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State Water Conservation Commission

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TWENTY-FOURTH BIENNIAL REPORT

of the

STATE ENGINEER

of

North Dakota

STREAM-FLOW MEASUREMENT SUPPLEMENT

From October 1, 1948 to June 30, 1950

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UNITED STATES DEPARTMENT OF THE INTERIOR
Geological Survey
WATER RESOURCES BRANCH

Surface Water Division

Stream flow measurements are being conducted by the above U. S. department on a 50-50 cost distribution between the State of North Dakota and the government agency. This is done in order to obtain accurate records of the flow of streams in North Dakota. The work consists of obtaining daily and continuous river stages and actually measuring the amount of water that flows past a gaging station. From this data computations are made of the daily flow, peak stage, peak discharge, minimum stage and minimum discharge. Monthly and annual summaries are compiled for publication. During the past two years this agency has operated twenty-two such stream-gaging stations in this state. Forty-four additional stations are operated in cooperation with the U. S. Fish & Wildlife Service, Bureau of Reclamation, U. S. Departments of State, and Corps of Engineers. The complete records of stream flow thus obtained has been made available to the State Water Conservation Commission for its reports. Current records are available for immediate use by State Agencies.

These records are being used extensively by State and Federal agencies in the design, construction, operation and evaluation of projects and structures pertaining to flood control, wildlife propagation, control of stream pollution, highway and bridge design, recreation, and other water problems. The Missouri river development program and the Red river improvement program will divert, reroute, store and return water to many streams throughout the state. Accurate records of the flow are essential to the sound utilization of this water. The strength of stream flow data lies in long-time records which will show the extremes over a long period of time.

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MISSOURI RIVER NEAR WILLISTON, N. DAK.

Location.—Water-stage recorder, lat. 48°07′, long. 103°44′, in sec. 31, T. 154 N., R. 101 W., at Lewis and Clark Highway bridge, 7 miles west of Williston and 25 miles downstream from Yellowstone River. Datum of gage is 1,830.20 feet above mean sea level, datum of 1929.

Drainage area.—164,500 square miles.

Records available.—September 1928 to September 1948.

Average discharge.—20 years, 19,180 second-feet.

Extremes.—Maximum discharge during year, 78,300 second-feet June 10; maximum gage-height, 12.00 feet Mar. 26 (affected by ice); minimum daily discharge, 7,800 second-feet Feb. 13.

1926-48: Maximum discharge, 231,000 second-feet Apr. 4, 1930, from rating curve extended above 80,000 second-feet; maximum gage height, 19.78 feet Mar. 28, 1943 (ice jam); minimum daily discharge, 1,320 second-feet Dec. 28, 1939.

Remarks.—Records good except those for period of ice effect, which are fair. Many diversions above station for irrigation. Flow partly regulated by Fort Peck Reservoir.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	682,300	30,200	17,500	22,010	1,353,000
November	297,800	15,800	4,000	9,927	590,700
December	259,000	10,100	6,100	8,355	513,700
January	272,800	12,600	6,900	8,800	541,100
February	286,500	17,000	7,200	10,230	568,300
March	769,700	180,000	6,800	24,830	1,527,000
April	934,700	38,600	23,500	31,160	1,854,000
May	1,350,600	64,600	31,100	43,570	2,679,000
June	1,619,100	74,200	37,900	53,970	3,211,000
July	1,371,400	62,800	33,700	44,240	2,720,000
August	1,057,100	44,000	25,000	34,100	2,097,000
September	950,600	34,500	26,600	31,690	1,885,000
Water Year 1946-47	9,851,600	180,000	4,000	26,990	19,540,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,047,600	35,000	32,600	33,790	2,078,000
November	638,200	33,600	16,200	21,270	1,266,000
December	436,000	18,400	11,000	14,060	864,800
January	320,600	12,000	8,500	10,340	635,900
February	304,400	17,000	7,800	10,500	603,800
March	537,100	28,000	9,900	17,330	1,065,000
April	697,100	35,000	17,000	23,240	1,383,000
May	984,400	57,600	22,900	31,750	1,953,000
June	1,979,200	77,200	55,300	65,970	3,926,000
July	1,524,000	60,400	35,600	49,160	3,023,000
August	1,039,200	40,000	28,500	33,520	2,061,000
September	933,100	37,200	27,700	31,100	1,851,000
Water Year 1947-48	10,440,900	77,200	7,800	28,530	20,710,000

MISSOURI RIVER MAIN STEM

Missouri River near Elbowoods, N. Dak.

Location.—Wire-weight gage, lat. 47°34′, long. 102°12′, in NE¼ NE¼ sec. 12, T. 147 N., R. 91 W., at bridge on State Highway 8, 2 miles downstream from Little Missouri River and 2½ miles west of Elbowoods. Datum of gage is 1,720.55 feet above mean sea level, datum of 1929.

Drainage area.—179,800 square miles.

Records available.—October 1939 to September 1948.

Extremes.—Maximum daily discharge during year, 76,500 second-feet June 10; maximum gage height observed, 15.14 feet Mar. 25 (affected by ice); minimum daily discharge, 7,800 second-feet Feb. 10; minimum gage height observed, 5.39 feet Nov. 14.

1938-48: Maximum discharge, about 260,000 second-feet Mar. 26, 1947, from rating curve extended above 110,000 second-feet by logarithmic plotting (gage-height, 23.2 feet); minimum discharge, about 1,500 second-feet Dec. 30, 1939; minimum gage height, 2.00 feet Sept. 18, 1940.

Remarks.—Records good except those for period of ice effect, which are fair. Flow partly regulated by Fort Peck Reservoir.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	735,000	30,800	19,300	23,710	1,458,000
November	314,000	20,200	3,400	10,470	622,800
December	252,700	10,800	5,300	8,152	501,200
January	275,450	10,600	7,250	8,885	546,300
February	320,300	17,800	7,100	11,440	635,300
March	890,600	210,000	7,800	28,730	1,766,000
April	1,089,600	49,500	24,900	36,320	2,161,000
May	1,320,500	59,600	32,300	42,600	2,619,000
June	1,714,600	90,400	37,500	57,150	3,401,000
July	1,481,100	69,900	36,500	47,780	2,938,000
August	1,099,800	44,000	26,600	35,480	2,181,000
September	965,300	35,600	22,800	32,180	1,915,000
Water Year 1946-47	10,458,950	210,000	3,400	28,660	20,740,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,052,800	35,300	32,300	33,960	2,088,000
November	634,400	33,700	13,000	21,150	1,258,000
December	407,300	16,500	9,500	13,140	807,900
January	322,400	14,000	8,700	10,400	639,500
February	277,000	14,200	7,800	9,552	549,400
March	632,300	34,500	10,400	20,400	1,254,000
April	855,100	62,800	18,000	28,500	1,696,000
May	983,800	57,100	23,100	31,740	1,951,000
June	1,990,100	76,500	54,100	66,340	3,947,000
July	1,578,400	63,000	35,700	50,920	3,131,000
August	1,064,200	40,100	29,100	34,330	2,111,000
September	926,300	37,400	27,900	30,880	1,837,000
Water Year 1947-48	10,724,100	76,500	7,800	29,300	21,270,000

MISSOURI RIVER BASIN

Missouri River Below Garrison Dam

Location.—Wire-weight gage, lat. 47°30′, long. 101°24′, in sec. 5, T. 146 N., R. 84 W., on construction bridge at Garrison dam site, 12 miles north of Stanton. Datum of gage is sea level (levels by Corps of Engineers).

Drainage area.—181,400 square miles.

Records available.—January to March 1948 (gage heights only), April to September 1948.

Extremes.—Maximum discharge during period, 75,700 second-feet June 11; maximum elevation 1890.70 Mar. 30 (affected by ice); minimum discharge, not determined.

Remarks.—Records good.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	------	------	------	------	------
November	------	------	------	------	------
December	------	------	------	------	------
January	------	------	------	------	------
February	------	------	------	------	------
March	------	------	------	------	------
April	------	------	------	------	------
May	978,500	55,500	23,500	31,560	1,941,000
June	1,980,700	75,000	53,100	66,020	3,929,000
July	1,585,500	64,000	35,800	51,150	3,145,000
August	1,068,400	40,400	28,400	34,460	2,119,000
September	928,600	38,900	28,100	30,950	1,842,000
Water Year 1947-48	------	------	------	------	12,980,000

MISSOURI RIVER MAIN STEM

Missouri River at Bismarck, N. Dak.

Location.—Water-stage recorder, lat. 46°48′50″, long. 100°49′10″, in sec. 31, T. 139 N., R. 80 W., at Bismarck city water plant, 2,100 feet downstream from Northern Pacific Railway bridge, 1 mile west of Bismarck, and about 4 miles upstream from Heart River. Datum of gage is 1,618.38 feet above mean sea level, datum of 1929.

Drainage area.—186,400 square miles.

Records available.—September 1904 to December 1905, October 1927 to September 1948.

Average discharge.—20 years (1928-48), 20,320 second-feet.

Extremes.—Maximum discharge during year, 76,400 second-feet June 12; maximum gage height, 15.84 feet Apr. 1 (affected by ice); minimum daily discharge, 7,900 second-feet Feb. 13; minimum gage height, 5.64 feet Nov. 14.

1904-05, 1927-48: Maximum discharge, 282,000 second-feet Apr. 3, 1943; maximum gage height, 22.2 feet Apr. 1, 1943, from floodmarks; minimum discharge, about 1,800 second-feet Jan. 3, 1940; minimum gage height, 1.35 feet, present site and datum, Sept. 4, 1934.

Maximum stage known, 31.6 feet, present site and datum, Mar. 31, 1881 (ice jam).

Remarks.—Records good except those for period of ice effect, which are fair. Flow partly regulated by Fort Peck Reservoir.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	752,700	38,900	19,900	24,280	1,493,000
November	335,100	20,400	2,800	11,170	664,700
December	246,900	11,400	4,600	7,965	489,700
January	282,600	10,700	7,400	9,116	560,500
February	316,300	18,000	7,800	11,300	627,400
March	891,400	241,000	8,800	28,750	1,768,000
April	1,180,500	52,300	29,500	39,350	2,341,000
May	1,300,800	61,000	31,200	41,960	2,580,000
June	1,738,700	104,000	35,100	57,960	3,449,000
July	1,467,300	66,800	36,300	47,330	2,910,000
August	1,125,400	44,000	30,600	36,300	2,232,000
September	953,200	34,500	26,900	31,770	1,891,000
Water Year 1946-47	10,590,900	241,000	2,800	29,020	21,010,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,052,000	33,300	32,400	33,940	2,087,000
November	630,300	34,900	11,000	21,010	1,250,000
December	398,900	17,000	9,000	12,870	791,200
January	329,200	13,400	8,800	10,620	653,000
February	266,400	12,500	7,900	9,186	528,400
March	641,400	40,000	13,100	20,690	1,272,000
April	1,029,500	60,500	26,600	34,320	2,042,000
May	976,400	56,800	23,200	31,500	1,937,000
June	1,983,300	75,600	51,700	66,110	3,934,000
July	1,602,800	67,400	36,500	51,700	3,179,000
August	1,071,000	40,000	28,600	34,550	2,124,000
September	916,900	37,700	28,400	30,560	1,819,000
Water Year 1947-48	10,898,100	75,600	7,900	29,780	21,620,000

LITTLE MUDDY CREEK BASIN

Little Muddy Creek near Williston, N. Dak.

Location.—Staff gage, lat. 48°11′40″, long. 103°35′50″, on line between sec. 31, T. 155 N., R. 100 W. and sec. 6, T. 154 N., R. 100 W., at highway bridge, 4 miles northeast of Williston and 6 miles upstream from mouth.

Drainage Area.—1,010 square miles.

Records available.—June 1932 to July 1933, April 1946 to September 1949. February 1904 to April 1909 (no winter records) at site just above Camp Creek, 2½ miles upstream.

Extremes.—Maximum discharge during year, 1,300 second-feet Mar. 28, Apr. 3; maximum gage height, 12.0 feet Mar. 28 (floodmark), affected by ice; minimum, 0.5 second-foot Jan. 26 to Feb. 21.

1904-09, 1932-33, 1946-49: Maximum discharge, 4,340 second-feet (estimated) Apr. 11, 1904 (gage height, 10.3 feet, site and datum then in use); minimum, 0.1 second-foot Feb. 1-20, 1933.

Remarks.—Records fair except those for period of ice effect, which are poor. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	400	21	9	12.9	793
November	240	10	4	8.0	476
December	179	9	3	5.8	355
January	156	7	4	5.0	309
February	274	50	2	9.8	543
March	8,754	2,200	1	282	17,360
April	4,848	953	31	162	9,620
May	711	30	18	22.9	1,410
June	1,122	82	17	37.4	2,230
July	361	30	7	11.6	716
August	320	41	7	10.3	635
September	233	8	7	7.8	462
Water Year 1946-47	17,598	2,200	1	48.2	34,910

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	251	9	8	8.1	498
November	282	11	8	9.4	559
December	286	11	8	9.2	567
January	192	8	4	6.2	381
February	55	3	1	1.9	109
March	7,092	1,700	3	229	14,070
April	4,812	318	60	160	9,540
May	1,079	81	16	34.8	2,140
June	606	37	10	20.2	1,200
July	541	106	9	17.5	1,070
August	271	12	7	8.7	538
September	204	8	6	6.8	405
Water Year 1947-48	15,671	1,700	1	42.8	31,077

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	290.8	10	8.8	9.38	577
November	283.1	11	9.1	9.44	562
December	185.9	9.1	4.6	6.00	369
January	73.0	4	.5	2.35	145
February	15.3	.7	.5	.55	30
March	4,131.7	1,100	.8	133	8,200
April	6,707	1,200	24	224	13,300
May	580	32	15	18.7	1,150
June	464	26	10	15.5	920
July	286.7	15	5.5	9.25	569
August	154.0	7.3	3.9	4.97	305
September	161.5	6.1	4.3	5.38	320
Water Year 1948-49	13,333.0	1,200	.5	36.5	26,450

LITTLE MISSOURI RIVER BASIN

Little Missouri River near Watford City, N. Dak.

Location.—Water-stage recorder and wire-weight gage, lat. 47°36′, long. 103°16′, in NW¼ sec. 35, T. 148 N., R. 99 W., at highway bridge, 17½ miles south of Watford City and 18 miles upstream from Cherry Creek. Datum of gage is 1,929.03 feet above mean sea level, datum of 1929.

Drainage area.—8,490 square miles.

Records available.—October 1934 to September 1949.

Average discharge.—15 years, 642 second-feet.

Extremes.—Maximum discharge during year, 26,000 second-feet Mar. 28; (gage height, 13.7 feet, backwater from ice); minimum, 1 second-foot Jan. 26 to Mar. 3.

1934-49: Maximum discharge, 110,000 second-feet Mar. 25, 1947 (gage height 24.0 feet, floodmark); no flow at times.

Remarks.—Records fair except those for periods of ice effect, which are poor. Some diversions above station for irrigation. Wire-weight gage read once daily or oftener.

Revisions (water years).—W 926:1935.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	25,428	2,410	79	820	50,440
November	12,284	1,500	40	409	24,360
December	4,270	350	30	138	8,470
January	2,105	400	20	68	4,180
February	39,151	6,000	6	1,398	77,650
March	186,500	55,000	150	6,016	369,900
April	117,473	9,670	490	3,916	233,000
May	9,229	452	210	298	18,300
June	80,134	9,300	201	2,671	158,900
July	38,622	6,100	330	1,246	76,610
August	19,615	2,900	89	633	38,910
September	1,626	82	39	54	3,230
Water Year 1946-47	536,437	55,000	6	1,470	1,064,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,277	63	31	41.2	2,530
November	764	44	18	25.5	1,520
December	438	30	7	14.1	869
January	67	6	1	2.2	133
February	7,465	2,500	0	257	14,810
March	96,310	10,300	50	3,107	191,000
April	34,378	2,590	373	1,146	68,190
May	13,955	1,130	158	450	27,680
June	30,705	2,960	199	1,024	60,900
July	33,565	2,550	309	1,083	66,580
August	12,001	2,010	82	387	23,800
September	1,096	74	18	36.5	2,170
Water Year 1947-48	232,021	10,300	0	634	460,200

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	616	24	16	19.9	1,220
November	1,933	116	27	64.4	3,830
December	366	60	3	11.8	726
January	63	3	1	2.0	125
February	28	1	1	1.0	56
March	177,715	24,000	1	5,733	352,500
April	112,485	14,700	488	3,750	223,100
May	9,257	465	181	299	18,360
June	3,815	248	65	127	7,570
July	2,572	154	49	83.0	5,100
August	1,439	112	18	46.4	2,850
September	527	39	10	17.6	1,050
Water Year 1948-49	310,816	24,000	1	852	616,500

KNIFE RIVER BASIN

Knife River at Hazen, N. Dak.

