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Precipitation Summary for 1993

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Wisconsin experienced many contrasts in precipitation in 1993. Some areas received less than normal rainfall; others set all-time high precipitation records for their locations. When categorized by state average precipitation, however, 1993 was only moderately wet. The annual statewide average of 35.6 inches was 112 percent of normal, 3.8 inches above the 1961–90 average of 31.8 inches, but several inches below the 1991 average of 38.1 inches, when wet conditions prevailed across the state. Precipitation was measured at more than 200 National Weather Service and other stations around Wisconsin (fig. 1).

Yearly precipitation varied significantly from one region to another. Table 1 compares 1993 to 1992 precipitation for each climate division; figure 2 shows the distribution of precipitation across the state during the year. The values ranged from more than 49 inches in southwestern Wisconsin to less than 24 inches in northern locations. In general, the southern two-thirds of the state experienced above-normal precipitation; the northern third of Wisconsin was below the long-term average (fig. 3).

Precipitation amounts also fluctuated from month to month. Table 2 lists monthly totals of precipitation for each division as well as a statewide average. Exceptionally wet spring and summer conditions in the south contrasted with dry conditions in northern Wisconsin

Table 1. Comparison of precipitation amounts for Wisconsin climatological divisions for 1993 and 1992. "Normal" is the 30-year average from 1961–90. Divisions are shown in figure 1.

Division	Total 1993 (in.)	Departure from normal (in.)	Total 1992 (in.)	Departure from normal (in.)
Northwest	30.8	- 0.6	28.0	- 3.4
North Central	31.4	- 0.5	30.1	- 1.8
Northeast	32.4	+ 1.1	31.4	+ 0.1
West Central	38.2	+ 6.0	32.4	+ 0.2
Central	38.5	+ 6.5	32.5	+ 0.5
East Central	34.1	+ 3.5	29.7	- 0.9
Southwest	43.6	+11.4	35.4	+ 3.2
South Central	42.3	+ 9.8	32.7	+ 0.2
Southeast	36.4	+ 3.9	29.7	- 2.8

