ /s	ft ³ /s-mi ²	Recur- rence interval (years)	
Red River of the North basin--Continued													
26	05061400	Hay Creek above Downer, Minn.	5.81	1961-74	6- 8-62	13.46	g	--	June 29	13.52	1,460	251	>100
27	05061500	South Branch Buffalo River at Sabin, Minn.	522	1945-74	4-10-69	18.12	6,410	12.3	July 2	19.90	8,500	16.3	60
28	05062000	Buffalo River near Dilworth, Minn.	1,040	1931-74	4-11-69	25.55	10,400	10.0	July 2	27.06	13,600	13.1	90
29	05062280	Mosquito Creek near Bagley, Minn.	3.98	1961-74	4-17-67	9.72	68	17.1	July 2	17.94	9.4	2.4	<2
30	05062470	Marsh Creek tributary near Mahnommen, Minn.	11.9	1961-74	4-11-69	13.76	436	36.6	July 2	10.47	119	10.0	3
31	05062500	Wild Rice River at Twin Valley, Minn.	888	1909-17, 1931-74	7-22-09	120.0	9,200	10.4	July 1	11.29	3,660	4.1	12
32	05062700	Wild Rice River tributary near Twin Valley, Minn.	2.16	1961-74	6-16-70	14.76	324	150	July 2	12.39	90	41.7	2
33	05062800	Coon Creek near Twin Valley, Minn.	50.8	1962-74	4- 9-69	13.42	1,520	29.9	June 29	14.59	2,700	53.1	>50
34	05062900	Wild Rice River above Ada, Minn.	1,050	e	--	--	--	--	July 1	124.34	15,850	5.6	--
35	05063200	Spring Creek tributary near Ogema, Minn.	4.99	1963-74	4- 9-69	8.68	115	23.0	June 29	8.44	101	20.2	7
36	05063400	South Branch Wild Rice River near Felton, Minn.	180	e	--	--	--	--	June 30	115.53	7,610	42.3	--
37	05063500	South Branch Wild Rice River near Borup, Minn.	254	1944-49, 1972-74	3-19-46 4-13-47	13.60 112.86	950 1,150	-- 4.5	July 1	20.59	3,700	14.6	>100
38	05063800	State ditch 45 near Felton, Minn.	g29.4	e	--	--	--	--	June 29	19.95	1,020	34.7	--
39	05063810	State ditch 45 near Borup, Minn.	--	e	--	--	--	--	June 30	194.10	810	--	--

Table 1.--Summary of flood stages and discharges--Continued

Site No. on figure 2	Station No.	Stream and place of determination	Contributing drainage area (mi ²)	Period of known floods	Maximum flood previously known				Maximum during June-July 1975 floods				Recurrence interval (years)
					Date	Gage height (ft)	Discharge ft ³ /s	ft ³ /s-mi ²	Date	Gage height (ft)	Discharge ft ³ /s	ft ³ /s-mi ²	
Red River of the North basin--Continued													
40	05064000	Wild Rice River at Hendrum, Minn.	1,600	1944-74	4-15-69	31.42	8,300	5.2	July 5	530.95	7,660	4.8	35
41	05064500	Red River of the North at Halstad, Minn.	221,800	1897, 1936-37, 1942-74	1897, 4-18-69	38.5	--	--	July 9	532.05	--	--	--
42	05067500	Marsh River near Shelly, Minn.	151	1944-74	5-11-50	21.96	4,660	30.9	July 3	13.15	1,170	7.7	3
43	05069000	Sandhill River at Climax, Minn.	--	1943-74	4-14-65	117.81	4,560	--	July 8	--	369	--	<2
44	05073600	South Branch Battle River at Northome, Minn.	2.80	1960-74	4-17-69	28.32	--	--	July 11	24.84	--	--	--
45	05073750	Spring Creek near Blackduck, Minn.	7.96	1960-74	4-13-69	16.43	109	38.9	July 2	15.09	126	45.0	10
46	05073800	Perry Creek tributary near Shooks, Minn.	1.14	1960-74	5-23-62	16.54	346	43.5	July 2	16.85	896	113	>50
47	05075000	Red Lake River at High Landing near Goodridge, Minn.	2,300	1930-74	4-13-69	8.05	76	66.7	July 2	9.91	140	123	>100
48	05076000	Thief River near Thief River Falls, Minn.	959	1909-17, 1919-26, 1929-74	5-11-50	13.42	3,720	1.6	July 3	13.44	--	--	--
49	05077700	Ruffy Brook near Convick, Minn.	45.2	1960-74	5-13-50	17.38	5,610	5.8	July 7	13.39	4,060	1.8	25
50	05078000	Clearwater River at Plummer, Minn.	512	1939-74	3-30-67	6.35	453	10.0	July 2	4.78	269	6.0	2
51	05078200	Silver Creek tributary at Clearbrook, Minn.	6.02	1960-74	4-9-67	16.62	--	--	July 4	11.19	2,960	5.8	9
					6-9-62	11.90	3,640	7.1	July 2	14.17	3,260	3.4	10
					4-10-69	12.31			July 2	14.17	3,260	3.4	10
					9-2-73	16.11	152	25.2	July 2	11.85	68	11.3	3