Location.—Water-stage recorder and wire weight gage, lat. 47°17′, long. 101°37′, in NE¼ Sec. 19, T. 144 N., R. 86 W., at county highway bridge, 0.5 mile south of Hazen and 2 miles upstream from Antelope Creek.

Drainage area.—2,352 square miles.

Records available.—October 1928 to August 1933 (fragmentary), August 1937 to September 1949.

Average discharge.—12 years (1937-49), 195 second-feet.

Extremes.—Maximum discharge during year, 7,760 second-feet Apr. 6 (gage height, 23.3 feet); maximum gage height, 24.1 feet (backwater from ice) Apr. 3; minimum daily discharge, 7 second-feet Feb. 21 to Mar. 4; minimum gage height 3.19 feet Oct. 1-3.

1928-33, 1937-49: Maximum discharge, 11,400 second-feet Mar. 26 or 27, 1943 (gage height, 26.3 feet, from floodmarks); no flow (estimated) Jan. 21 to Feb. 5 1933.

Remarks.—Records good except those for periods of ice effect, which are poor. Gage read once daily to Mar. 22 and twice daily or oftener, thereafter. Some diversions above station. Flow regulated by Ilo Lake (capacity, 7,130 acre-feet).

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,039	41	30	33.5	2,060
November	957	37	28	31.9	1,900
December	801	35	20	25.8	1,590
January	571	23	14	18.4	1,130
February	561	100	11	19.3	1,110
March	43,840	6,700	25	1,414	86,960
April	23,994	3,590	156	800	47,590
May	6,029	847	53	194	11,960
June	8,980	1,990	60	299	17,810
July	2,310	177	43	74.5	4,580
August	1,139	53	22	36.7	2,260
September	617	21	19	20.6	1,220
Water Year 1947-48	90,838	6,700	11	248	180,200

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	748	31	19	24.1	1,480
November	989	40	28	33.0	1,960
December	595	28	14	19.2	1,180
January	347	14	10	11.2	688
February	226	9	7	8.1	448
March	4,604	3,000	7	149	9,130
April	64,342	7,640	155	2,145	127,600
May	3,425	194	83	110	6,790
June	2,761	323	48	92.0	5,480
July	1,682	111	40	54.3	3,340
August	1,489	149	27	48.0	2,950
September	823	47	24	27.4	1,630
Water Year 1948-49	82,031	7,640	7	225	162,700

HEART RIVER BASIN

Heart River near Lark, N. Dak.

Location.—Water-stage recorder, lat. 46°36′00″, long. 101°22′30″, in S½ sec. 9, T. 136 N., R. 85 W., at bridge on State Highway 31, 1 mile downstream from Muddy Creek and 10 miles north of Lark. Prior to Nov. 16, wire-weight gage at same site and datum.

Records available.—June 1946 to September 1949.

Extremes.—Maximum discharge during year, 9,810 second-feet Mar. 29 (gage-height, 14.72 feet); minimum daily, 0.3 second-foot Feb. 15 to Mar. 4.

1946-49: Maximum discharge, 10,400 second-feet Mar. 25, 1947 (gage height, 15.85 feet); minimum, that of Feb. 15 to Mar. 4, 1949.

Remarks.—Records good except those for periods of ice effect or no gage-height record, which are fair. Gage read intermittently.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	858.5	36	7.5	27.7	1,700
November	687	36	11	22.9	1,360
December	262	16	3	8.5	520
January	293	100	2	9.5	581
February	11,498	1,800	25	411	22,810
March	34,254	7,800	45	1,105	67,940
April	32,967	3,500	170	1,099	65,390
May	2,787	150	55	89.9	5,530
June	26,140	5,400	48	871	51,850
July	6,815	1,060	51	220	13,520
August	2,369	327	25	76.4	4,700
September	558	30	15	18.6	1,110
Water Year 1946-47	119,488.5	7,800	2	327	237,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	723	35	15	23.3	1,430
November	648	28	19	21.6	1,290
December	484	18	13	15.6	960
January	304	13	7	9.8	603
February	693	100	6	23.9	1,370
March	58,721	7,500	15	1,894	116,500
April	15,981	1,750	130	533	31,700
May	4,460	399	55	144	8,850
June	6,717	1,700	55	224	13,320
July	6,701	2,000	36	216	13,290
August	2,579	500	13	83.2	5,120
September	263.4	12	7.1	8.78	522
Water Year 1947-48	98,274.4	7,500	6	269	195,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	462.2	31	7	14.9	917
November	900	55	20	30.0	1,790
December	346	24	6	11.2	686
January	48.8	6	.6	1.57	97
February	10.5	.6	.3	.38	21
March	32,718.2	9,000	.3	1,055	64,900
April	72,587	8,380	148	2,420	144,000
May	3,310	243	66	107	6,570
June	1,822	192	21	60.7	3,610
July	786	53	15	25.4	1,560
August	1,054.4	119	9.7	34.0	2,090
September	312.6	24	5.5	10.4	620
Water Year 1948-49	114,357.7	9,000	.3	313	226,900

HEART RIVER BASIN

Heart River near Mandan, N. Dak.

Location.—Water-stage recorder and wire-weight gage, lat. 46°50′, long. 100°59′, in NE¼NW¼ sec. 25, T. 139 N., R. 82 W., at bridge on U. S. Highway 10, 3 miles west of Mandan and 4 miles downstream from Sweetbriar Creek. Datum of gage is 1,638.70 feet above mean sea level, datum of 1929, and 1,632.03 feet above Northern Pacific Railway datum.

Drainage area.—3,360 square miles.

Records available.—April to September 1924, March 1928 to June 1933, August 1937 to September 1949.

Average discharge.—14 years (1929, 1931, 1937-49), 266 second-feet.

Extremes.—Maximum discharge during year, about 16,000 second-feet Mar. 29; maximum gage height, 21.95 feet Mar. 29, affected by ice; no flow Jan. 20 to Mar. 7.

1924, 1928-33, 1937-49: Maximum discharge, 21,400 second-feet Mar. 27, 1943 (gage height, 24.7 feet); no flow on many days.

Remarks.—Records good except those for periods of ice effect or no gage-height record, which are poor. Some diversions above station.

Revision (water years).—W 926; 1938.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,047	45	11	33.8	2,080
November	839	53	13	28.0	1,660
December	359	21	4	11.6	712
January	168	100	1	5.4	333
February	12,549	2,200	30	448	24,890
March	43,397	9,500	68	1,400	86,080
April	39,369	3,950	259	1,312	78,090
May	3,805	238	68	123	7,550
June	26,596	4,900	62	887	52,750
July	8,912	1,040	77	287	17,680
August	2,673	255	42	86.2	5,300
September	953	105	17	31.8	1,890
Water Year 1946-47	140,667	9,500	1	385	279,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	951	105	17	30.7	1,890
November	878	47	21	29.3	1,740
December	594	21	17	19.2	1,180
January	321	16	6	10.4	637
February	51.3	5	.2	1.77	102
March	90,012.8	11,600	.4	2,900	171,500
April	26,171	3,300	242	872	51,910
May	5,716	380	80	184	11,340
June	7,220	1,610	75	241	14,320
July	7,162	1,780	52	231	14,210
August	2,810	350	15	90.6	5,570
September	400.8	27	6.9	14.4	795
Water Year 1947-48	142,287.9	11,600	.2	389	282,200

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	621	34	13	20.0	1,230
November	919	45	20	30.6	1,820
December	396	32	2	12.8	785
January	39.0	5	0	1.26	77
February	0	0	0	0	0
March	32,612.9	9,940	0	1,052	64,690
April	87,436	9,470	198	2,915	173,400
May	4,656	296	91	150	9,240
June	2,485	180	22	82.8	4,930
July	1,199	90	26	38.7	2,380
August	1,375	188	17	44.4	2,730
September	489	24	12	16.3	970
Water Year 1948-49	132,227.9	9,940	0	362	262,300

HEART RIVER BASIN

Muddy Creek near Almont, N. Dak.

Location.—Wire-weight gage, lat. 46°41'40", long. 101°27'50", in SW¼, sec. 7, T. 137 N., R. 85 W., at bridge on county road, 2 miles downstream from Hailstone Creek, 3 miles southeast of Almont, and 12 miles (revised) upstream from mouth.

Records available.—October 1945 to September 1949.

Extremes.—Maximum discharge during year, 1,400 second-feet Apr. 1 (gage height, 15.41 feet); no flow Jan. 21 to Feb. 16, Feb. 18-22.

1945-49: Maximum discharge, 2,250 second-feet Mar. 24, 1948 (gage height, 19.20 feet, affected by ice), no flow at times.

Remarks.—Records fair.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	63.0	3.5	1.0	2.03	125
November	58.8	3.4	1.4	1.96	117
December	32.5	1.7	.5	1.05	64
January	142.2	40	.2	4.59	282
February	968.9	350	.3	34.6	1,920
March	4,658	1,300	2	150	9,240
April	3,287	400	13	110	6,520
May	124.3	10	1.8	4.01	247
June	3,118.7	932	1.8	104	6,190
July	345.4	46	1.7	11.1	685
August	31.6	1.8	.4	1.02	63
September	15.7	.8	.4	.52	31
Water Year 1946-47	12,846.1	1,300	.2	35.2	25,480

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	27.9	2.0	0.5	0.90	55
November	37.5	1.5	1.0	1.25	74
December	38.4	1.4	.9	1.24	76
January	46.5	6	.3	1.50	92
February	168.1	30	.2	5.80	333
March	13,011.4	2,150	1.0	420	25,810
April	4,916	973	11	164	9,750
May	240.0	21	1.9	7.74	476
June	110.8	11	1.4	3.69	220
July	388.3	150	.6	12.5	770
August	25.3	2.6	.4	.82	50
September	13.1	.6	.4	.44	26
Water Year 1947-48	19,023.3	2,150	.2	52.0	37,730

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	21.4	1.1	0.5	0.69	42
November	33.0	1.3	.9	1.10	65
December	10.9	1.1	.1	.35	22
January	2.0	.1	0	.06	4.0
February	.7	.1	0	.02	1.4
March	3,852.3	1,270	.1	124	7,640
April	10,112.8	1,360	8.4	337	20,060
May	494.5	160	2.3	16.0	981
June	208.4	54	.7	6.95	413
July	41.7	4.6	.6	1.35	83
August	86.5	23	.4	2.79	172
September	17.4	.8	.4	.58	35
Water Year 1948-49	14,881.6	1,360	0	40.8	29,520

APPLE CREEK BASIN

Apple Creek near Menoken, N. Dak.

Location.—Staff gage, lat. 46°47'35", long. 100°39'15", on line between secs. 4 and 9, T. 138 N., R. 79 W., at bridge on former U. S. Highway 10, 4 miles upstream from Hoy Creek, 6.3 miles west of Menoken, and 6.4 miles east of Bismarck.

Drainage area.—1,520 square miles.

Records available.—October 1945 to September 1949.

Extremes.—Maximum discharge during year, 750 second-feet Apr. 5 (gage height, 12.40 feet, affected by ice); minimum, 0.1 second-feet Feb. 1 to Mar. 3, Sept. 22, 23.

1945-49: Maximum discharge, 2,340 sec.-ft. Apr. 7, 1948 (gage height, 15.80 feet); no flow Aug. 25 to Sept. 17, 1946.

Remarks.—Records good except those for period Dec. 10 to Mar. 23, which are poor.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	21.7	2.0	------	0.70	43
November	15.0	------	0.2	.50	30
December	24.0	------	------	.77	48
January	26.1	5.0	------	.84	52
February	25.6	8.0	------	.91	51
March	4,482.5	780	------	145	8,890
April	3,829	360	26	128	7,590
May	347	22	------	11.2	688
June	511.7	40	4.7	17.1	1,010
July	428	34	2	13.8	849
August	15.5	1.0	------	.50	31
September	14.9	------	------	.50	30
Water Year 1946-47	9,741.0	780	.2	26.7	19,310

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	13.3	1.0	.2	.43	26
November	15.2	4.1	.1	.51	30
December	7.2	.4	.1	.23	14
January	4.6	.2	.1	.15	9.1
February	15.1	1.0	.1	.52	30
March	57.4	15	.4	1.85	114
April	20,061	2,000	50	669	39,790
May	2,516.9	200	.3	81.2	4,990
June	413.1	30	4.4	13.8	819
July	305.2	28	3.6	9.85	605
August	90.6	5.6	1.1	2.92	180
September	19.2	1.0	.3	.64	38
Water Year 1947-48	23,518.8	2,000	.1	64.3	46,650

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	9.7	0.5	0.2	0.31	19
November	20.9	1.1	.4	.70	41
December	18.7	1.0	------	.60	37
January	14.0	1.0	.2	.45	28
February	2.8	.1	.1	.1	5.6
March	873.3	240	.2	28.2	1,730
April	6,556	700	31	219	13,000
May	391.4	31	4.7	12.6	776
June	510.8	49	2.7	17.0	1,010
July	88.8	13	1.0	2.86	176
August	192.8	48	.4	6.22	382
September	14.3	.9	.1	.48	28
Water Year 1948-49	8,693.5	700	.1	23.8	17,230

CANNONBALL RIVER BASIN

Cannonball River at Breien, N. Dak.

Location.—Water-stage recorder, staff, and wire-weight gage, lat. 46°23′, long. 100°56′, in sec. 36, T. 134 N., R. 82 W., at bridge on State Highway 6, 950 feet downstream from Louise Creek and 0.5 mile south of Breien. Datum of gage is 1,676.54 feet above mean sea level, datum of 1929.

Drainage area.—4,066 square miles.

Records available.—August 1934 to September 1949.

Average discharge.—15 years, 229 second-feet.

Extremes.—Maximum discharge during year, 8,320 second-feet Apr. 1; maximum gage height, 11.9 feet Mar. 30 (from floodmark), affected by ice; no flow Feb. 20 to Mar. 1.

1934-49: Maximum discharge, 21,900 second-feet Mar. 27, 1943 (gage height, 17.4 feet, from floodmark); no flow at times in some years.

Remarks.—Records good except those for period of ice effect, which are fair. Some diversions above station. Some storage in several small lakes above station.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,796.2	222	6.6	57.9	3,560
November	676	48	13	22.5	1,340
December	250.0	16	2.5	8.06	496
January	321.5	75	2.5	10.4	638
February	12,605	2,000	25	450	25,000
March	27,745	7,000	80	895	55,030
April	29,629	2,980	199	988	58,770
May	3,029	182	57	97.7	6,010
June	28,922	4,640	53	964	57,370
July	7,930	926	53	256	15,730
August	812	50	12	26.2	1,610
September	266.5	15	6.6	8.88	529
Water Year 1946-47	113,982.2	7,000	2.5	312	226,100

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,181.6	158	7.3	38.1	2,340
November	960	128	18	32.0	1,900
December	587	40	14	18.9	1,160
January	573	30	7	18.5	1,140
February	1,187	320	1	40.9	2,350
March	72,760	11,100	50	2,347	144,300
April	8,897	658	124	297	17,650
May	4,089	536	42	132	8,110
June	2,311	244	26	77.0	4,580
July	4,283	412	51	138	8,500
August	2,391	162	25	77.1	4,740
September	236.2	25	2.5	7.87	468
Water Year 1947-48	99,455.8	11,100	1	272	197,200

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	195.4	21	2.5	6.30	388
November	761	40	16	25.4	1,510
December	319	20	6	10.3	633
January	79.5	8	.2	2.56	158
February	2.0	.2	0	.07	4.0
March	55,052.3	8,000	0	1,776	109,200
April	65,935	8,200	169	2,198	130,800
May	9,889	3,160	82	319	19,610
June	4,606	1,660	29	154	9,140
July	971	74	10	31.3	1,930
August	1,882.4	330	8.0	60.7	3,730
September	396.9	27	4.8	13.2	787
Water Year 1948-49	140,089.5	8,200	0	384	277,900

JAMES RIVER BASIN

James River at Jamestown, N. Dak.