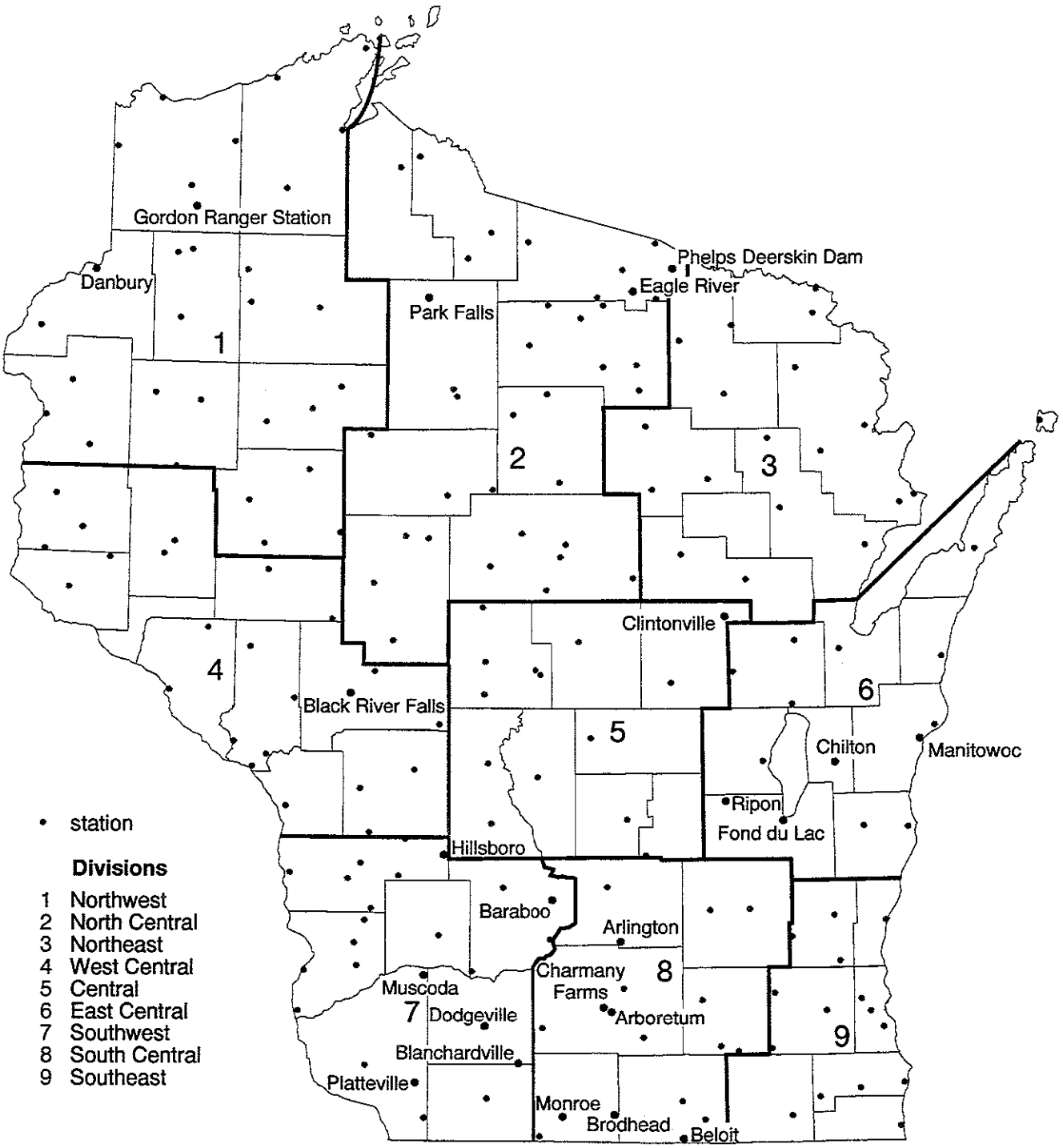

Figure 1. Station locations and climatological divisions (adapted from *Climatological Data, Wisconsin,* National Oceanic and Atmospheric Administration, National Climatic Data Center). Only stations that are discussed in text are named on this map.