Table 1.--Summary of flood stages and discharges--Continued

Site No. on figure 2	Station No.	Stream and place of determination	Contributing drainage area (mi ²)	Period of known floods	Maximum flood previously known				Maximum during June-July 1975 floods				
					Date	Gage height (ft)	Discharge ft ³ /s	Discharge ft ³ /s-mi ²	Date	Gage height (ft)	Discharge ft ³ /s	Discharge ft ³ /s-mi ²	Reurrence interval (years)
Red River of the North basin--Continued													
52	05078230	Lost River at Oklee, Minn.	266	1950, 1960-74	4-21-50 4-11-69	18.39 14.91	2,790 3,210	-- 12.1	July 3	13.40	1,710	6.4	3
53	05078500	Clearwater River at Red Lake Falls, Minn.	1,370	1909-17, 1934-74	4-15-13 4-12-69	17.5 11.82	-- 9,740	-- 7.1	July 4	8.76	5,130	3.7	5
54	05079000	Red Lake River at Crookston, Minn.	5,280	1901-74	4-12-69	27.33	28,400	5.4	July 5	20.48	13,500	2.6	6
55	05082500	Red River of the North at Grand Forks, N. Dak.	230,100	1882-1974	1897 Apr. 10	150.2	80,000	2.7	July 14	43.08	42,700	1.4	10
56	05085500	Snake River at Warren, Minn.	g175	1945, 1950, 1953-56	May 1950	18.42	3,510	20.1	July 3	17.73	2,080	11.9	--
57	05087500	Middle River at Argyle, Minn.	265	1945, 1950-74	Apr. 1950 4-3-66	15.25 16.00	2,790 --	10.5 --	July 3	16.59	4,260	16.1	35
58	05092000	Red River of the North at Drayton, N. Dak.	234,800	1936-37, 1941-74	5-12-50	141.58	86,500	2.5	July 19	39.10	38,000	1.1	5
James River basin													
59	d463150 098321700	Bone Hill Creek near Dickey, N. Dak.	71.0	e	--	--	--	--	June 29	--	1,020	14.4	--
60	06470500	James River at La Moure, N. Dak.	1,790	1950-74	4-14-69	16.17	6,800	3.8	July 1	12.76	2,900	1.6	c
61	d463150 098134500	Bear Creek tributary near Marion, N. Dak.	80.0	e	--	--	--	--	June 30	--	1,270	15.9	--
62	d460818 098042100	Bear Creek near Glover, N. Dak.	437	e	--	--	--	--	July 1	--	4,590	10.5	--

FOOTNOTES TO TABLE 1

- > Greater than.
- < Less than.
- a Backwater from ice.
- b At site 1.5 miles downstream.
- c Not computed, partially regulated.
- d Latitude-longitude identifier, no downstream order number assigned.
- e Miscellaneous site, peak discharge available for 1975 flood only.
- f Backwater from Red or Maple Rivers.
- g Revised.
- h Higher stage and discharge during April 1975.
- i At different site or datum.
- j U.S. Army Corps of Engineers gage datum.
- k Includes diversion flow to Marsh River.
- l Approximately.
- m Backwater from debris.
- n. Backwater from tributary ditches.
- o Channel dredged 8 feet in 1964.