Location.—Wire-weight gage, lat. 46°54′, long. 98°41′, in SE¼ sec. 36, T. 140 N., R. 64 W., at Asylum bridge at southeast corner of Jamestown, 2.5 miles downstream from Pipestem Creek.

Drainage area.—2,740 square miles.

Records available.—June 1928 to August 1933, August 1937 to September 1938, March 1943 to September 1949.

Average discharge.—12 years (1928-33, 1937-38, 1943-49) 41.3 second-feet.

Extremes.—Maximum discharge during year, 1,350 second-feet Apr. 23 (gage height, 10.06 feet); minimum observed discharge, 1.1 second-feet Oct. 9; minimum gage-height record observed, 2.55 feet, Sept. 30.

1928-33, 1937-38, 1943-49: Maximum discharge, 3,250 second-feet Apr. 23, 1948; maximum gage-height, 14.31 feet Apr. 24, 1948; no flow June 28, 29, July 4, 5, 1933.

Remarks.—Records good from March to August, otherwise fair. Gage read once daily. Flow regulated by Arrowood and Jim Lakes (capacity, 16,000 acre-feet).

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	139.0	17	1.6	4.48	276
November	42.3	2.5	1.1	1.41	84
December	57.3	2.5	1.2	1.85	114
January	75.9	15	1.2	2.45	151
February	55.5	6.4	1.2	1.98	110
March	3,201.5	550	1.2	103	6,350
April	8,226	680	41	274	16,320
May	1,553	128	16	50.1	3,080
June	1,318	86	13	43.9	2,610
July	1,756	148	22	56.6	3,480
August	357.5	27	1.7	11.5	709
September	43.0	1.6	1.2	1.43	85
Water Year 1946-47	16,825.0	680	1.1	46.1	33,370

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	61.4	3.4	1.5	1.98	122
November	66.2	2.6	1.9	2.21	131
December	76.4	2.6	2.2	2.46	152
January	76.7	2.9	1.8	2.47	152
February	60.5	2.4	1.8	2.09	120
March	3,453.5	750	2.4	111	6,850
April	43,737	3,140	397	1,458	86,750
May	16,860	1,740	103	544	33,440
June	2,027	98	50	67.6	4,020
July	1,151	55	26	37.1	2,280
August	895.1	42	9.1	28.9	1,780
September	78.9	11	1.2	2.63	156
Water Year 1947-48	68,543.7	3,140	1.2	187	136,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	88.1	5.0	1.1	2.84	175
November	62.6	3.8	1.2	2.09	124
December	56.0	2.0	1.6	1.81	111
January	66.3	2.7	1.7	2.14	132
February	56.9	2.3	1.8	2.03	113
March	2,841.8	689	2.0	91.7	5,640
April	20,651	1,230	245	688	40,960
May	3,537	236	28	114	7,020
June	3,035	295	22	101	6,020
July	735.5	96	6.0	23.7	1,460
August	111.6	8.6	1.7	3.60	221
September	66.9	3.2	1.6	2.23	133
Water Year 1948-49	31,308.7	1,230	1.1	85.8	62,110

LITTLE MISSOURI RIVER BASIN

Little Missouri River at Marmarth, N. Dak.

Location.—Wire-weight gage, lat. 46°14′, long. 103°54′, in SE¼ sec. 30, T. 133 N., R. 105 W., at highway bridge in Marmarth, 1½ miles downstream from Little Beaver Creek.

Drainage area.—4,570 square miles.

Records available.—March 1938 to September 1949.

Average discharge.—11 years, 402 second-feet.

Extremes.—Maximum discharge during year, 11,700 second-feet Mar. 24 (gage height, 11.2 feet, from graph based on gage readings; no flow at times.

1938-49: Maximum discharge, 45,000 second-feet Mar. 23, 1947 (gage height, 21.7 feet); no flow for part of most winters.

Remarks.—Records fair except those for periods of ice effect or doubtful or no gage-height record, which are poor. Gage read once or twice daily, oftener during high stages. Some small diversions above station for irrigation.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	21,948	2,230	41	708	43,530
November	7,224	1,490	25	241	14,330
December	3,096	500	5	100	6,140
January	469	90	3	15.1	930
February	27,319	4,500	5	97.6	54,190
March	85,735	28,300	50	2,766	170,100
April	41,050	6,710	190	1,368	81,420
May	3,264	200	55	105	6,470
June	45,262	6,980	58	1,509	89,780
July	9,769	1,300	44	315	19,380
August	3,290	773	15	106	6,530
September	442	22	10	14.7	877
Water Year 1946-47	248,868	28,300	3	682	493,700

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	658	60	12	21.2	1,310
November	449	40	10	15.0	891
December	423	30	6	13.6	839
January	1,448	350	4	46.7	2,870
February	3,022	1,000	2	104	5,990
March	46,430	6,000	10	1,498	92,090
April	13,655	2,050	155	455	27,080
May	5,683	460	32	183	11,270
June	22,274	3,950	45	742	44,180
July	13,800	1,860	58	445	27,370
August	5,579	2,340	11	180	11,070
September	191.3	10	3.0	6.38	379
Water Year 1947-48	113,612.3	6,000	2	310	225,300

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	300.5	15	4	9.69	596
November	1,328	101	16	44.3	2,630
December	193	30	0	6.2	383
January	0	0	0	0	0
February	0	0	0	0	0
March	109,510	11,000	0	3,533	217,200
April	40,054	3,550	188	1,335	79,450
May	4,409	248	94	142	8,750
June	1,269	83	13	42.3	2,520
July	874.2	203	6.2	28.2	1,730
August	239.8	64	.7	7.74	476
September	174.0	25	1.7	5.80	345
Water Year 1948-49	158,351.5	11,000	0	434	314,100

LITTLE MISSOURI RIVER BASIN

Little Missouri River at Medora, N. Dak.

Location.—Wire-weight gage, lat. 46°55′10″, long. 103°31′40″, in NE¼ sec. 27, T. 140 N., R. 102 W., at bridge on U. S. Highway No. 10, 1 mile upstream from Andrews Creek.

Drainage area.—6,190 square miles.

Records available.—May 1903 to October 1908, October 1921 to September 1924, August 1928 to September 1934, October 1945 to September 1949.

Extremes.—Maximum discharge during year, 14,600 second-feet Mar. 27; maximum gage height, 13.0 feet (flood mark, backwater from ice); minimum daily discharge, 0.2 second-foot Feb. 15 to Mar. 3.

1903-08; 1921-24; 1928-34; 1945-49: Maximum discharge, 65,000 second-feet Mar. 23, 1947 (gage height, 20.5 feet); no flow at times during 1933, 1934 and 1946.

Remarks.—Records good except those for periods of ice effect or no gage height record, which are poor. Gage usually read once daily; two or three times daily at higher stages. Some small diversions above station for irrigation.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	22,227	2,340	66	717	44,090
November	11,074	1,540	35	369	21,960
December	3,922	450	12	127	7,780
January	1,392	400	7	44.9	2,760
February	30,104	5,000	4	1,075	59,710
March	110,410	38,000	100	3,562	219,000
April	77,109	8,360	343	2,570	152,900
May	5,692	320	117	184	11,290
June	59,648	7,830	100	1,988	118,300
July	19,561	3,900	110	631	38,800
August	6,451	1,340	30	208	12,800
September	734	31	17	24.5	1,460
Water Year 1946-47	348,324	38,000	4	953	690,800

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	977	54	21	31.5	1,940
November	530	36	10	17.7	1,050
December	353	20	8	11.4	700
January	179	10	2	5.8	355
February	7,399	3,500	1	255	14,680
March	70,020	6,940	35	2,259	138,900
April	19,802	1,590	234	660	39,280
May	8,372	542	79	270	16,610
June	30,607	3,350	136	1,020	60,710
July	20,269	2,240	120	654	40,200
August	8,465	2,050	35	273	16,790
September	505.8	28	5.5	16.9	1,000
Water Year 1947-48	167,478.8	6,940	1	458	332,200

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	392.6	26	8.0	12.7	779
November	1,288	95	17	42.9	2,550
December	249	40	2	8.0	494
January	27.4	2	.6	.88	54
February	8.8	.5	.2	.31	17
March	145,502.6	14,000	.2	4,694	288,600
April	59,475	6,400	311	1,982	118,000
May	6,446	311	113	208	12,790
June	2,047	151	17	68.2	4,060
July	1,154.8	174	9.8	37.3	2,290
August	768.7	113	6.1	24.8	1,520
September	337.0	31	6.1	11.2	668
Water Year 1948-49	217,696.9	14,000	.2	596	431,800

LITTLE MISSOURI RIVER BASIN

Little Beaver Creek near Marmarth, N. Dak.

Location.—Staff and wire-weight gages, lat. 46°16′, long. 103°58′, at center of sec. 7, T. 132 N., R. 106 W., a quarter of a mile downstream from Corral Creek, 3¼ miles southwest of Marmarth, and 5½ miles upstream from mouth.

Records available.—April 1936 to September 1949.

Average discharge.—Eleven years, 51.9 second-feet.

Extremes.—Maximum discharge during year, 3,300 second-feet Mar. 23 (gage-height, 10.5 feet, from graph based on gage readings); no flow at times.

1938-1949: Maximum discharge, 6,820 second-feet during night of June 22, 1944 (gage height, 12.5 feet, observer's estimate at site then in use) but may have been higher during flood of March 23, 1947; no flow at times.

Remarks.—Records fair except those for periods of ice effect which are poor. Gage read once daily, oftener during high stages.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	2,258.4	530	0.5	72.9	4,480
November	226.1	19	4.4	7.54	448
December	775.1	222	1.5	25.0	1,540
January	153.9	50	.4	4.96	305
February	3,173.5	900	2	113	6,290
March	10,451	5,000	3	337	20,730
April	7,878	1,940	29	263	15,630
May	561	26	11	18.1	1,110
June	6,101.8	1,280	6.4	203	12,100
July	787.1	136	4.5	25.4	1,560
August	1,365.0	371	2.1	44.0	2,710
September	72.3	4.6	1.2	2.41	143
Water Year 1946-47	33,803.2	5,000	0.4	92.6	67,050

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	133.6	28	2.2	4.31	265
November	98.5	5.6	2.2	3.28	195
December	85.8	5.6	2.0	2.77	170
January	1,541.5	400	1.4	49.7	3,060
February	1,790	800	1	61.7	3,550
March	7,189	1,800	1	232	14,260
April	762	70	14	25.4	1,510
May	1,283.1	539	5.2	41.4	2,540
June	6,598.0	1,240	6.4	220	13,090
July	984.4	219	1.0	31.8	1,950
August	2,250.0	1,870	.3	72.6	4,460
September	6.9	.5	.1	.23	14
Water Year 1947-48	22,722.8	1,870	.1	62.1	45,060

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	57.6	4.1	0.5	1.86	114
November	148.3	21	1.4	4.94	294
December	30.6	3.1	.1	.99	61
January	0	0	0	0	0
February	0	0	0	0	0
March	15,805	3,000	0	510	31,350
April	3,211	305	18	107	6,370
May	448.2	40	8.5	14.4	889
June	147.2	8.5	1.4	4.91	292
July	85.0	25	.1	2.74	169
August	18.1	4.5	0	.58	36
September	7.6	1.0	0	.25	15
Water Year 1948-49	19,958.6	3,000	0	54.7	39,590

KNIFE RIVER BASIN

Knife River near Golden Valley, N. Dak.

Location.—Water-stage recorder, lat. 47°09′, long. 102°05′, in SW¼ sec. 3, T. 142 N., R. 90 W., at highway bridge, 2½ miles downstream from Elm Creek and 10 miles south of Golden Valley.

Drainage area.—1,230 square miles.

Records available.—(In reports of Geological Survey) April 1943 to September 1949. April to November 1904 at site 3 miles downstream, published as Knife River at Broncho. March 1905 to October 1919, October 1921 to September 1924 at site 1 mile upstream, published as Knife River near Broncho.

Records as above, also June to September 1903, October 1924 to September 1925 and March to September 1927 in reports of the North Dakota Water Conservation Board.

Average discharge.—12 years (1909-11, 1921-25, 1943-49), 101 second-feet.

Extremes.—Maximum daily discharge during year, 5,300 second-feet Apr. 4; maximum gage height, 22.9 feet, backwater from ice, Apr. 4; minimum daily, 2 second-feet Feb. 1 to Mar. 2.

1903-19, 1921-24, 1943-49: Maximum discharge, 7,700 second-feet June 26, 1914 (gage height, 24.0 feet, from floodmark, site and datum then in use), from rating curve extended above 2,000 second-feet; no flow Sept. 6-8, 1905, Sept. 18, 19, 1908.

Maximum stage since 1903 (according to local residents), 26.7 feet, from floodmark, March 26, 27, 1943 (discharge, 11,500 second-feet, from rating table extended above 6,500 second-feet).

Remarks.—Records good except those for period of ice effect, which are poor.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	327.4	12	9.8	10.6	649
November	341	13	10	11.4	676
December	310	13	9	10.0	615
January	216	9	5	7.0	428
February	479	70	4	16.5	950
March	27,263	4,100	10	879	54,080
April	7,999	890	54	267	15,870
May	3,492	645	20	113	6,930
June	5,626	2,080	20	188	11,160
July	1,050	77	17	33.9	2,080
August	403.2	24	5.1	13.0	800
September	134.4	5.1	3.9	4.48	267
Water Year 1947-48	47,641.0	4,100	3.9	130	94,500

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	196.5	8.8	4.2	6.34	390
November	282.9	11	7	9.43	561
December	175	8	4	5.6	347
January	100	4	3	3.2	198
February	56	3	2	2.0	111
March	6,814	3,000	2	220	13,520
April	36,646	5,300	58	1,222	72,690
May	1,127	63	25	36.7	2,260
June	774	50	15	25.8	1,540
July	621	36	13	20.0	1,230
August	704.3	128	6.9	22.7	1,400
September	189.5	11	4.5	6.32	376
Water Year 1948-49	47,696.2	5,300	2	131	94,620

KNIFE RIVER BASIN

Spring Creek at Zap, N. Dak.

Location.—Water-stage recorder, lat. 47°16′50″, long. 101°55′10″, in SW¼ sec. 14 T. 144 N., R. 89 W., 250 feet downstream from Northern Pacific Railroad trestle in Zap, and 9 miles upstream from Knife River.

Drainage area.—545 square miles.

Records available.—March to September, 1924; October 1945 to September 1949.

Extremes.—Maximum discharge during year, 2,890 second-feet Apr. 7 (gage height, 16.0 feet); no flow Feb. 1 to Mar. 6, Mar. 15-20.

1924, 1945-49: Maximum discharge, that of Apr. 7, 1949; no flow at times.

Remarks.—Records good except those for period of ice effect, which are poor. Flow regulated by Ho Lake (capacity, 7,130 acre-feet).

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	255.0	14	7.0	8.23	506
November	219.7	9.0	6	7.32	436
December	177	8	5	5.7	351
January	143	6	3	4.6	284
February	74	5	1	2.6	147
March	9,301	1,330	2	300	18,450
April	6,281	1,040	44	209	12,460
May	1,565	173	11	50.5	3,100
June	1,382.1	326	8.7	46.1	2,740
July	404.4	26	8.4	13.0	802
August	296.1	15	4.6	9.55	587
September	125.0	5.0	3.4	4.17	248
Water Year 1947-48	20,223.3	1,300	1	55.3	40,110

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	193.1	8.7	5.0	6.23	383
November	209.3	8.4	6	6.98	415
December	135	6	3	4.4	268
January	69	3	1	2.2	137
February	0	0	0	0	0
March	105	40	0	3.4	208
April	12,470	2,540	32	416	24,730
May	678	38	14	21.9	1,340
June	523.1	59	6.4	17.4	1,040
July	263.2	12	7.2	8.49	522
August	232.1	17	4.6	7.49	460
September	164.7	6.7	4.8	5.49	327
Water Year 1948-49	15,042.5	2,540	0	41.2	29,830

HEART RIVER BASIN

Heart River near South Heart, N. Dak.