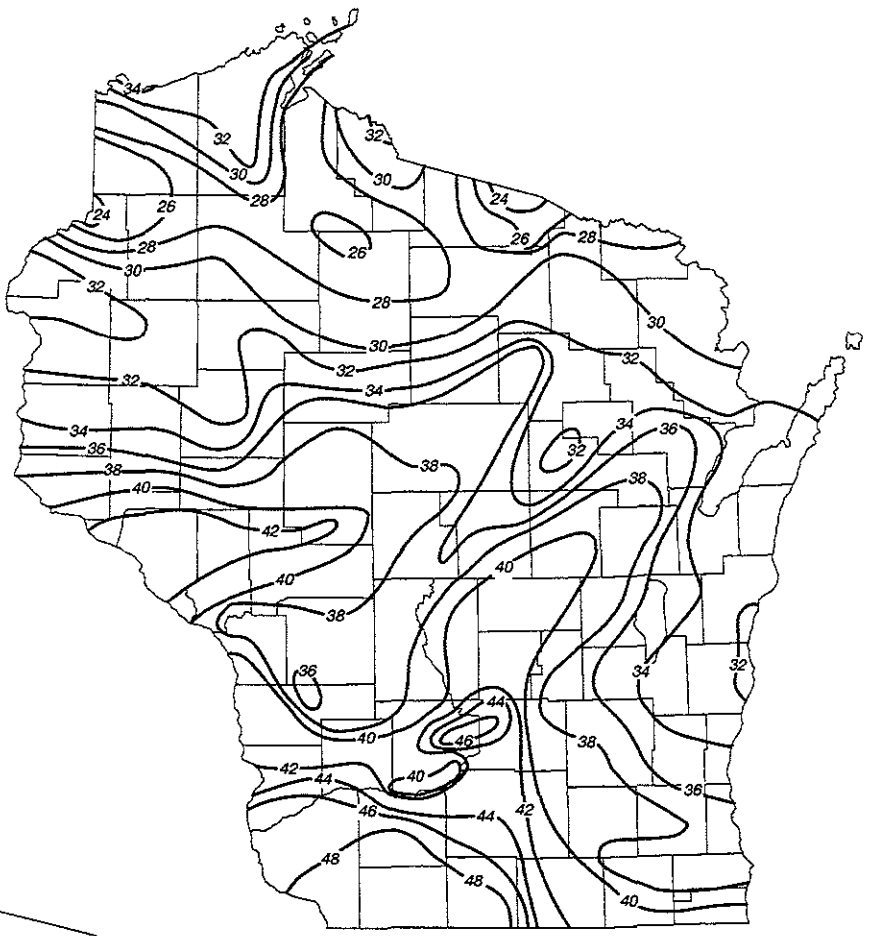

Figure 2. Total precipitation, in inches, 1993.

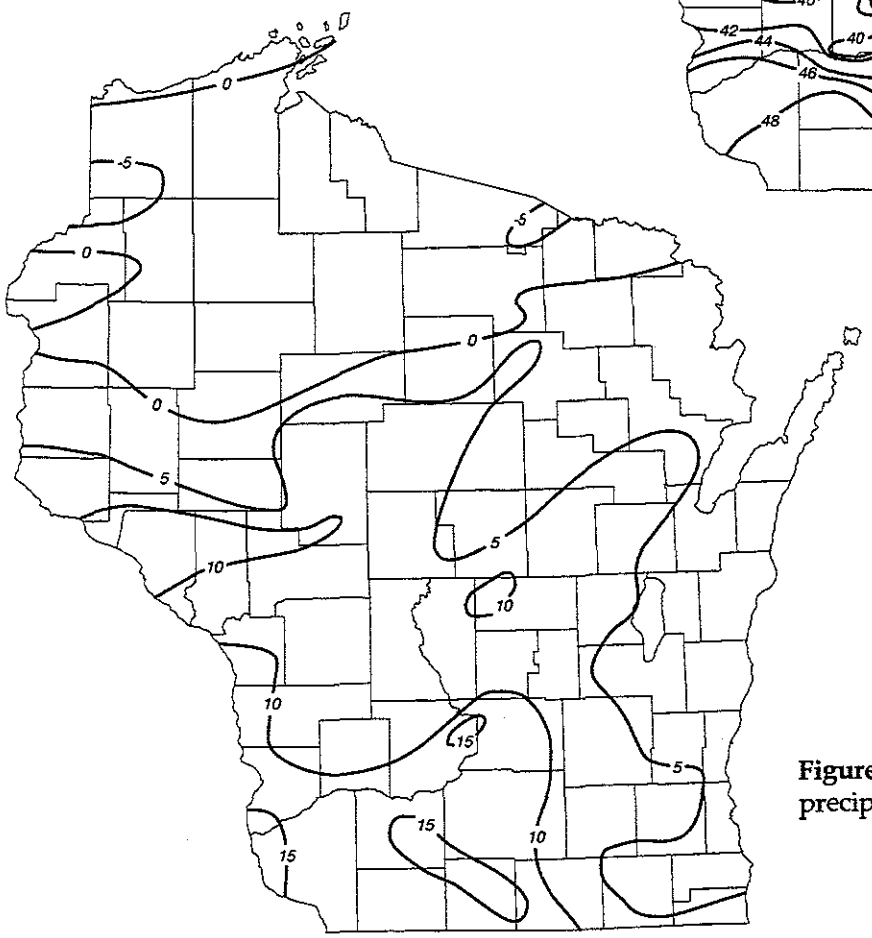

Figure 3. Departure from normal precipitation, in inches, 1993.

Table 2. Precipitation in 1993, averaged by climatological division.