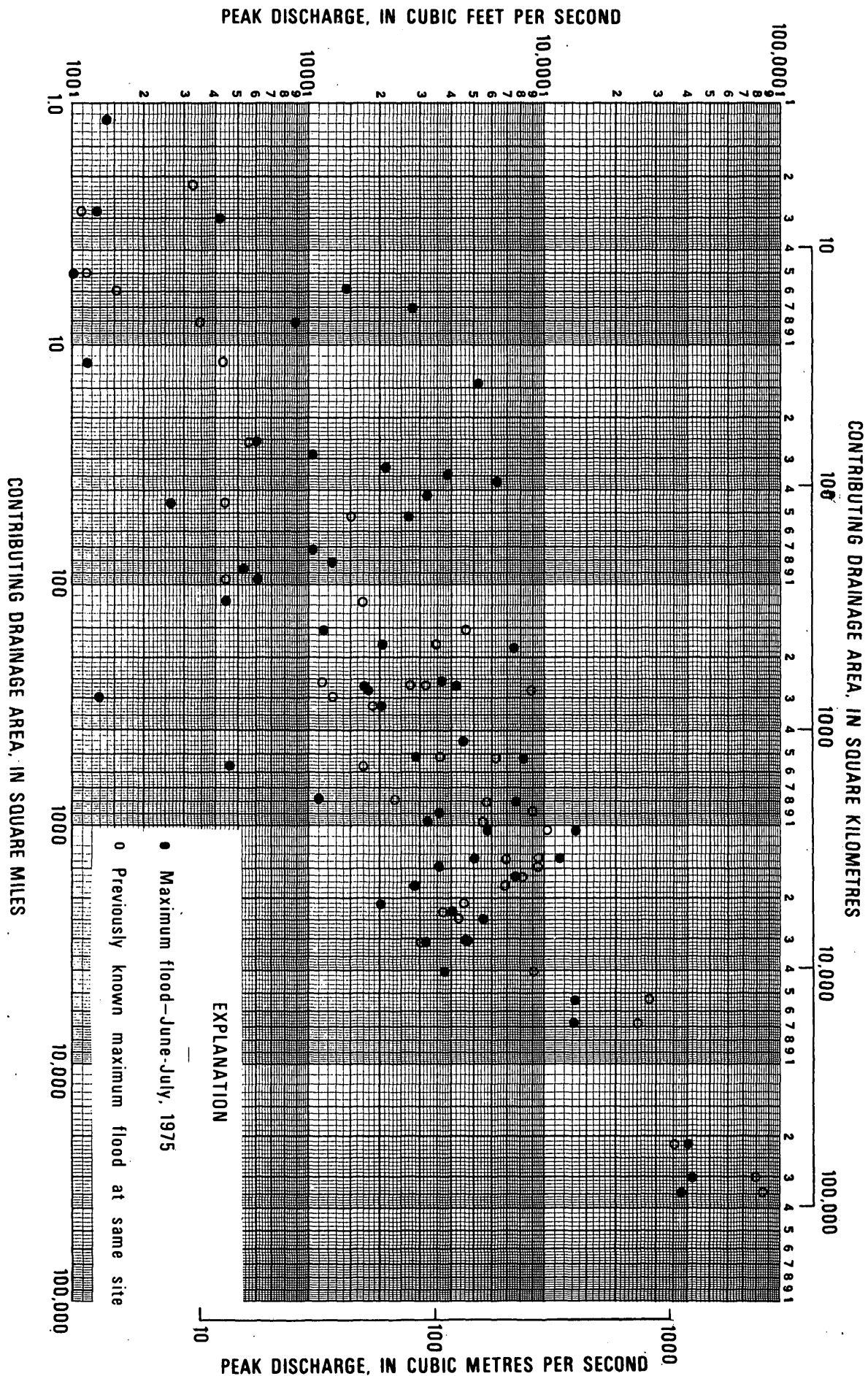


Figure 3.—Comparison of the June-July, 1975 floods with maximum floods previously determined at the same sites.