Location.—Water-stage recorder, lat. 46°51′40″, long. 102°56′50″, in SW¼ sec. 8, T. 139 N., R. 97 W., half a mile downstream from North Creek and 2 miles east of South Heart.

Drainage area.—315 square miles.

Records available.—May 1947 to September 1949.

Extremes.—Maximum discharge during year, 2,400 second-feet Mar. 31 (gage height, 17.75 feet); minimum daily 0.3 second-foot Dec. 26 to Feb. 23.

1947-49: Maximum discharge, that of Mar. 31, 1949; minimum daily, 0.3 second-foot Feb. 6-14, 1948, Dec. 26 to Feb. 23, 1949.

Remarks.—Records fair except those for periods of ice effect, which are poor.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	------	------	------	------	------
November	------	------	------	------	------
December	------	------	------	------	------
January	------	------	------	------	------
February	------	------	------	------	------
March	------	------	------	------	------
April	------	------	------	------	------
May 17-31	26.4	2.2	1.2	1.76	52
June	5,289.2	1,630	1.3	176	10,490
July	1,560.9	803	1.7	50.4	3,100
August	55.8	15	.6	1.80	111
September	26.7	1.2	.6	.89	53
The period 1946-47	------	------	------	------	13,810

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	32.0	1.2	0.8	1.03	63
November	27.4	1.1	.8	.91	54
December	23.5	1.2	.6	.76	47
January	18.6	.9	.4	.60	37
February	89.0	15	.3	3.07	177
March	8,502	1,530	1	274	16,860
April	522.5	77	2.8	17.4	1,040
May	311.9	47	1.8	10.1	619
June	1,486.6	635	1.9	49.6	2,950
July	416.7	86	1.3	13.4	827
August	37.1	4.5	.5	1.20	74
September	17.0	.7	.5	.57	34
Water Year 1947-48	11,484.3	1,530	.3	31.4	22,780

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	26.5	1.2	0.7	0.85	53
November	39.4	4.3	.7	1.31	78
December	13.6	.8	.3	.44	27
January	9.3	.3	.3	.30	18
February	8.9	.4	.3	.32	18
March	4,694.9	1,860	.4	151	9,310
April	12,964.1	2,260	6.4	432	25,710
May	95.7	7.5	1.8	3.09	190
June	46.9	3.8	1.1	1.56	93
July	65.9	11	.8	2.13	131
August	41.6	13	.4	1.34	83
September	14.6	.7	.4	.49	29
Water Year 1948-49	18,021.4	2,260	.3	49.4	35,740

HEART RIVER BASIN

Heart River near Dickinson, N. Dak.

Location.—Wire-weight gage, lat. 46°51'10", long. 102°53'30", in NW¼ sec. 14, T. 139 N., R. 97 W., 3 miles upstream from Duck Creek and 5 miles west of Dickinson.

Drainage area.—330 square miles.

Records available.—June 1946 to May 1947.

Extremes.—Maximum discharge during period, 2,200 second-feet Mar. 24 (gage height, 17.0 feet, from graph based on gage readings, backwater from ice); minimum daily discharge, 0.5 second-foot Nov. 21-30, Jan. 5-24.

1946-47: Maximum discharge, that of Mar. 24, 1947; minimum observed, 0.4 second-foot, Aug. 9, 10, 1946.

Remarks.—Records fair except those for periods of ice effect or no gage-height record, which are poor.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	191.9	24	.8	6.19	381
November	54.8	6.2	.5	1.83	109
December	78.0	12	1	2.5	155
January	26.0	2	.5	.84	52
February	2,517	800	1	89.9	4,990
March	6,341	2,000	2	205	12,580
April	6,171.0	1,440	9.0	206	12,240
May	106.6	8.0	2.0	3.44	211
June	.....	.....	.....	.....	.....
July	.....	.....	.....	.....	.....
August	.....	.....	.....	.....	.....
September	.....	.....	.....	.....	.....
The period 1946-47	.....	.....	.....	.....	30,720

HEART RIVER BASIN

Heart River at Lehigh, N. Dak.

Location.—Wire-weight gage, lat. 46°52', long. 102°43', in NE¼ sec. 7, T. 139 N., R. 95 W., at county highway bridge in Lehigh, 150 feet downstream from Northern Pacific Railway bridge and about 10 miles upstream from Green River.

Drainage area.—453 square miles.

Records available.—March 1943 to September 1949.

Extremes.—Maximum discharge during year, 3,800 second-feet Apr. 2; (gage height, 14.9 feet, from highwater mark, backwater from ice); minimum discharge, 0.5 second-foot Sept. 23-25 (gage height, 3.27 feet).

1943-49: Maximum discharge, 5,420 second-feet Mar. 25, 1943; maximum gage height, 17.7 feet, from floodmark, Mar. 25, 1943 and Mar. 13, 1945; no flow Mar. 14-18, 1944.

Maximum stage known, that of Mar. 25, 1943, Mar. 13, 1945.

Remarks.—Records good above 10 second-feet and fair below, except those for periods of ice effect, which are poor. Gage read twice daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	354.9	36	1.4	11.4	704
November	162.4	14	2	5.41	322
December	167	15	3	5.4	331
January	127	17	2	4.1	252
February	3,216	900	3	115	6,380
March	9,053	3,200	6	292	17,960
April	7,856	1,520	20	262	15,580
May	288.2	16	2.9	9.30	572
June	6,129.0	1,640	3.2	204	12,160
July	2,260.6	715	6.6	72.9	4,480
August	135.7	14	.8	4.38	269
September	82.6	5.4	1.2	2.75	164
Water Year 1946-47	29,832.4	3,200	.8	81.7	59,170

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	82.1	5.0	1.1	2.65	163
November	133.7	7	2.6	4.46	265
December	123	6	2	4.0	244
January	102	5	2	3.3	202
February	258	25	2	8.9	512
March	11,604	1,500	4	374	23,020
April	1,285.4	200	9.4	42.8	2,550
May	612.2	69	3.2	19.7	1,210
June	1,846.8	695	5.8	61.6	3,660
July	647.9	94	3.5	20.9	1,290
August	98.0	10	.4	3.16	194
September	20.7	1.2	.4	.69	41
Water Year 1947-48	16,813.8	1,500	.4	45.9	33,350

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	108.3	42	0.8	3.49	215
November	102.4	7	1	3.41	203
December	71	5	1	2.3	141
January	58	3	1	1.9	115
February	56	2	2	2.0	111
March	5,774	2,000	2	186	11,450
April	17,199	3,000	14	573	34,110
May	359.8	48	5.2	11.6	714
June	123.8	7.7	1.9	4.13	246
July	133.2	12	1.6	4.30	264
August	100.6	35	.6	3.25	200
September	39.3	14	.5	1.31	78
Water Year 1948-49	24,125.4	3,000	.5	66.1	47,847

HEART RIVER BASIN

Heart River near Richardton, N. Dak.

Location.—Water-stage recorder and wire-weight gage, lat. 46°45′, long. 102°18′, in NE¼ sec. 29, T. 138 N., R. 92 W., at bridge on State Highway 8, half a mile downstream from Blacktail Creek and 9½ miles south of Richardton.

Drainage area.—1,310 square miles.

Records available.—May 1903 to September 1922. April 1943 to September 1949.

Extremes.—Maximum discharge during year, 6,540 second-feet Apr. 6 (gage height, 18.8 feet, from graph based on gage readings); minimum daily discharge, 1 second-feet Jan. 24 to Mar. 2.

1903-1922, 1943-49: Maximum discharge, 9,920 second-feet Mar. 14, 1945 (gage height, 22.57 feet); no flow during some periods in 1903, 1905, 1914, 1919, 1945, and 1946.

Maximum stage known, about 26.0 feet July 5, 1938, from information by local resident (discharge, 14,000 second-feet).

Flood of Mar. 25, 1943, reached a stage of 24.2 feet, from floodmarks (discharge 11,700 second-feet).

Remarks.—Records good except those for periods of ice effect or indefinite stage-discharge relation, which are poor. Wire-weight gage read once daily, with additional readings on days of changing stage.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	567.7	36	2.3	18.3	1,130
November	347	25	6	11.6	688
December	407	23	7	13.1	807
January	1,416	300	4	45.7	2,810
February	7,737	1,100	11	276	15,350
March	20,818	4,500	16	672	41,290
April	20,249	3,260	67	675	40,160
May	1,071	62	18	34.5	2,120
June	16,898	3,870	15	563	33,520
July	4,591	1,020	20	148	9,110
August	1,858.5	376	9.0	60.0	3,690
September	302.5	12	7.5	10.1	600
Water Year 1946-47	76,262.7	4,500	2.3	209	151,300

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	367.5	16	8.5	11.9	729
November	422	19	11	14.1	837
December	321	17	8	10.4	637
January	235	13	4	7.6	466
February	888	100	3	30.6	1,760
March	29,393	3,500	8	948	58,300
April	6,531	950	60	218	12,950
May	2,846	312	20	91.8	5,640
June	5,422	1,580	20	181	10,750
July	4,232	1,720	12	137	8,390
August	794.5	279	5.5	25.6	1,580
September	118.0	6.0	2.8	3.93	234
Water Year 1947-48	51,570.0	3,500	2	141	102,300

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	256.1	16	4	8.26	508
November	416	21	10	13.9	825
December	180	14	3	5.8	357
January	56	3	1	1.8	111
February	28	1	1	1.0	56
March	15,395	3,600	1	497	30,550
April	43,161	6,050	66	1,440	85,610
May	1,648	93	31	53.2	3,270
June	676	74	11	22.5	1,340
July	496.3	70	9.3	16.0	984
August	567.6	153	4.4	18.3	1,130
September	144.9	8.4	2.5	4.83	287
Water Year 1948-49	63,024.9	6,050	1	173	125,000

HEART RIVER BASIN

Heart River near Glen Ullin, N. Dak.

Location.—Water-stage recorder, lat. 46°35′50″, long. 101°48′05″, in NE¼ Sec. 13, T. 136 N., R. 89 W., 10 miles upstream from Heart Butte Creek, 14 miles south of Glen Ullin, and 14 miles north of Elgin.

Drainage area.—1,760 square miles.

Records available.—April 1943 to September 1949.

Extremes.—Maximum discharge during year, 7,300 second-feet Mar. 28 (gage height, 10.78, backwater from ice); minimum discharge, 0.3 second-feet Sept. 30 (gage height, 1.37 feet).

1943-49: Maximum discharge, 25,000 second-feet Mar. 24, 1947 (gage height 21.5 feet, former site and datum, from floodmark, backwater from ice); no flow Dec. 21-28, 1945, Feb. 13-18, 1946.

Flood of Mar. 25, 1943 reached a stage of 18.77 feet, former site and datum (discharge 20,000 second-feet, by slope-area method).

Remarks.—Records good except those for periods of ice effect, which are poor. Flow regulated by Heart Butte Reservoir after September 29, 1949.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	676.6	34	3.6	21.8	1,340
November	535	29	8	17.8	1,060
December	447	25	8	14.4	887
January	1,786	350	4	57.6	3,540
February	8,751	1,400	15	313	17,360
March	29,168	12,000	24	941	57,850
April	24,788	3,370	115	826	49,170
May	1,594	101	21	51.4	3,160
June	20,373	4,110	17	679	40,410
July	6,204	1,100	38	200	12,310
August	2,098	322	13	67.7	4,160
September	391	15	11	13.0	776
Water Year 1946-47	96,811.6	12,000	3.6	265	192,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	565	24	13	18.2	1,120
November	507	24	11	16.9	1,010
December	376	20	9	12.1	746
January	207	15	2	6.7	411
February	1,032	150	2	35.6	2,050
March	38,215	4,300	20	1,230	75,800
April	8,691	1,000	86	290	17,240
May	3,534	335	36	114	7,010
June	6,396	1,780	41	213	12,690
July	6,375	2,150	26	206	12,640
August	2,551	707	10	82.3	5,060
September	240.3	9.3	6.9	8.01	477
Water Year 1947-48	68,689.3	4,300	2	188	136,300

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	396.2	29	6.9	12.8	786
November	657	29	15	21.9	1,300
December	279	24	3	9.0	553
January	45	3	1	1.5	89
February	28	1	1	1.0	56
March	28,217	6,500	1	910	55,970
April	53,029	6,730	100	1,770	105,200
May	2,087	114	46	67.3	4,140
June	1,107	100	18	36.9	2,200
July	656	43	12	21.2	1,300
August	876.7	222	7.4	28.3	1,740
September	274.8	22	.3	9.16	545
Water Year 1948-49	87,652.7	6,730	.3	240	173,900

HEART RIVER BASIN

Green River near Gladstone, N. Dak.

Location.—Wire-weight gage, lat. 46°53′20″, long. 102°38′20″, in SW¼ sec. 36, T. 140 N., R. 95 W., at bridge on U. S. Highway 10, 3 miles northwest of Gladstone and 3 miles upstream from the mouth.

Drainage area.—356 square miles.

Records available.—October 1945 to September 1949.

Extremes.—Maximum discharge during year, 3,780 second-feet Apr. 5 (gage height 16.9 feet); minimum, 0.8 second-foot Aug. 10.

1945-49: Maximum daily discharge, that of Apr. 5, 1949; no flow at times in 1946.

Maximum stage known, about 20 feet March 1943.

Remarks.—Records fair except those for period of ice effect, which are poor. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	155.5	8.0	1.9	5.02	308
November	109.2	5.0	2	3.64	217
December	140.5	12	2	4.53	279
January	118	15	2	3.8	234
February	2,682	800	2	95.8	5,320
March	8,237	2,200	4	266	16,340
April	7,982	1,310	18	266	15,830
May	302.3	17	6.1	9.75	600
June	5,527.1	1,280	5.4	184	10,960
July	394.7	232	5.4	28.9	1,780
August	1,598.3	440	4.8	51.6	3,170
September	112.7	5.2	2.6	3.76	224
Water Year 1946-47	27,859.3	2,200	1.9	76.3	55,260

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	137.4	6.3	3.2	4.43	273
November	183.9	7	5	6.13	365
December	134	7	2	4.3	266
January	95	5	2	3.1	188
February	389	60	2	13.4	772
March	10,446	1,700	2	337	20,720
April	3,258	450	18	109	6,460
May	1,327.8	168	9.8	42.8	2,630
June	2,962.5	1,080	9.5	98.8	5,880
July	508.8	47	5.9	16.4	1,010
August	183.6	10	2.0	5.92	364
September	57.3	3.0	1.4	1.91	114
Water Year 1947-48	19,683.3	1,700	1.4	53.8	39,040

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	112.0	6	2.2	3.61	222
November	164.8	7	4	5.49	327
December	144	6	3	4.6	286
January	70	3	2	2.3	139
February	56	2	2	2.0	111
March	1,274	350	2	41.1	2,530
April	16,633	3,420	20	554	32,990
May	578	56	10	18.6	1,150
June	210.9	10	5.7	7.03	418
July	111.1	5	2.2	3.58	220
August	70.7	8.4	.8	2.28	140
September	43.3	2.0	.9	1.44	86
Water Year 1948-49	19,467.8	3,420	0.8	53.3	38,620

HEART RIVER BASIN

Antelope Creek near Carson, N. Dak.

Location.—Wire-weight gage, lat. 46°32′, long. 101°39′, in NW¼ NE¼ sec. 8, T. 135 N., R. 87 W., at county road bridge, 4 miles upstream from mouth and 8 miles northwest of Carson.

Drainage area.—221 square miles.

Records available.—June 1948 to September 1949.