	Monthly totals, 1993 (in inches)												Statistics, 1993			
Division*	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	NORM	DEPART	PCT
Northwest	1.26	0.19	0.66	2.73	5.51	5.44	3.65	3.57	3.06	1.44	2.43	0.83	30.77	31.34	-0.59	98
North Central	1.46	0.13	0.57	3.15	4.91	6.43	2.92	3.29	3.68	2.24	1.96	0.70	31.44	31.91	-0.46	99
Northeast	1.60	0.20	0.41	4.11	4.90	6.78	3.35	3.10	3.54	2.00	1.72	0.55	32.37	31.15	1.08	103
West Central	1.20	0.60	1.59	4.80	5.27	7.64	5.02	5.82	2.83	1.28	1.47	0.66	38.18	32.24	5.97	119
Central	1.27	0.51	1.10	4.75	5.34	7.94	6.29	4.32	3.05	1.88	1.67	0.35	38.47	31.96	6.50	120
East Central	1.66	0.59	0.84	5.20	3.39	6.76	6.11	2.32	3.34	1.69	1.85	0.30	34.05	30.52	3.53	112
Southwest	1.39	1.09	2.12	5.65	5.51	8.11	7.69	6.07	2.78	1.43	1.26	0.47	43.57	32.12	11.43	136
South Central	1.73	1.01	2.39	6.67	3.91	8.19	6.76	3.95	4.51	1.02	1.60	0.58	42.32	32.56	9.75	130
Southeast	2.34	0.93	2.12	7.08	2.57	6.60	4.13	3.41	4.10	0.78	1.75	0.62	36.43	32.57	3.88	112
Statewide average, 1993	1.47	0.49	1.16	4.46	4.83	6.95	4.81	3.99	3.36	1.62	1.81	0.60	35.56	31.79	3.77	
Normal, 1961–90	1.09	0.95	1.96	2.72	3.39	3.83	3.75	4.05	4.01	2.51	2.03	1.48	31.79			
Departure from normal	0.39	-0.46	-0.80	1.74	1.44	3.12	1.06	-0.06	-0.65	-0.89	-0.22	-0.88	3.77			
Percentage of normal	135	52	59	164	142	181	128	98	84	64	89	41	112			
Cumulative statistics																
Total	1.47	1.96	3.12	7.58	12.41	19.36	24.18	28.17	31.53	33.15	34.96	35.56				
Departure	0.39	-0.07	-0.88	0.86	2.30	5.42	6.49	6.42	5.77	4.88	4.65	3.77				
Percentage of normal	135	96	78	113	123	139	137	130	122	117	115	112				

* See Fig. 1.

Division averages are based on arithmetic averages of available station precipitation measurements. These data are collected from National Weather Service offices, cooperative observers, and other participating agencies. Some values may differ from those in *Climatological Data, Wisconsin* (published by the National Oceanic and Atmospheric Administration, National Climatic Data Center). Statewide precipitation is calculated using an area-weighted average of climatological division values.

Precipitation totals for individual stations can be obtained from the State Climatology Office, 1225 W. Dayton Street, Madison, Wisconsin 53706; telephone 608/263.2374; FAX 608/262.5964; Internet stclim@macc.wisc.edu. Please consult the State Climatology Office before using the data for legal or regulatory purposes.

throughout the year. A dry October through December statewide also affected the range of precipitation amounts.

The driest areas in 1993 were centered in northwest and north-central Wisconsin (fig. 3). These locations experienced not only a dry fall but also an extremely dry February and March. Twenty-nine stations in northern Wisconsin reported less than 0.10 inches of precipitation in February. For most sites, the monthly amounts received in February 1993 are normally exceeded 95 to 99 percent of the time. December was also an exceptionally dry month in some areas. Chilton, Fond du Lac, Manitowoc, Ripon, Hillsboro, and Arlington stations reported December precipitation amounts that are usually surpassed in 99 percent of all years. Precipitation amounts at

many other stations in December were also unusually low.

The driest stations in the state over the entire year were Eagle River and Danbury, where only 23.77 inches was measured at each site. Other northern Wisconsin stations that reported low precipitation totals were Phelps Deerskin Dam (23.89 in.), Park Falls (25.73 in.), and Gordon Ranger Station (25.99 in.).