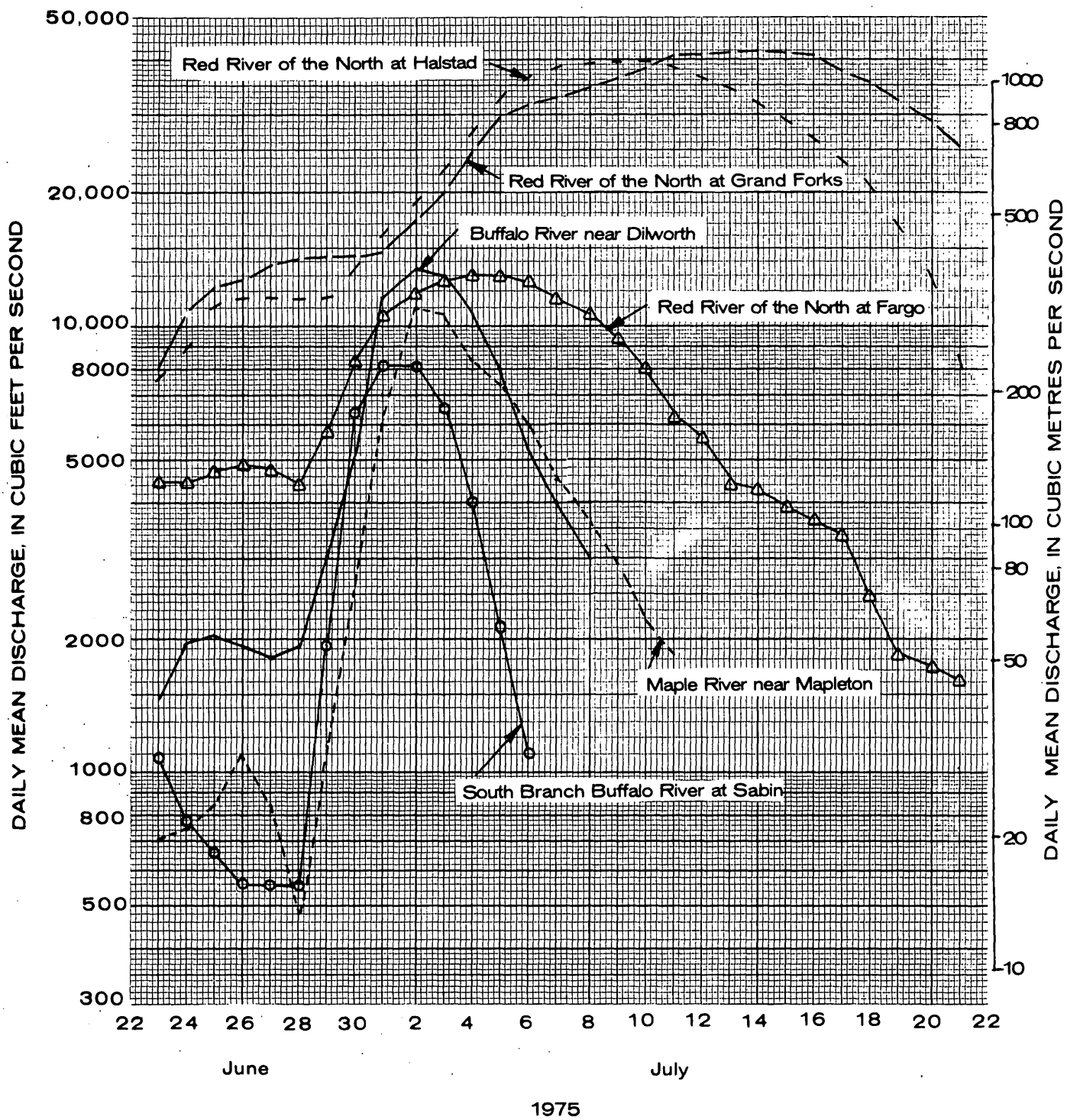


Figure 4.--Flood hydrographs at selected locations.