Extremes.—Maximum discharge observed during year, 1300 second-feet Mar. 28 (gage height, 13.84 feet, affected by ice); no flow at times.

1948-49: Maximum discharge, that of Mar. 28, 1949; no flow at times in each year.

Maximum stage known, 17.1 feet Mar. 25, 1943.

Remarks.—Records fair. Gage read once daily Oct. 1 to Nov. 13 and intermittently from Mar. 26 to Sept. 30.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	------	------	------	------	------
November	------	------	------	------	------
December	------	------	------	------	------
January	------	------	------	------	------
February	------	------	------	------	------
March	------	------	------	------	------
April	------	------	------	------	------
May	------	------	------	------	------
June 23-30	28.9	5.6	2.2	3.61	57
July	291.1	75	.2	9.39	577
August	18.5	2.2	0	.60	37
September	0	0	0	0	0
The period 1948	------	------	------	------	671

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	2.7	0.6	0	0.09	5.4
November	31.9	1.6	.7	1.06	63
December	7.7	1.0	------	.25	15
January	1.0	------	------	.03	2.0
February	0	0	0	0	0
March	4,607	1,200	0	149	9,140
April	1,961.9	428	7.0	65.4	3,890
May	248.7	48	2.9	8.02	493
June	56.2	20	.3	1.87	111
July	61.1	25	.1	1.97	121
August	1.5	.1	0	.05	3.0
September	0	0	0	0	0
Water Year 1948-49	6,979.7	1,200	0	19.1	13,840

CANNONBALL RIVER BASIN

Cannonball River near New Leipzig, N. Dak.

Location.—Water-stage recorder, lat. 46°20′, long. 101°57′, in SW¼ sec. 11, T. 133 N., R. 90 W., at bridge on State Highway No. 49, 2½ miles south of New Leipzig and 8 miles downstream from Thirtymile Creek.

Drainage area.—1,180 square miles (revised).

Records available.—April 1943 to September 1949.

Extremes.—Maximum discharge during year, 5,350 second-feet Mar. 30; maximum gage height, 18.3 feet, backwater from ice, Mar. 28; no flow at times in February and March.

1943-49: Maximum discharge, 8,000 second-feet Mar. 24, 1947 (gage height, 20.5 feet); no flow at times in 1946 and 1949; minimum gage height, 4.54 feet Aug. 12, 1946.

Maximum discharge known, 15,000 second-feet Mar. 25, 26, 1943 (gage height, 26.9 feet, from floodmarks), by slope-area method.

Remarks.—Records good except those for period of ice effect, which are poor. Some diversions and some storage in small lakes above station.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	250.2	12	6.1	8.07	496
November	280.3	13	7.7	9.34	556
December	198	10	4	6.4	393
January	147	9	3	4.7	292
February	299	80	2	10.3	593
March	16,995	2,000	20	548	33,710
April	1,955	150	32	65.2	3,880
May	907	71	11	29.3	1,800
June	655.2	53	7.3	21.8	1,300
July	2,019	213	15	65.1	4,000
August	1,535	258	8.2	49.5	3,040
September	147.3	7.3	2.9	4.91	292
Water Year 1947-48	25,388.0	2,000	2	69.4	50,350

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	157.9	18	2.5	5.09	313
November	274.5	12	7	9.15	544
December	100	7	1	3.2	198
January	15.5	.....	.....	.5	31
February	2.8	.....	.....	.1	5.6
March	19,726	4,910	0	636	39,130
April	26,769	4,770	41	892	53,100
May	1,096	68	22	35.4	2,170
June	676.1	63	3.6	22.5	1,340
July	313.3	47	3.4	10.1	621
August	1,154	602	3.6	37.2	2,290
September	139.7	8.9	2.9	4.66	277
Water Year 1948-49	50,424.8	4,910	0	138	100,000

CANNONBALL RIVER BASIN

Cedar Creek near Pretty Rock, N. Dak.

Location.—Water-stage recorder lat. 46°02′, long. 101°49′, in S½ sec. 33, T. 130 N., R. 89 W., at county highway bridge, 7 miles north of Keldron, S. Dak., 10½ miles south of Pretty Rock, and 15 miles downstream from Timber Creek.

Drainage area.—1,260 square miles.

Records available.—April 1943 to September 1949.

Extremes.—Maximum daily discharge during year, 3,500 second-feet, Apr. 2; maximum gage height, 18.0 feet, backwater from ice, Apr. 2; no flow at times.

1943-49: Maximum discharge, 4,450 second-feet (revised) Apr. 20, 1944 (gage height, 14.9 feet); no flow at times; minimum gage height, 2.51 feet Sept. 6, 1946.

Maximum stage known, 21.8 feet, from floodmarks, March 24, 1943 (discharge, 15,000 second-feet).

Remarks.—Records good except those below five second-feet, which are fair, and those for periods of ice effect, which are poor.

Revisions.—Revised figures of discharge for high water periods in the water years 1944 and 1947 are given herein. They supersede those previously published.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
April 1944	33,563	4,410	54	1,119	66,570
June 1944	11,208	1,150	13	374	22,230
Water Year 1943-44	49,724.9	4,410	.....	136	98,630

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
April 1947	9,134	1,620	38	305	18,120
June 1947	10,209.4	2,720	6.1	340	20,250
Water Year 1946-47	40,533.2	3,000	.2	111	80,400

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	66.3	4.2	.2	2.14	132
November	109.6	6	3	3.65	217
December	132	5	3	4.3	262
January	87	6	2	2.8	173
February	866	150	1	29.9	1,720
March	15,983	1,900	20	516	31,700
April	1,439	149	22	48.0	2,850
May	573.4	42	5.4	18.5	1,140
June	853.1	80	3.8	28.4	1,690
July	1,109	80	15	35.8	2,200
August	786.8	106	6.1	25.4	1,560
September	36.7	4.7	.2	1.22	73
Water Year 1947-48	22,041.9	1,900	.2	60.2	43,720

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	3.0	0.6	0	0.10	6.0
November	116.6	5.7	.3	3.89	231
December	78.0	4.3	1.3	2.52	155
January	12.4	.....	.....	.4	25
February	2.8	.....	.....	.1	5.6
March	17,212	3,000	0	555	34,140
April	18,602	3,500	42	620	36,900
May	857	57	14	27.6	1,700
June	253.8	20	2.4	8.46	503
July	48.6	4.3	.5	1.57	96
August	265.9	156	0	8.58	527
September	9.0	1.1	0	.30	18
Water Year 1948-49	37,461.1	3,500	0	103	74,310

GRAND RIVER BASIN

North Fork Grand River at Haley, N. Dak.

Location.—Wire-weight gage, lat. 45°57′, long. 103°07′, in NE¼ sec. 36, T. 129 N., R. 100 W., at bridge on county road about 300 feet south of post office at Haley and half a mile north of the South Dakota State line.

Records available.—May 1908 to September 1917 (no winter records), October 1945 to September 1949.

Extremes.—Maximum discharge during year, 1,770 second-feet Mar. 28; maximum gage height, 14.0 feet from graph based on gage readings, backwater from ice; no flow at times.

1908-17, 1945-49: Maximum discharge observed, 5,810 second-feet March 31, 1913, discharge measurement (gage height, 9.85 feet, datum then in use); no flow at times.

Remarks.—Records good except those for period of ice effect, which are poor. Gage read once daily or oftener.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	46.5	2.0	1.2	1.50	92
November	70.7	3.1	2.0	2.36	140
December	72.8	3.1	2.0	2.35	144
January	48.4	2.2	.8	1.56	96
February	1,096.2	250	.7	37.8	2,170
March	4,220	1,100	1.0	136	8,370
April	357.7	19	4.9	11.9	709
May	176.2	19	1.9	5.68	349
June	293.7	50	1.3	9.79	583
July	923.7	214	2.2	29.8	1,830
August	44.9	2.7	.4	1.45	89
September	15.1	.8	.3	.50	30
Water Year 1947-48	7,365.9	1,100	.3	20.1	14,600

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	23.4	1.0	0.6	0.75	46
November	38.2	2.2	.8	1.27	76
December	28.2	1.2	.5	.91	56
January	4.5	.5	0	.15	9
February	0	0	0	0	0
March	10,698	1,600	0	345	21,220
April	4,318	580	17	144	8,560
May	369.3	21	6.0	11.9	732
June	157.4	16	1.5	5.25	312
July	213.1	96	.7	6.87	423
August	52.1	12	.2	1.68	103
September	27.3	1.8	.3	.91	54
Water Year 1948-49	15,929.5	1,600	0	43.6	31,590

RED RIVER OF THE NORTH BASIN

Red River of the North at Wahpeton, N. Dak.

Location.—Chain gage, lat. 46°15′55″, long. 96°35′40″, in NE¼ sec. 8, T. 132 N., R. 47 W., in Wahpeton, 800 feet downstream from confluence of Bois de Sioux and Otter Tail Rivers. Datum of gage is 942.97 feet above mean sea level, datum of 1929.

Drainage area.—4,010 square miles.

Records available.—April 1942 to September 1949

Extremes.—Maximum discharge during year, 2,290 second-feet July 10 (gage height, 9.24 feet); minimum daily, 40 second-feet Dec. 31, Jan. 1.

1942-49: Maximum daily discharge, 5,000 second-feet Apr. 2-6, 1943; maximum gage height, 14.75 feet Apr. 2, 1943, from floodmark (affected by ice); minimum daily discharge, that of Dec. 31, 1948, Jan. 1, 1949.

Remarks.—Records good except those for periods of ice effect or doubtful gage height record, which are fair. Gage read twice daily. Flow regulated by Lake Traverse Reservoir and by several power plants on Otter Tail River.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	6,085	258	169	196	12,070
November	6,153	250	149	205	12,200
December	5,780	210	160	186	11,460
January	4,610	180	120	149	9,140
February	3,340	140	80	115	6,620
March	7,940	800	80	256	15,750
April	38,374	2,200	616	1,279	76,110
May	43,492	1,640	859	1,403	86,270
June	16,360	1,120	330	545	32,450
July	7,920	359	183	255	15,710
August	6,731	265	183	217	13,350
September	5,377	241	139	179	10,670
Water Year 1947-48	152,162	2,200	80	416	301,800

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	4,055	222	58	131	8,040
November	3,532	152	75	118	7,010
December	1,698	80	40	54.8	3,370
January	2,163	90	40	69.8	4,290
February	2,400	110	70	85.7	4,760
March	7,510	900	100	242	14,900
April	12,191	1,130	125	406	24,180
May	6,755	313	149	218	13,400
June	6,740	284	202	225	13,370
July	22,559	2,240	180	728	44,750
August	6,143	395	120	198	12,180
September	2,764	125	66	92.1	5,480
Water Year 1948-49	78,510	2,240	40	215	155,700

RED RIVER OF THE NORTH BASIN

Red River of the North at Fargo, N. Dak.

Location.—Staff gage, lat. 46°52'10", long. 96°47'00", in NE¼, sec. 7, T. 139 N., R. 48 W., just upstream from Island Park Dam in Fargo and 10 miles upstream from Sheyenne River. Datum of gage is 870.00 feet above mean sea level, adjustment of 1912.

Drainage area.—6,800 square miles.

Records available.—May 1901 to September 1949.

Average discharge.—47 years (1902-1949), 458 second-feet (unadjusted).

Extremes.—Maximum discharge during year, 2,660 second-feet July 12 (gage-height, 11.27 feet); minimum observed, 38 second-feet Nov. 1, 2 (gage-height, 7.48 feet).

1901-49: Maximum discharge, 17,000 second-feet Apr. 7, 1943 (gage height, 28.40 feet); no flow for many days in each year for period 1932-41.

Maximum stage known, 40.1 feet Apr. 7, 1897, Weather Bureau gage, datum of which is 863.5 feet above mean sea level, adjustment of 1912.

Remarks.—Records good except those for days of no gage-height record, which are fair. Flow partly regulated by several lakes in Otter Tail River Basin and municipal pools created by dams in channel of Red River. Figures of daily discharge do not include diversion by city of Fargo.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	6,730	262	188	224	13,750
November	6,139	255	114	211	12,550
December	5,672	202	159	189	11,630
January	4,346	184	114	146	9,000
February	2,996	131	83	109	6,300
March	6,688	877	75	222	13,650
April	54,174	3,340	819	1,812	107,800
May	50,190	1,990	1,190	1,627	100,000
June	18,763	1,270	396	633	37,650
July	8,484	414	173	281	17,300
August	6,752	255	195	226	13,880
September	5,164	228	139	181	10,770
Water year 1947-48	176,098	3,340	75	488	354,300

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	4,384	188	56	149	9,130
November	3,112	137	40	110	6,540
December	1,962	90	47	69.3	4,260
January	2,024	88	42	71.1	4,370
February	2,416	106	70	92.3	5,130
March	5,609	619	101	187	11,500
April	21,533	1,780	175	724	43,100
May	7,788	336	178	258	15,870
June	6,736	264	194	232	13,790
July	27,029	2,600	204	879	54,040
August	7,125	546	117	239	14,680
September	2,652	139	47	95.9	5,700
Water Year 1948-49	92,370	2,600	40	260	188,100

RED RIVER OF THE NORTH BASIN

Red River of the North at Halstad, Minn.

Location.—Wire-weight gage, lat. 47°21', long. 96°51', on line between sec. 24 and 25, T. 145 N., R. 49 W., at highway bridge half a mile west of Halstad and 2½ miles downstream from Wild Rice River. Datum of gage is 826.65 feet above mean sea level, datum of 1929.

Drainage area.—21,800 square miles (includes 3,940 square miles in closed Devils Lake Basin).

Records available.—March 1936 to June 1937 (no winter records); April 1942 to August 1949 (fragmentary).

Extremes.—Maximum discharge observed during season, 7,710 second-feet Apr. 7 (gage height, 16.53 feet); minimum not determined.

1936-37, 1942-49: Maximum discharge, 24,500 second-feet Apr. 10, 1947; maximum gage height, 34.00 feet Apr. 17, 1947; minimum observed, 5.4 second-feet Oct. 8, 9, 12-14, 1936.

Remarks.—Records good. Gage read once daily during high stages.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	------	------	------	------	------
November	------	------	------	------	------
December	------	------	------	------	------
January	------	------	------	------	------
February	------	------	------	------	------
March	------	------	------	------	------
April 7-30	217,990	16,000	3,740	9,083	432,400
May	107,850	4,420	1,930	3,479	213,900
June	35,708	1,890	881	1,190	70,830
July	17,298	846	385	558	34,310
August	------	------	------	------	------
September	------	------	------	------	------
Water Year 1948	------	------	------	------	751,400

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	------	------	------	------	------
November	------	------	------	------	------
December	------	------	------	------	------
January	------	------	------	------	------
February	------	------	------	------	------
March	------	------	------	------	------
April 8-30	62,000	6,890	1,640	2,696	123,000
May	35,980	2,190	600	1,161	71,370
June	22,139	1,260	540	738	43,910
July	48,252	3,390	425	1,557	95,710
August	22,081	1,470	304	712	43,800
September	------	------	------	------	------
Water Year 1949	------	------	------	------	377,800

RED RIVER OF THE NORTH BASIN

Red River of the North at Grand Forks, N. Dak.

Location.—Water-stage recorder, lat. 47°56′26″, long. 97°02′47″, in SE¼NE¼ sec. 33, T. 152 N., R. 50 W., in Grand Forks, 2 miles downstream from Red Lake River. Datum of gage is 778.42 feet above mean sea level, datum of 1929.

Drainage area.—30,100 square miles (includes 3,940 square miles in closed Devils Lake Basin).

Records available.—May 1901 to September 1949 in reports of the Geological Survey. April 1882 to November 1912 in report of Minnesota State Drainage Commission.

Average discharge.—67 years, 2,215 second-feet.

Extremes.—Maximum discharge during year, 15,200 second-feet Apr. 10; maximum gage height, 29.11 feet Apr. 10; minimum discharge, 365 second-feet Nov. 20 (gage height, 3.02 feet).

1882-1949: Maximum discharge observed, 43,000 second-feet Apr. 10, 1897 (gage height, 50.2 feet), from rating curve extended above 32,000 second-feet; minimum discharge, 2.4 second-feet Feb. 3-5, 12, 14, 16-19, 1937 (caused by unusual regulation during repair of dam at Grand Forks).