In contrast, southern Wisconsin experienced unusually wet conditions during much of the year. The largest precipitation amounts were measured in areas affected by the heavy rainfall events that caused flooding across the upper Midwest in 1993. The highest annual rainfall was reported at Monroe (49.99 inches). Several other stations in southwestern Wisconsin had high annual precipitation totals, including Dodgeville (49.87 in.), Platteville (48.94 in.), Brodhead (48.85 in.), Baraboo (48.65 in.) and Blanchardville (48.61 in.). A number of stations set new annual precipitation records, including Baraboo, Blanchardville, Dodgeville, Muscoda, Arlington Experimental Farm, and the Arboretum and Charmany Farms stations in Madison. Most of these stations began taking observations after 1938, the wettest year in Wisconsin history.

The wettest months across Wisconsin were June and July. In June, ten stations in southern Wisconsin experienced monthly precipitation amounts higher than expected statistically in 99 percent of all years. In July, 13 stations measured monthly precipitation totals above the 99 percent level. In Clintonville, June and July precipitation amounts were higher than the 99 percent level. Single-month records were broken at many of these locations during the summer.

Several notable storms occurred over the summer months. The economic effects of these storms are described in Heinrichs (1993). One of the biggest storms occurred in west-central Wisconsin over the Black River valley; this storm contributed to damage to several dams and the failure of a levee upstream of downtown Black River Falls. This storm occurred from June 16 to 21, with amounts of up to 7 inches falling during the storm period (fig. 4). The heaviest rainfalls occurred in two distinct bursts coinciding with the passage of two low pressure centers on June 17 and June 19–20. Near-saturated soil conditions contributed to the high runoff from this storm. The return period for precipitation near the storm center was approximately 30 years; that is, this amount of precipitation can be expected approximately once every 30 years.

Another significant storm occurred from July 4 to 7 in a broad band extending from southwest through east-central sectors of Wisconsin (fig. 5). Many locations along the axis of heaviest rain measured 3 to 4 inches of rainfall in the period from 7 AM on July 5 until 7 AM on the next day. This corresponds to a return period of 5 to 10 years for a 24-hour storm in southern Wisconsin. Unofficial observations of more than 6 inches were also reported for the same period near several of the official stations.

In addition to these widespread storms, a locally extreme storm drenched Baraboo on the night of July 17–18. During a 3.5 hour period, 7.78 inches of rain was observed at the Baraboo City Waterworks, the official station closest to the center of heavy rain. This alone surpasses the 100-year 3-hour storm amount by 77 percent. However, rainfall amounts of more than 12 inches were measured by several unofficial observers closer to the center of the storm (fig. 6). Return periods of the flow on some of the small creeks near the center of the storm exceeded 1,000 years. Damage from this deluge was estimated at $8 to $10 million.

The growing season rainfall reflects the effects of high-intensity rains at many locations. Figure 7 shows the total rainfall for April through September and the locations of the heaviest short-period rains during this period. The sizes of the dots show the magnitude of