Sediment concentrations

Sediment data were collected at four sites in North Dakota and three sites in Minnesota during the June-July 1975 floods. Available data for evaluating the sediment loads of the major rivers draining the areas flooded are summarized in table 2. A comparison of the discharges listed in table 2 with the peak discharges listed in table 1 shows that all of the sediment data were obtained near the crests of the floods. The sediment concentrations measured during the June-July 1975 floods are not exceptionally high and have been exceeded numerous times in the past.

Remote-sensing data available from EROS Data Center

The data collected by the EROS Data Center, summarized in table 3, document the areas flooded during June-July 1975. Aerial photography and LANDSAT data are being evaluated for use as a tool for mapping the areas inundated. Beyond the evaluation of short-term flood effects, the LANDSAT data may be useful for studying possible long-term effects like increased soil salinity, erosion, and deposition.

Table 2.--Summary of sediment data collected during the flood

Station No.	Site No. on figure 2	Stream and place of determination	Date	Time	Water temperature (°C)	Suspended sediment			
						Discharge ft ³ /s	Concentration (mg/l)	Sediment discharge (tons per day)	Percent finer than 0.062 mm sieve
05053000	6	Wild Rice River near Abercrombie, N. Dak.	07-04-75	1215	27.0	3,460	199	1,860	92
05054000	7	Red River of the North at Fargo, N. Dak.	07-03-75	1400	23.0	12,500	141	4,760	98
05059000	15	Sheyenne River near Kindred, N. Dak.	07-03-75	1530	23.5	4,200	822	9,320	90
05060000	21	Maple River near Mapleton, N. Dak.	07-03-75	1115	22.0	11,600	120	3,760	96
05062000	28	Buffalo River near Dilworth, Minn.	07-02-75	1400	24.5	13,600	88	3,300	--
05062500	31	Wild Rice River at Twin Valley, Minn.	07-01-75	1600	19.0	3,660	193	1,910	--
05083500	55A	Red River of the North at Oslo, Minn.	07-15-75	0940	22.0	43,000	156	18,100	92

Table 3.--Summary of remote sensing data on 1975 Red River of the North flood available through EROS Data Center (furnished by Applications Assistance Branch, EROS Data Center, U.S. Geological Survey, Sioux Falls, S. Dak.)

May 12, 1975

1. LANDSAT 2 Overpass 0% Cloud Cover
 Identification: E-2110-16370 Fargo-Moorhead area
 E-2110-16364 St. Vincent to N. Grand Forks area
 E-2110-16373 Wahpeton-Breckenridge area

June 26, 1975

1. LANDSAT 1 Overpass 70% Cloud Cover, Mapleton visible
 Identification: E-5068-16260 Mapleton area

July 5, 1975

1. LANDSAT 1 Overpass 10% Cloud Cover
 Identification: E-2164-16372 Fargo-Moorhead area
 E-2164-16365 St. Vincent to N. Grand Forks area
 E-2164-16374 Wahpeton-Breckenridge area
2. EDC 35mm, color and color infrared oblique low-altitude aerial slides of West Fargo, Mapleton, and Kindred area.

July 10, 1975

1. NASA RB-57 Overflight Mission 315X 1:116,000 scale, metric color infrared imagery, Breckenridge to Canadian Border. Fifty frames of coverage. Frame 1-D. Roll 8, Frames 019 to 092.
2. EDC 35mm color and color infrared ground slides, Fargo-Moorhead, West Fargo area.

July 13, 1975

1. EDC Contract Overflight, 1:48,000 scale color infrared imagery. EDC 001, Rolls 1 and 2. Grand Forks to Breckenridge; 205 frames.

July 14, 1975

1. LANDSAT 1 Overpass - Cloud Cover 10%, Red River Valley visible.
 Identification: E-5086-16250 Fargo to Grand Forks
 E-5086-16243 Grand Forks to Canadian Border
 E-5086-16252 Kindred to Watertown

July 17, 1975

1. EDC Contract Overflight, 1:24,000 scale color infrared imagery. EDC 001, Roll 3, Breckenridge to Grand Forks, along the Red River; 81 frames.

July 25, 1975

1. EDC 35mm color, and color infrared oblique low-altitude slides of Halstad, West Fargo, Mapleton areas.

September 15, 1975

1. EDC Contract Overflight identical to July 13th and 17th Missions.