Remarks.—Records good except those for period of ice effect, which are fair, and those for period of no gage-height record, which are poor.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	18,598	656	553	600	36,890
November	17,808	687	382	594	35,320
December	14,360	720	380	463	28,480
January	12,930	480	380	417	25,650
February	12,430	560	400	444	24,650
March	21,060	1,000	520	679	41,770
April	203,390	15,100	1,050	6,780	403,400
May	82,360	3,440	1,630	2,657	163,400
June	145,280	13,400	1,560	4,843	288,200
July	102,490	5,530	1,370	3,306	203,300
August	95,030	3,840	2,270	3,065	188,500
September	48,371	2,360	926	1,612	95,940
Water Year 1948-49	774,107	15,100	380	2,121	1,536,000

RED RIVER OF THE NORTH BASIN

Red River of the North at Oslo, Minn.

Location.—Wire-weight gage, lat. 48°11′, long. 97°09′, in sec. 31, T. 155 N., R. 50 W., on highway bridge in Oslo. Auxiliary staff gage, lat. 48°13′30″, long. 97°07′10″ in SE¼SW¼ sec. 20, T. 155 N., R. 50 W., 7½ miles downstream from Oslo.

Drainage area.—30,500 square miles (includes 3,940 square miles in closed Devils Lake Basin).

Records available.—April 1936 to June 1937, April 1941 to September 1949 (fragmentary). Records prior to 1945 do not include flow in bypass channel.

Extremes.—Maximum discharge during season, 18,700 second-feet Apr. 10; maximum gage height, 24.08 feet Apr. 10; minimum discharge not determined.

1936-37, 1941-49: Maximum daily discharge, 41,400 second-feet Apr. 17, 1948; maximum gage height, 31.17 feet Apr. 15, 1948; minimum not determined.

Remarks.—Records good. Gage read once or twice daily during high stages only. For stages above 13 feet, discharge includes flow in bypass channel 1½ miles west of Oslo.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	------	------	------	------	------
November	------	------	------	------	------
December	------	------	------	------	------
January	------	------	------	------	------
February	------	------	------	------	------
March	------	------	------	------	------
April 16-30	458,400	41,400	16,200	30,560	909,200
May	256,630	14,400	4,170	8,278	509,000
June	75,250	3,970	1,790	2,508	149,300
August	------	------	------	------	------
September	------	------	------	------	------
Water Year 1948	------	------	------	------	1,568,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	------	------	------	------	------
November	------	------	------	------	------
December	------	------	------	------	------
January	------	------	------	------	------
February	------	------	------	------	------
March	------	------	------	------	------
April 9-30	198,410	18,600	3,690	9,019	393,500
May	86,520	3,570	1,800	2,791	171,600
June	155,780	14,200	1,780	5,193	309,000
July	105,390	5,720	1,480	3,400	209,000
August	98,460	3,680	2,440	3,176	195,300
September	------	------	------	------	------
Water Year 1949	------	------	------	------	1,278,000

RED RIVER OF THE NORTH BASIN

Red River at Drayton, North Dakota

Location.—Wire-weight gage, lat. 48°33'40", long. 97°10'30" in NW¼SE¼ sec. 26, T. 159 N., R. 51 W. on highway bridge in Drayton. Datum of gage is 756.59 feet above mean sea level, datum of 1929.

Drainage area.—34,800 square miles (includes 3,940 square miles in closed Devils Lake Basin).

Records available.—April 1936 to June 1937, April 1941 to September 1949 (fragmentary).

Extremes.—Maximum discharge during season, 27,900 second-feet Apr. 12; maximum gage height, 31.65 feet Apr. 15; minimum discharge not determined.

1936-37, 1941-49: Maximum daily discharge, 57,000 second-feet Apr. 21, 1948; maximum gage height, 40.05 feet Apr. 22, 1948; minimum discharge not determined. Maximum stage known, about 41 feet in 1897 from marks furnished by local residents.

Remarks.—Records good except those for period of no gage-height record, which are fair, and those for period of ice effect, which are poor. Gage read twice daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	.....	.....	.....	.....	.....
November	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....
April 18-30	602,600	57,000	31,200	46,350	1,195,000
May	393,650	28,500	4,580	12,700	780,800
June	92,870	4,440	2,200	3,096	184,200
July	64,090	2,870	1,560	2,067	127,100
August	.....	.....	.....	.....	.....
September	.....	.....	.....	.....	.....
Apr. 18 to July 31, 1948	.....	.....	.....	.....	2,287,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	.....	.....	.....	.....	.....
November	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....
January	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....
April	343,130	27,800	1,000	11,440	680,600
May	92,290	4,200	1,920	2,977	183,100
June	166,430	13,500	1,970	5,548	330,100
July	110,090	5,540	1,670	3,551	218,400
August	106,880	4,010	2,700	3,448	212,000
September	54,600	2,600	1,100	1,820	108,300
Water Year 1949	.....	.....	.....	.....	1,732,000

RED RIVER OF THE NORTH BASIN

Red River of the North at Emerson, Manitoba

(International gaging station)

Location.—Chain gage, lat. 49°00'30", long. 97°13'00", on Canadian National Railway bridge in Emerson. Datum of gage is at mean sea level, datum of 1929, by Geodetic Survey of Canada. Prior to Oct. 1, 1948, at datum 0.57 foot higher.

Drainage area.—40,200 square miles (includes 3,940 square miles of closed Devils Basin).

Records available.—March to November 1902 and October 1929 to September 1949 in reports of Geological Survey; May 1912 to September 1949 in reports of the Dominion Water and Power Bureau, Department of Mines and Resources, Canada.

Average discharge.—36 years (1913-49) 2,392 second-feet.

Extremes.—Maximum daily discharge during year, 29,200 second-feet Apr. 15; maximum elevation observed 777.49 feet Apr. 16; minimum daily discharge, 409 second-feet Jan. 20; minimum elevation observed, 746.58 feet Oct. 28.

1912-49: Maximum daily discharge, 51,800 second-feet Apr. 27, 1948 (elevation, 787.98 feet, present datum); minimum observed, 0.9 second-feet Feb. 6-8, 1937.

Remarks.—Records good except those for periods of ice effect, which are fair. Gage read once daily.

Cooperation.—This station is one of the international gaging stations maintained by Canada under agreement with the United States.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	57,810	2,160	1,700	1,860	114,700
November	49,600	1,930	1,150	1,650	98,380
December	41,720	1,540	1,150	1,350	82,750
January	33,616	1,250	921	1,080	66,680
February	24,492	921	801	845	48,580
March	26,380	1,270	781	851	52,320
April	746,610	51,800	1,410	24,900	1,481,000
May	621,610	45,100	6,320	20,100	1,233,000
June	115,730	6,030	2,300	3,860	229,500
July	97,320	4,500	2,070	3,140	193,000
August	51,500	2,630	1,300	1,660	102,100
September	30,262	1,260	734	1,010	60,000
Water Year 1947-48	1,896,650	51,800	734	5,180	3,762,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	20,886	728	633	674	41,430
November	21,356	768	648	712	42,360
December	17,251	644	486	556	34,220
January	13,919	486	409	449	27,610
February	12,709	497	417	454	25,210
March	18,491	876	497	596	36,680
April	441,714	29,200	910	14,700	876,100
May	157,850	8,700	2,820	5,090	313,100
June	164,770	13,100	2,190	5,490	326,800
July	105,840	5,450	1,840	3,410	209,900
August	101,970	3,910	3,450	3,290	202,300
September	54,180	2,610	1,060	1,810	107,500
Water Year 1948-49	1,130,936	29,200	409	3,100	2,243,000

RED RIVER OF THE NORTH BASIN

Bois de Sioux River near White Rock, S. Dak.

Location.—Water-stage recorder, lat. 45°51'45", long. 96°34'25", in SW¼SW¼ sec. 27, T. 128 N., R. 47 W., just downstream from Sig Slough outlet, 300 feet downstream from White Rock dam, 4 miles south of White Rock, and 5 miles northwest of Wheaton, Minn. Datum of gage is 959.89 feet above mean sea level, adjustment of 1912 (levels by Corps of Engineers).

Drainage area.—1,160 square miles.

Records available.—October 1941 to September 1949.

Extremes.—Maximum daily discharge during year, 210 second-feet July 15; minimum gage height, 8.84 feet Mar. 29 (backwater from ice); no flow on many days.

1941-49: Maximum discharge observed, 1,120 second-feet May 24, 1943; maximum gage height, 9.28 feet June 23, 1944; no flow at times in most years.

Remarks.—Records good except for those periods of flow during ice effect. Flow partly regulated by Lake Traverse-Bois de Sioux Flood Control and Water Conservation Project. Available capacity for flood control, 137,000 acre-feet.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	96.7	5.7	1.5	3.12	192
November	313.9	25	3.8	10.5	623
December	137.6	7.0	2.0	4.44	273
January	52.7	------	1.1	1.70	105
February	22.7	1.2	.7	.81	45
March	191.1	24	.2	6.16	379
April	8,144.1	875	4.9	271	16,150
May	18,354	900	334	592	36,400
June	13,001	580	------	433	25,790
July	14,057	775	13	453	27,880
August	280.2	16	5.7	9.04	556
September	179.5	9.0	4.5	5.98	356
Water Year 1946-47	54,830.5	900	.2	150	108,700

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	209.5	10	4.1	6.76	416
November	250.8	22	5.0	8.36	497
December	57.1	4.8	.2	1.84	113
January	.2	.1	0	.01	.4
February	0	0	0	0	0
March	1,144.0	320	0	36.9	2,270
April	10,762.5	1,000	6.5	359	21,350
May	23,255	1,000	90	750	46,130
June	2,535.0	380	7.0	84.5	5,030
July	477.5	27	7.0	15.4	947
August	563	30	14	18.2	1,120
September	449.9	38	.7	15.0	892
Water Year 1947-48	39,704.5	1,000	0	108	78,770

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	19.3	1.1	0.2	0.62	38
November	21.0	1.1	.5	.70	42
December	6.8	.5	0	.22	13
January	------	------	------	------	------
February	------	------	------	------	------
March	612	65	0	19.7	1,210
April	247.9	55	1.5	8.26	492
May	62.5	7.5	.9	2.02	124
June	85.1	10	.5	2.84	169
July	2,010.8	210	.2	64.9	3,990
August	140.4	6.6	2.1	4.53	278
September	45.3	4.9	.2	1.51	90
Water year 1948-49	3,251.1	210	0	8.91	6,450

RED RIVER OF THE NORTH BASIN

Wild Rice River near Mantador, N. Dak.

Location.—Staff gage, lat. 46°10'20", long. 97°00'35", in SE¼ sec. 12, T. 131 N., R. 51 W., 1½ miles west of Mantador. Datum of gage is 997.78 feet above mean sea level, datum of 1929 (Corps of Engineers, bench mark).

Records available.—March 1944 to September 1949.

Extremes.—Maximum discharge during year, 105 second-feet Mar. 28 (gage height, 4.9 feet, affected by ice); no flow during several months.

1944-49: Maximum discharge, 938 second-feet Mar. 20, 1945, (gage height, 9.57 feet); no flow at times in each year.

Remarks.—Records fair except those for periods of ice effect or no gage height record, which are poor. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	137.7	8.1	0	4.44	273
November	116.7	8.6	.7	3.89	231
December	42.9	1.9	0	1.38	85
January	0	0	0	0	0
February	0	0	0	0	0
March	395	70	0	12.7	783
April	8,826	551	50	294	17,500
May	3,473	313	26	112	6,890
June	1,506	119	20	50.2	2,990
July	417.9	28	2.4	13.5	829
August	6.1	1.6	0	.20	12
September	0	0	0	0	0
Water year 1946-47	14,921.3	551	0	40.9	29,590

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	.5	.1	0	.02	1.0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	155	50	0	5.0	307
April	1,588	140	21	52.9	3,150
May	324.1	20	1.1	10.5	643
June	133.3	15	.1	4.44	264
July	88.1	14	0	2.84	175
August	243.5	63	0	7.85	483
September	.7	.4	0	.02	1.4
Water Year 1947-48	2,533.2	140	0	6.92	5,020

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	5.1	2.7	0	0.16	10
November	44.5	3.9	.2	1.48	88
December	2.5	.5	0	.08	5.0
January	0	0	0	0	0
February	0	0	0	0	0
March	668	100	0	21.5	1,320
April	1,234	80	20	41.1	2,450
May	480.5	31	4.4	15.5	953
June	163.0	9.8	1.8	5.43	323
July	743.8	71	1.8	24.0	1,480
August	184.8	39	0	5.96	367
September	0	0	0	0	0
Water Year 1948-49	3,526.2	100	0	9.66	7,000

RED RIVER OF THE NORTH BASIN

Wild Rice River near Abercrombie, N. Dak.

Location.—Staff gage, lat. 46°28′35″, long. 96°47′15″, in NE¼SW¼ sec. 25, T. 135 N., R. 49 W., 160 feet upstream from rubble masonry dam which serves as control, 3½ miles northwest of Abercrombie, and 8 miles downstream from Antelope Creek. Datum of gage is 907.94 feet above mean sea level, datum of 1929.

Drainage area.—2,170 square miles.

Records available.—April 1932 to September 1949.

Average discharge.—13 years (1932-33, 1936-37, 1938-49), 69.4 second-feet.

Extremes.—Maximum discharge during year, about 650 second-feet Apr. 3 (gage height 5.60 feet, affected by ice); no flow Oct. 1 to Mar. 24, Aug. 27 to Sept. 30.

1932-49: Maximum discharge, 5,500 second-feet Apr. 2, 1943 (gage height, 21.02 feet, from flood mark) from rating table extended above 2,100 second-feet; no flow for some periods each year.

Remarks.—Records good. Gage read once or twice daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	163.4	8.3	.2	5.27	324
November	206.8	11	2.5	6.89	410
December	64.8	2.7	1.2	2.09	129
January	29.8	3.9	.3	.96	59
February	6.8	.8	0	.24	13
March	1,636	200	0	52.8	3,240
April	21,507	2,450	140	717	42,660
May	4,911	388	47	158	9,740
June	2,236	154	32	74.5	4,440
July	683.7	53	5.2	22.1	1,360
August	18.8	4.4	0	.61	37
September	0	0	0	0	0
Water Year 1946-47	31,464.1	2,450	0	86.2	62,410

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	117.1	64	0	3.78	232
April	6,515	680	47	217	12,920
May	608.8	44	3.9	19.6	1,210
June	188.8	28	1.1	6.29	374
July	172.9	20	0	5.58	343
August	222.1	44	.3	7.16	441
September	1.8	.8	0	.06	3.6
Water Year 1947-48	7,826.5	680	0	21.4	15,520

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	1,011	350	0	32.6	2,010
April	4,509	600	38	150	8,940
May	774.5	50	7.4	25.0	1,540
June	214.0	20	4.6	7.13	424
July	2,945.9	491	3.6	95.0	5,840
August	411.9	44	0	13.3	817
September	0	0	0	0	0
Water Year 1948-49	9,866.3	600	0	27.0	19,570

RED RIVER OF THE NORTH BASIN

Antelope Creek at Dwight, N. Dak.

Location.—Chain gage, lat. 46°18′50″, long. 96°44′05″, in SE¼SE¼ sec. 20, T. 133 N., R. 48 W., at bridge on U. S. Highway 81, half a mile north of Dwight and 7 miles upstream from mouth.

Drainage area.—About 250 square miles.

Records available.—March 1944 to September 1949 (discontinued).

Extremes.—Maximum discharge during year, 270 second-feet Mar. 31; maximum gage height, 6.3 feet July 8 (backwater from weeds); no flow in several months.

1944-49: Maximum discharge, 1,360 second-feet Mar. 21, 1946 (gage height, 12.33 feet); no flow for several months in each year.