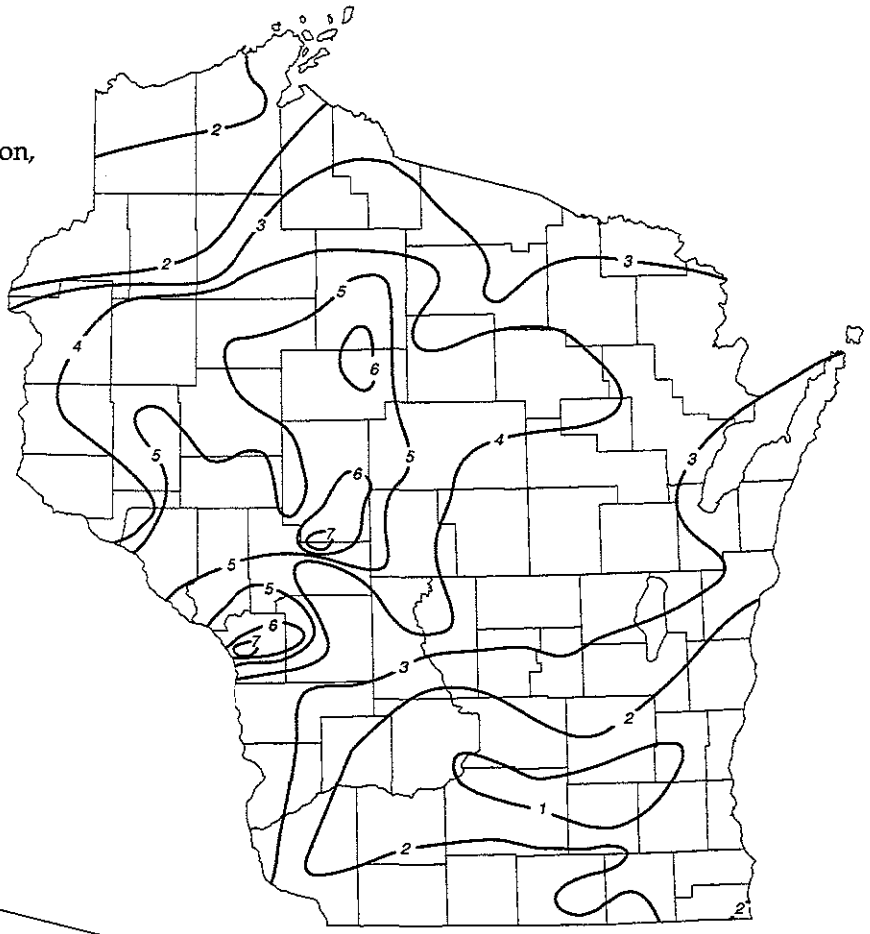

Figure 4. Accumulated precipitation, in inches, June 16–21, 1993.