Remarks.—Records fair. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	1,268	200	0	40.9	2,520
April	6,055.3	1,100	3.8	202	12,010
May	37.4	4.4	.2	1.21	74
June	126.8	24	.2	4.23	252
July	11.2	1.3	0	.36	22
August	0	0	0	0	0
September	0	0	0	0	0
Water Year 1946-47	7,498.7	1,100	0	20.5	14,880

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	3	2	0	.10	6.0
April	960.6	100	3	32.0	1,910
May	14.6	2.2	0	.47	29
June	0	0	0	0	0
July	0	0	0	0	0
August	0	0	0	0	0
September	0	0	0	0	0
Water Year 1947-48	978.2	100	0	2.67	1,940

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	524	250	0	16.9	1,040
April	704.1	200	.2	23.5	1,400
May	3.2	.2	0	.10	6.3
June	0.4	.1	0	.01	.8
July	776.0	211	0	25.0	1,540
August	41.3	11	0	1.33	82
September	0	0	0	0	0
Water year 1948-49	2,049.0	250	0	5.61	4,070

RED RIVER OF THE NORTH BASIN

Sheyenne River near Harvey, N. Dak.

Location.—Staff gage and loose rock dam, lat. 47°47′25″, long. 99°53′25″, in SE¼SW¼ sec. 21, T. 150 N., R. 72 W., 300 feet north of Harvey Water Works and 2¼ miles northeast of Harvey.

Records available.—October 1945 to September 1949.

Extremes.—Maximum discharge during year, 846 second-feet Apr. 7 (gage height, 6.20 feet); no flow during several months.

1945-49: Maximum discharge observed, 1,220 second-feet Apr. 18, 1948 (gage height, 6.45 feet); no flow during several months in each year.

Remarks.—Records fair except those for the period of ice effect, which are poor. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	1.4	.1	0	.05	2.8
December	1.0	.1	0	.03	2.0
January	0	0	0	0	0
February	0	0	0	0	0
March	740	150	0	23.9	1,470
April	467.7	40	3.9	15.6	928
May	119.7	8.4	.7	3.86	237
June	213.5	22	.4	7.12	423
July	211.1	40	.5	6.81	419
August	11.2	1.0	0	.36	22
September	5.0	.8	0	.17	9.9
Water Year 1946-47	1,770.6	150	0	4.85	3,510

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	17.9	1.6	.1	.58	36
November	20.3	1.4	.2	.68	40
December	19.2	1.0	.4	.62	38
January	3.5	.4	0	.11	6.9
February	0	0	0	0	0
March	5	2	0	.2	9.9
April	6,304	952	3	210	12,500
May	907.2	89	2.1	29.3	1,800
June	97.2	15	.6	3.24	193
July	36.9	4.0	.3	1.19	73
August	7.4	.7	0	.24	15
September	0	0	0	0	0
Water Year 1947-48	7,418.6	952	0	20.3	14,710

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	9	5	0	.29	18
April	4,941	547	13	165	9,800
May	238.7	24	1.4	7.70	473
June	205.0	31	.5	6.83	407
July	35.7	5.2	0	1.15	71
August	0	0	0	0	0
September	0	0	0	0	0
Water Year 1948-49	5,429.4	547	0	14.9	10,770

RED RIVER OF THE NORTH BASIN

Sheyenne River at Sheyenne, N. Dak.

Location.—Staff gage, lat. 47°50′20″, long. 99°07′30″, in NE¼ sec. 5, T. 150 N., R. 66 W., at recreation-pond dam, 1 mile north of Sheyenne. Datum of gage is 1,408.65 feet above mean sea level, adjustment of 1912.

Drainage area.—1,980 square miles.

Records available.—April 1929 to June 1933, October 1939 to September 1949.

Average discharge.—11 years (1929-30, 1939-49), 36.5 second-feet.

Extremes.—Maximum discharge during year, 2,080 second-feet Apr. 9 (gage height, 7.15 feet); no flow at times.

1929-33, 1939-49: Maximum discharge, 3,840 second-feet Apr. 18, 19, 1948 (gage-height, 8.51 feet); no flow during parts of most years.

Remarks.—Records fair above 50 second-feet and poor below. Gage read once daily. Stage-discharge relation substantially affected by wind at times.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	34.9	6.6	0	1.13	69
November	60.4	2.4	1.7	2.01	120
December	28.2	1.7	.1	.91	56
January	1.0	.1	0	.03	2.0
February	0	0	0	0	0
March	3,881	600	0	125	7,700
April	2,934	215	27	97.8	5,820
May	462.0	36	1.4	14.9	916
June	277.1	48	1.2	9.24	550
July	617.6	36	6.6	19.9	1,220
August	163.5	18	0	5.27	324
September	4.5	1.2	0	.15	8.9
Water Year 1946-47	8,464.2	600	0	23.2	16,790

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	9.1	1.7	0	.29	18
November	12.5	1.7	0	.42	25
December	6.2	.2	.2	.20	12
January	3.7	.2	.1	.12	7.3
February	2.9	.1	.1	.10	5.8
March	6.6	2	.1	.21	13
April	32,038	3,840	2	1,068	63,550
May	3,809	448	25	123	7,560
June	412.3	39	5.1	13.7	818
July	276.9	18	1.7	8.93	549
August	20.3	1.7	0	.65	40
September	0	0	0	0	0
Water Year 1947-48	36,597.5	3,840	0	100	72,600

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	4.7	.7	0	.16	9.3
December	5.6	.5	.1	.18	11
January	1.5	.1	0	.05	3.0
February	0	0	0	0	0
March	26	20	0	.84	52
April	20,334	2,030	30	678	40,330
May	1,139	72	12	36.7	2,260
June	604.5	34	1.7	20.2	1,200
July	250.4	24	0	8.08	497
August	0	0	0	0	0
September	0	0	0	0	0
Water Year 1948-49	22,365.7	2,030	0	61.3	44,360

RED RIVER OF THE NORTH BASIN

Sheyenne River near Cooperstown, N. Dak.

Location.—Wire-weight gage, lat. 47°26′, long. 98°02′, in NE¼SE¼ sec. 27, T. 146 N., R. 58 W., at county bridge 5 miles east of Cooperstown. Datum of gage is 1,274.57 feet above mean sea level, datum of 1929 (Corps of Engineers, bench mark).

Records available.—March 1945 to September 1949.

Extremes.—Maximum discharge during year, 2,290 second-feet Apr. 17 (gage height, 15.95 feet); minimum discharge observed, 1.6 second-feet Oct. 3 (gage height, 3.53 feet).

1945-49: Maximum discharge, 5,600 second-feet Apr. 23, 1948; minimum daily discharge, 1 second-foot Mar. 1-9, 1947; minimum gage height observed, 3.52 feet Sept. 6, 1945 and Sept. 27, 1948.

Remarks.—Records good except those for period of ice effect, which are fair.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	578.8	37	2.2	18.7	1,150
November	467	27	11	15.6	926
December	375	14	10	12.1	744
January	330	15	5	10.6	655
February	157	8	4	5.4	311
March	210	13	6	6.8	417
April	53,408	5,130	8	1,780	105,900
May	19,178	2,170	114	619	38,040
June	2,080	124	44	69.3	4,130
July	1,451	86	27	46.8	2,880
August	824.4	66	7.3	26.6	1,640
September	82.7	7.0	1.3	2.76	164
Water Year 1947-48	79,141.9	5,130	1.3	216	157,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	194.0	13	1.6	6.26	385
November	469	19	12	15.6	930
December	354	14	9	11.4	702
January	174	8	4	5.6	345
February	130	6	4	4.6	258
March	688	250	7	22.2	1,360
April	34,271	2,280	300	1,142	67,980
May	4,351	282	74	140	8,630
June	2,222	306	36	74.1	4,410
July	1,728	96	29	55.7	3,430
August	761.7	87	3.6	24.6	1,510
September	85.5	5.0	2.0	2.85	170
Water Year 1948-49	45,428.2	2,280	1.6	124	90,110

RED RIVER OF THE NORTH BASIN

Sheyenne River at Valley City, N. Dak.

Location.—Water-stage recorder and concrete control, lat. 46°54′50″, long. 98° 00′30″, SE¼NW¼ sec. 28, T. 140 N., R. 58 W., 100 feet downstream from College Dam in Valley City and 15 miles downstream from Baldhill Creek.

Drainage area.—8,360 square miles (includes 3,940 square miles in closed Devils Lake Basin).

Records available.—March to August 1919, March 1938 to September 1949.

Average discharge.—11 years (1938-49), 110 second-feet.

Extremes.—Maximum discharge during year, 2,120 second-feet Apr. 21 (gage height, 10.90 feet); minimum, 0.2 second-foot on many days; minimum gage height, 2.38 feet Sept. 29.

1919, 1938-49: Maximum discharge, 4,580 second-feet Apr. 28, 1948 (gage height, 17.51 feet); no flow during several periods in 1938-41.

Remarks.—Records good except those for period of no gage-height record, which are poor. Regulation by Baldhill Reservoir and other smaller reservoirs. Storage in Baldhill Reservoir began in August 1949.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	741.5	62	2.0	23.9	1,470
November	462.4	49	.8	15.4	917
December	460.6	33	.6	14.9	914
January	253.9	12	4.9	8.19	504
February	144.4	7.5	3.7	4.98	286
March	990.5	176	5.7	32.0	1,960
April	62,306	4,490	129	2,077	123,600
May	29,753	3,270	155	960	59,010
June	2,946	146	68	98.2	5,840
July	1,690	88	38	54.5	3,350
August	1,256	72	19	40.5	2,490
September	313.9	18	1.3	10.5	623
Water Year 1947-48	101,318.2	4,490	.6	277	201,000

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	24.5	1.4	0.4	0.79	49
November	783.9	66	.8	26.1	1,550
December	335.5	49	.2	10.8	665
January	193.6	12	.2	6.25	384
February	201.5	8.0	6	7.20	400
March	2,500.9	488	4.6	80.7	4,960
April	37,606	2,110	467	1,254	74,590
May	5,838	433	88	188	11,580
June	3,102	302	40	103	6,150
July	3,114	449	22	100	6,180
August	94.0	22	.3	3.03	186
September	36.9	7.0	.2	1.25	73
Water Year 1948-49	53,830.8	2,110	.2	147	106,800

RED RIVER OF THE NORTH BASIN
Sheyenne River at West Fargo, N. Dak.

Location.—Water-stage recorder, lat. 46°53'20", long. 96°54'55", in sec. 31., T. 140 N., R. 49 W., one mile north of West Fargo and 3 miles upstream from Maple River. Datum of gage is 877.19 feet above mean sea level, datum of 1929.

Drainage area.—9,460 square miles (includes 3,940 square miles in closed Devils Lake Basin).

Records available.—September 1929 to September 1949. March 1902 to June 1907 and March to August 1919 at site a quarter of a mile upstream.

Average discharge.—20 years, 128 second-feet.

Extremes.—Maximum discharge during year, 1,980 second-feet Apr. 29 (gage height, 16.19 feet); minimum, 5.7 second-feet Aug. 20 (gage height 2.48 feet).

1902-07, 1919, 1929-49: Maximum discharge, 2,800 second-feet Apr. 18, 1947 (gage height, 20.53 feet), minimum, 2.0 second-feet Dec. 14, 1936 (gage height, 1.90 feet).

Remarks.—Records good except those for period of ice effect, which are fair. Flow regulated by Baldhill Reservoir after August 1949.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	2,371	107	54	76.5	4,700
November	1,746	73	44	58.2	3,460
December	1,293	48	37	41.7	2,560
January	1,179	40	35	38.0	2,340
February	1,130	50	32	40.4	2,240
March	2,218	280	34	71.5	4,400
April	38,294	2,800	422	1,276	75,960
May	7,394	405	157	239	14,670
June	6,936	400	139	231	13,760
July	3,538	159	72	114	7,020
August	1,793	70	50	57.8	3,560
September	966	49	24	32.2	1,920
Water year 1946-47	68,858	2,800	24	189	136,600

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,058	82	22	34.1	2,100
November	1,944	89	32	64.8	3,860
December	1,473	64	33	47.5	2,920
January	1,000	42	30	32.3	1,980
February	870	30	30	30.0	1,730
March	1,228	110	30	39.6	2,440
April	43,500	2,320	150	1,450	86,280
May	50,475	2,620	437	1,628	100,100
June	8,166	409	190	272	16,200
July	4,646	188	123	150	9,220
August	3,206	127	76	103	6,360
September	1,634	86	40	54.5	3,240
Water Year 1947-48	119,201	2,620	22	326	236,400

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,068	39	32	34.5	2,120
November	1,574	79	37	52.5	3,120
December	1,207	60	30	38.9	2,390
January	866	40	25	27.9	1,720
February	625	25	20	22.3	1,240
March	3,680	350	30	119	7,300
April	34,720	1,970	180	1,157	68,870
May	16,091	1,740	204	519	31,920
June	5,819	293	125	194	11,540
July	4,295	251	89	139	8,520
August	2,653	336	22	85.6	5,260
September	318	61	19	27.3	1,620
Water Year 1948-49	73,416	1,970	19	201	145,600

RED RIVER OF THE NORTH BASIN
Maple River at Mapleton, N. Dak.

Location.—Wire-weight gage and loose rock dam, lat. 46°53'20", long. 97°03'20", in NE¼ NE¼ sec. 1, T. 139 N., R. 51 W., in Mapleton, 10.5 miles upstream from mouth. Datum of gage is 886.67 feet above mean sea level, datum of 1929 (Corps of Engineers bench mark).

Drainage area.—1,480 square miles.

Records available.—April 1944 to September 1949.

Extremes.—Maximum discharge during year, 850 second-feet Apr. 3 (gage height, 14.75 feet, affected by ice); no flow at times.

1944-49: Maximum discharge, 3,880 second-feet Apr. 14, 1947 (gage height, 18.11 feet); no flow at times in most years.

Remarks.—Records good above 10 second-feet and fair below except those for periods of ice effect or doubtful or no gage-height record, which are poor. Gage read twice daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	184.8	8.4	1.9	5.96	367
November	164.4	6.9	2.7	5.48	326
December	39.7	3.1	.4	1.28	79
January	4.0	.3	0	.13	7.9
February	0	0	0	0	0
March	3,121	470	0	101	6,190
April	28,368	3,820	80	946	56,270
May	1,837	136	25	59.3	3,640
June	10,596	2,290	19	353	21,020
July	556.0	58	3.8	17.9	1,100
August	31.6	3.4	.2	1.02	63
September	121.2	16	.1	4.04	240
Water Year 1946-47	45,023.7	3,820	0	123	89,300

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	73.8	6.9	.5	2.38	146
November	194.3	6.9	6.0	6.48	385
December	173.8	6.9	5	5.61	345
January	80	4	1	2.6	159
February	9.4	.8	.2	.32	19
March	196.2	60	.2	6.33	389
April	15,526	1,460	60	518	30,800
May	1,591	104	15	51.3	3,160
June	584	28	13	19.5	1,160
July	428	18	12	13.8	849
August	283.4	13	4.4	9.14	562
September	46.6	4	.2	1.55	92
Water Year 1947-48	19,186.5	1,460	.2	52.4	38,070

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	21.5	2.6	0.1	0.69	43
November	185.9	9.4	3.2	6.20	369
December	54.4	4	.1	1.75	108
January	1.3	.1	0	.04	2.6
February	0	0	0	0	0
March	277.8	80	0	8.96	561
April	6,272	800	21	209	12,440
May	477.6	30	4.8	15.4	947
June	242.1	14	4	8.07	480
July	225	12	2	7.26	446
August	7.1	1	0	.23	14
September	0	0	0	0	0
Water year 1949	7,764.7	800	0	21.3	15,400

RED RIVER OF THE NORTH BASIN

Rush River at Amenia, N. Dak.

Location.—Wire-weight gage, lat. 47°00'40", long. 97°13'10", on line between sec. 23 and 24, T. 141 N., R. 52 W., on bridge on State Highway 18, 0.4 mile north of Amenia. Prior to Sept. 7, 1947, staff gage 150 feet downstream, at same datum.

Records available.—July 1946 to September 1949.

Extremes.—Maximum discharge during year, 400 second-feet Mar. 31; maximum gage height observed, 9.63 feet Mar. 29 (affected by ice); no flow during several months.