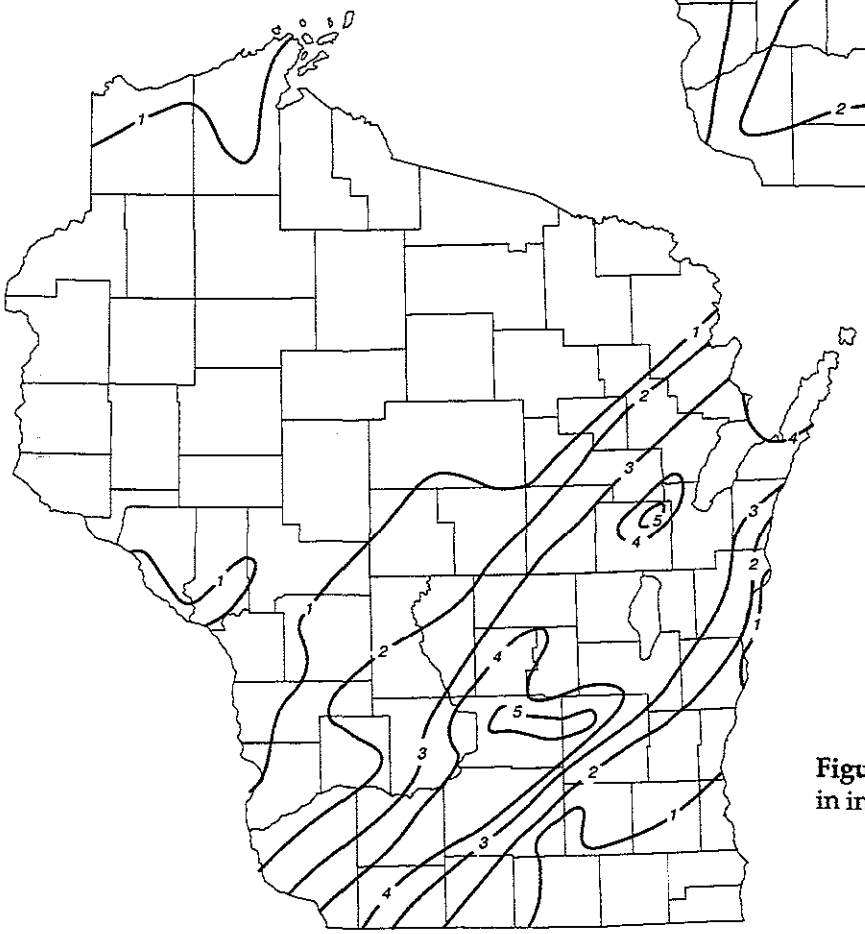

Figure 5. Accumulated precipitation, in inches, July 4–7, 1993.

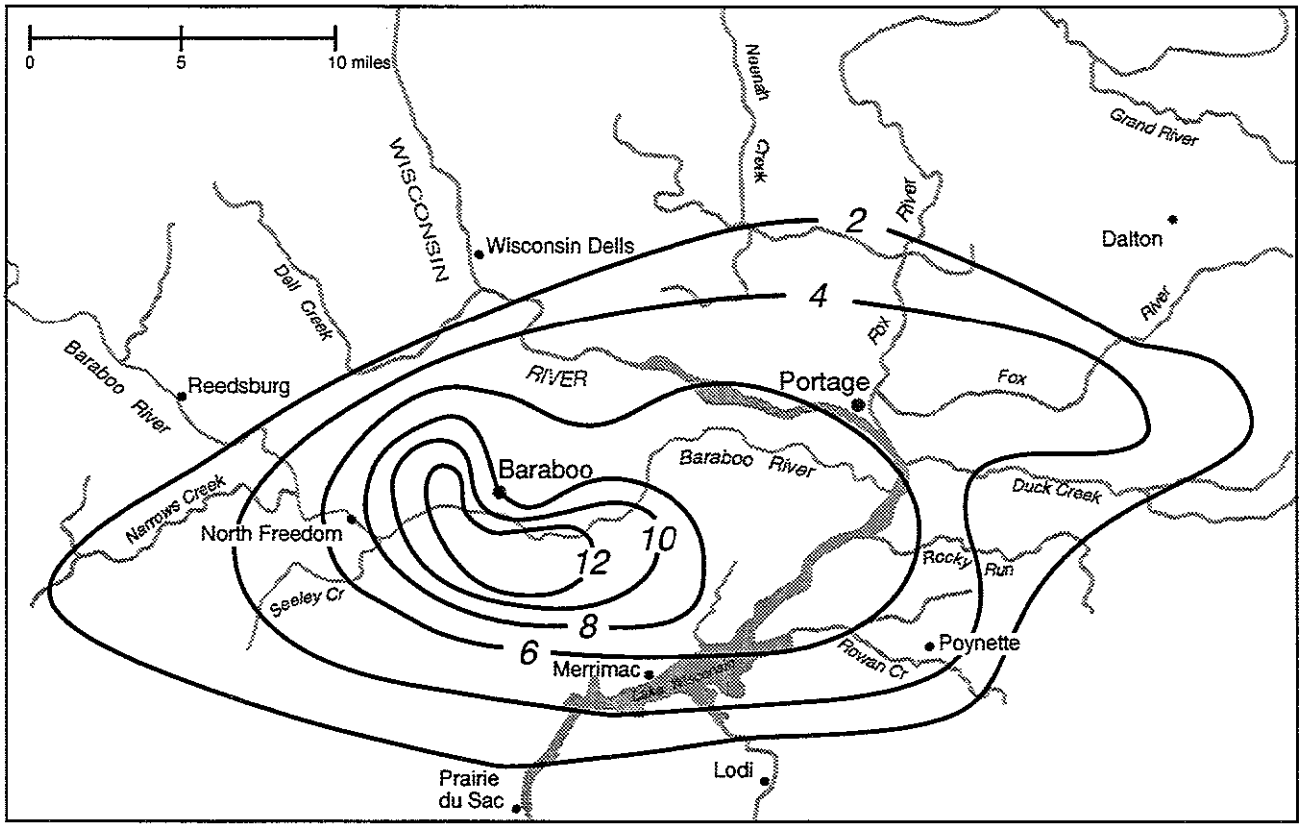

Figure 6. Accumulated precipitation, in inches, for the 24 hours ending 7AM, July 18, 1993, in the Baraboo area (courtesy of Brian Hahn, National Weather Service).

the greatest 24-hour rainfall received at the site. Only locations that received more than 3 inches in a 24-hour period are indicated. For example, Beloit received more than 5 inches of rain in a single storm that occurred on the night of June 29–30. Other nearby stations received 3 to 4 inches in this storm.

Because of the extensive summer rains, and in spite of dry autumn conditions, soils in many parts of the state were moist to very wet at the end of the year. Groundwater levels at many locations at the end of the year were also above normal, according to reports from the U.S. Geological Survey.

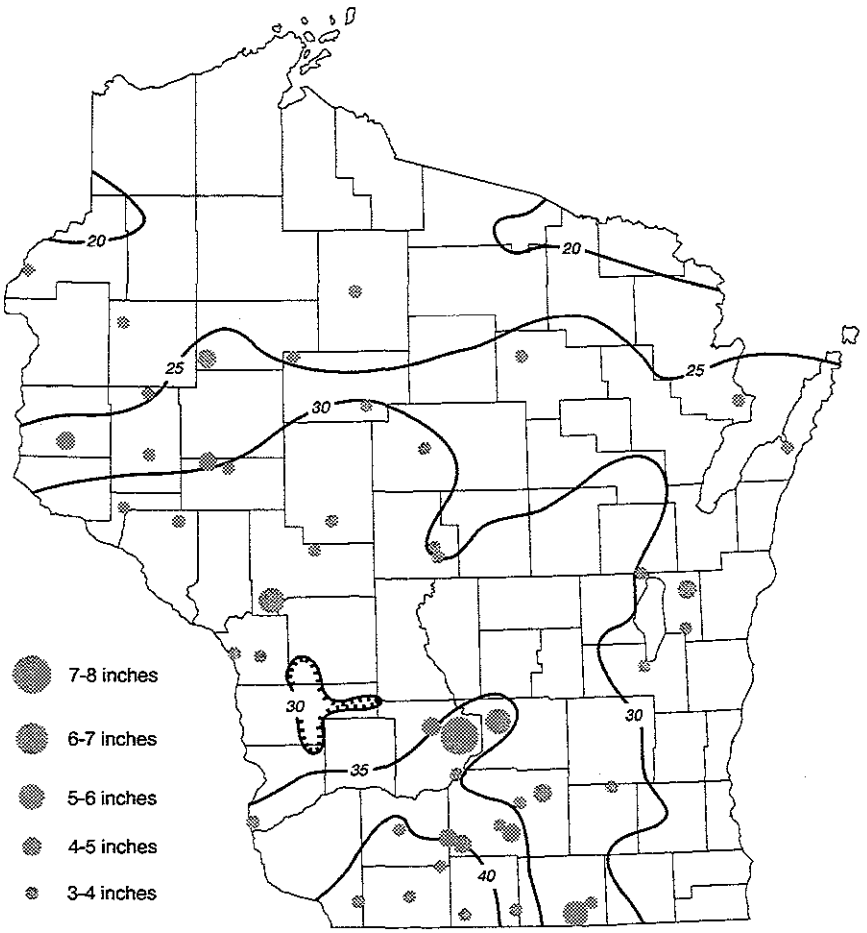

Figure 7. Total precipitation, in inches, April–September, 1993. Dots represent stations that reported at least one occurrence of greater than 3 inches of rain in a 24-hour period. The size of the dot indicates the magnitude of the largest 24-hour rainfall at the site.

Reference

Heinrichs, Gary (ed.), 1993, The floods of 1993: The Wisconsin experience: Wisconsin Department of Natural Resources, 54 p.

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