1946-49: Maximum discharge, 1,230 second-feet Apr. 14, 1947; maximum gage height, 10.20 feet, Apr. 8, 1948 (affected by ice); no flow for some periods in each year.

Remarks.—Records good except those for period of ice effect, which are fair.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	9.4	0.9	0	0.30	19
November	25.4	1.9	.3	.85	50
December	5.2	.3	0	.17	10
January	0	0	0	0	0
February	0	0	0	0	0
March	952	167	0	30.7	1,890
April	5,233	1,180	14	174	10,380
May	242.8	13	4.8	7.83	482
June	1,162.5	291	6	38.8	2,310
July	47.5	5.5	.1	1.53	94
August	0	0	0	0	0
September	0	0	0	0	0
Water Year 1946-47	7,677.8	1,180	0	21.0	15,240

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1.1	0.1	0	0.04	2.2
November	3.0	.1	.1	.10	6.0
December	4.0	1	.1	.13	7.9
January	3.1	.1	.1	.10	6.1
February	0	0	0	0	0
March	0	0	0	0	0
April	4,136	520	1	138	8,200
May	170.6	13	1.2	5.50	338
June	45.1	4.0	.5	1.50	89
July	15.7	1.6	.1	.51	31
August	3.5	.2	0	.11	6.9
September	0	0	0	0	0
Water Year 1947-48	4,382.1	520	0	12.0	8,690

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	5.5	.4	0	.18	11
December	1.0	.2	0	.03	2.0
January	0	0	0	0	0
February	0	0	0	0	0
March	472	320	0	15.2	936
April	1,218.3	250	1.8	40.6	2,420
May	80.0	7.2	.9	2.58	159
June	32.6	5.1	.2	1.09	65
July	61.5	13	.2	1.98	122
August	3.1	.5	0	.10	6.1
September	0	0	0	0	0
Water Year 1948-49	1,874.0	320	0	5.13	3,720

RED RIVER OF THE NORTH BASIN

Goose River near Portland, N. Dak.

Location.—Chain gage, lat. 47°33', long. 97°28', on line between secs. 12 and 13, T. 147 N., R. 54 W., at highway bridge 6½ miles northwest of Portland. Datum of gage is 978.76 feet above mean sea level, datum of 1929.

Drainage area.—544 square miles.

Records available.—October 1939 to September 1949.

Average discharge.—10 years, 19.9 second-feet.

Extremes.—Maximum discharge during year, 1,200 second-feet Apr. 7 (gage height, 13.60 feet, affected by ice); no flow for several months.

1939-49: Maximum discharge, 4,700 second-feet Apr. 21, 1948 (gage height, 21.30 feet); no flow for several months in each year.

Remarks.—Records good except those for periods of indefinite stage-discharge relation, which are poor. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	24,584	4,110	0	819	48,760
May	2,052	200	17	66.2	4,070
June	218.1	16	4.2	7.27	433
July	193.2	31	3.4	6.23	383
August	93.8	8.0	.2	3.03	186
September	0	0	0	0	0
Water Year 1947-48	27,141.1	4,110	0	74.2	53,830

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	3.0	.1	.1	.10	6.0
December	4.0	.2	.1	.13	7.9
January	3.1	.1	.1	.10	6.1
February	0	0	0	0	0
March	5.1	3	0	.16	10
April	7,709	1,100	5	257	15,290
May	341.1	23	3.2	11.0	677
June	1,730.2	535	2.1	57.7	3,430
July	150.4	40	.1	4.85	298
August	27.1	4.0	0	.87	54
September	0	0	0	0	0
Water Year 1948-49	9,973.0	1,100	0	27.3	19,780

RED RIVER OF THE NORTH BASIN

Goose River at Hillsboro, N. Dak.

Location.—Water-stage recorder, lat. 47°24′, long. 97°03′, in NW¼ sec. 5, T. 145 N., R. 50 W., 50 feet upstream from city water-supply dam.

Drainage area.—1,200 square miles.

Records available.—March 1931 to September 1949 (no winter records prior to 1938).

Average discharge.—11 years (1938-49), 44.6 second feet.

Extremes.—Maximum discharge during year, 1,640 second-feet Apr. 8 (gage height, 3.38 feet); minimum, 0.1 second-foot Oct. 1-11; minimum gage height, -1.03 feet Sept. 30.

1931-49: Maximum discharge, 4,180 second feet Apr. 16, 1948 (gage height, 10.65 feet); no flow at times in 1936, 1938-47.

Maximum stage since 1897, 11.55 feet March 25, 26, 1920 (present datum); discharge 4,800 second feet. Stage in 1897 was about 3 feet higher.

Remarks.—Records good except those for periods of ice effect or indefinite stage-discharge relation, which are fair.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	23.8	1.2	0.6	0.77	47
November	65.6	2.8	1.3	2.19	130
December	45.2	2.3	.9	1.46	90
January	14.0	.8	.2	.45	28
February	2.9	.1	.1	.10	5.8
March	16.5	1.6	.1	.53	33
April	55,198.8	4,150	1.5	1,840	109,500
May	4,588	474	46	148	9,100
June	696	44	14	23.2	1,380
July	485	46	10	15.6	961
August	307.0	18	2.0	9.90	609
September	28.5	2.0	.2	.95	57
Water Year 1947-48	61,471.3	4,150	.1	168	121,900

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	13.8	2.3	0.1	.45	27
November	113.3	5.8	2.5	3.78	225
December	50.0	2	.5	1.61	99
January	14.2	.5	.4	.46	28
February	7.2	.3	.2	.26	14
March	35.2	6	.3	1.14	70
April	15,486	1,550	8	516	30,720
May	1,174	62	14	37.9	2,330
June	4,766	838	14	159	9,450
July	577.6	65	9.4	18.6	1,150
August	388.6	73	1.5	12.5	771
September	33.3	1.4	.8	1.11	66
Water Year 1948-49	22,659.2	1,550	.1	62.1	44,950

RED RIVER OF THE NORTH BASIN

Turtle River at Manvel, N. Dak.

Location.—Chain gage, lat. 48°05′, long. 97°11′, in SE¼ sec. 10, T. 153 N., R. 51 W., at bridge on State Highway 33, 0.3 mile west of Manvel and 10 miles upstream from mouth.

Records available.—October 1945 to September 1949.

Extremes.—Maximum daily discharge during year, 1,600 second-feet Apr. 10; maximum gage height, 16.35 feet Apr. 9 (affected by ice); minimum discharge, 0.1 second-foot Jan. 10 to Apr. 6, Sept. 24, 25.

1945-49: Maximum discharge, 3,450 second-feet Apr. 19, 1948 (gage-height, 17.88 feet); minimum, 0.1 second-foot at times each year.

Remarks.—Records good except those for period of ice effect which are fair. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	353.5	57	1.6	11.4	701
November	131.3	6.9	1.9	4.38	260
December	58.8	2.5	.8	1.90	117
January	5.8	.8	.1	.19	12
February	2.8	.1	.1	.10	5.6
March	2,273.1	350	.1	73.3	4,510
April	5,793	418	27	193	11,490
May	639	31	14	20.6	1,270
June	1,763	259	11	58.8	3,500
July	257.1	16	2.8	8.29	510
August	266.3	35	1.4	8.59	528
September	45.7	5.6	.5	1.52	91
Water Year 1946-47	11,589.4	418	.1	31.8	22,990

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	198.4	12	1.7	6.40	394
November	211.5	9.9	5.0	7.05	420
December	77.4	5.0	.3	2.50	154
January	3.6	.2	.1	.12	7.1
February	2.9	.1	.1	.10	5.8
March	3.1	.1	.1	.10	6.1
April	27,063.7	3,360	.1	902	53,680
May	2,121	212	20	68.4	4,210
June	2,646	447	19	88.2	5,250
July	654.3	62	7.9	21.1	1,300
August	310.0	28	3.4	10.0	615
September	65.7	19	.4	2.19	130
Water Year 1947-48	33,357.7	3,360	.1	91.1	66,170

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	40.2	4.8	0.2	1.30	80
November	138.6	8.6	1	4.62	275
December	14.5	1	.2	.47	29
January	4.0	.2	.1	.13	7.9
February	2.8	.1	.1	.10	5.6
March	3.1	.1	.1	.10	6.1
April	11,536.6	1,600	.1	385	22,880
May	889	51	14	28.7	1,760
June	1,021.2	162	8.2	34.0	2,030
July	260.3	13	4.4	8.40	516
August	94.5	9.7	.5	3.05	187
September	12.4	.8	.1	.41	25
Water Year 1948-49	14,017.2	1,600	.1	38.4	27,800

RED RIVER OF THE NORTH BASIN

Forest River near Fordville, N. Dak.

Location.—Chain gage, lat. 48°12′, long. 97°44′, on line between sec. 32 and 33, T. 155 N., R. 55 W., at highway bridge, a quarter of a mile downstream from South Branch and 3 miles southeast of Fordville.

Drainage area.—491 square miles.

Records available.—April 1940 to September 1949.

Extremes.—Maximum discharge observed during year, 1,470 second-feet Apr. 7 (gage height 5.64 feet); minimum daily discharge, 2.1 second-feet Oct. 5; minimum gage height observed, 1.23 feet Aug. 22.

1940-49: Maximum discharge, 19,000 second-feet, Apr. 18, 1948, (gage height, 14.25 feet), by slope area method; no flow Apr. 1-13, Sept. 3, 1940.

Remarks.—Records fair after Apr. 6 and poor before. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	142.2	6.0	3.6	4.59	282
November	127.5	4.5	4.0	4.25	253
December	131.5	4.5	2.0	4.24	261
January	99.6	3.8	2.0	3.21	198
February	60.8	2.6	1.7	2.17	121
March	2,030.0	600	2.6	65.5	4,030
April	1,249	150	12	41.6	2,480
May	279.1	12	7.3	9.00	554
June	223.6	8.4	5.9	7.45	444
July	182.7	48	3.4	5.89	362
August	105.8	5.0	3.0	3.41	210
September	105.5	10	2.8	3.52	209
Water Year 1946-47	4,737.3	600	1.7	13.0	9,400

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	150.9	7.6	4.0	4.87	299
November	139.5	6.0	3.8	4.65	277
December	174.1	6.0	5.0	5.62	345
January	155	5	5	5.0	307
February	145	5	5	5.0	288
March	161.5	5.5	5	5.21	320
April	26,770	7,480	5	892	53,100
May	1,416	126	19	45.7	2,810
June	638	72	12	21.3	1,270
July	276.1	15	5.9	8.91	548
August	261.9	20	4.5	8.45	519
September	118.3	4.5	3.5	3.94	235
Water Year 1947-48	30,406.3	7,480	3.5	83.1	60,320

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	133.3	5.5	2.1	4.30	264
November	155.2	6.3	4.5	5.17	308
December	117.4	4.6	3.5	3.79	233
January	93	.....	.....	3	184
February	84	.....	.....	3	167
March	149.2	10	3	4.81	296
April	10,019	1,180	13	334	19,870
May	553	38	11	17.8	1,100
June	228.3	15	5.1	7.61	453
July	340.3	23	5.0	11.0	675
August	159.1	6.9	3.4	5.13	316
September	107.3	4.0	3.2	3.58	213
Water Year 1948-49	12,139.1	1,180	2.1	33.3	24,080

RED RIVER OF THE NORTH BASIN

Forest River at Minto, N. Dak.

Location.—Wire-weight gage, lat. 48°16′10″, long. 97°22′10″, in SE¼ sec. 31, T. 156 N., R. 52 W., in Minto.

Records available.—April 1944 to September 1949.

Extremes.—Maximum discharge during year, 2,140 second-feet Apr. 7 (gage height, 8.19 feet); minimum, 0.4 second-foot Mar. 13-19; minimum gage height, 1.14 feet Oct. 7-10.

1944-49: Maximum discharge, 12,000 second-feet April 19, 1948 (gage height, 11.80 feet); by contracted opening measurement; no flow at times each year 1945-47.

Remarks.—Records fair. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	157.1	7.2	2.3	5.07	312
November	174.8	7.2	3.8	5.83	347
December	84.9	4.6	.8	2.74	168
January	15.4	1.2	.3	.50	31
February	.6	.1	0	.02	1.2
March	2,790	700	0	90.0	5,530
April	2,901	270	24	96.7	5,750
May	532	26	13	17.2	1,060
June	466.3	30	9.3	15.5	926
July	607.9	129	5.4	19.6	1,210
August	166.6	8.2	3.8	5.37	330
September	109.4	6.2	1.2	3.65	217
Water Year 1946-47	8,006.0	700	0	21.9	15,880

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	121.3	6.2	1.7	3.91	241
November	182.9	7.2	5.4	6.10	363
December	162.2	5.4	4.6	5.23	322
January	107.0	4.6	2.3	3.45	212
February	21.9	2.3	.3	.76	43
March	5.5	.3	.1	.18	11
April	37,519.3	9,900	.5	1,251	74,420
May	3,294	270	39	106	6,530
June	1,215	80	23	40.5	2,410
July	581	35	12	18.7	1,150
August	294.8	16	5.4	9.51	585
September	142.2	7.2	3.8	4.74	282
Water Year 1947-48	43,647.1	9,900	.1	119	86,570

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	125.4	7.2	0.5	4.05	249
November	210.4	9.3	6.2	7.01	417
December	114.1	6.2	2	3.68	226
January	35.2	2	.6	1.14	70
February	14.0	.....	.....	.5	28
March	18.4	1	.4	.59	36
April	15,514	2,000	2	517	30,770
May	1,162	71	22	37.5	2,300
June	523	24	12	17.4	1,040
July	347.0	30	4.8	11.2	688
August	102.3	8.9	1.0	3.30	203
September	19.6	1.0	.5	.65	39
Water Year 1948-49	18,185.4	2,000	.4	49.8	36,070

RED RIVER OF THE NORTH BASIN

South Branch Park River near Park River, N. Dak.

Location.—Chain gage, lat. 48°24′, long. 97°50′, on line between sec. 15 and 16, T. 157 N., R. 56 W., at highway bridge, half a mile upstream from small stream and 4½ miles northwest of town of Park River.

Drainage area.—255 square miles.

Records available.—March 1940 to September 1949.

Extremes.—Maximum discharge observed during year, 1,200 second-feet Apr. 9 (gage height, 5.93 feet), no flow Aug. 5-10, 15-21, 25-31, Sept. 1-5.

1940-49: Maximum discharge, 11,000 second-feet Apr. 18, 1948 (gage height, 11.80 feet); no flow during part of most years.

Remarks.—Records good except those for periods of ice effect or doubtful gage-height record, which are poor. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	11.6	1.0	0.1	0.37	23
November	5.1	.2	.1	.17	10
December	3.1	.1	.1	.10	6.1
January	1.0	.1	0	.03	2.0
February	0	0	0	0	0
March	912.3	160	0	29.4	1,810
April	2,399.9	210	8.4	80.0	4,760
May	122.2	8.9	2.3	3.94	242
June	473.9	94	2.0	15.8	940
July	739.4	258	.4	23.9	1,470
August	77.5	9.4	.3	2.50	154
September	94.7	38	.1	3.16	188
Water Year 1946-47	4,840.7	258	0	13.3	9,610

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	48.0	5.6	0.8	1.55	95
November	28.4	1.4	.6	.95	56
December	14.3	.6	.3	.46	28
January	4.6	.2	.1	.15	9.1
February	2.9	.1	.1	.10	5.8
March	9.4	.8	.1	.30	19
April	17,354.7	4,900	.8	578	34,420
May	1,420	113	12	45.8	2,820
June	349	18	6.8	11.6	692
July	625.4	59	9.4	20.2	1,240
August	673.3	144	2.2	21.7	1,340
September	7.8	.9	.2	.26	15
Water Year 1947-48	20,537.8	4,900	.1	56.1	40,740

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	11.8	0.8	0.2	0.38	23
November	6.2	.3	.2	.21	12
December	4.3	.2	.1	.14	8.5
January	3.1	.1	.1	.10	6.1
February	2.8	.1	.1	.10	5.6
March	3.5	.4	.1	.11	6.9
April	7,532.7	1,110	.7	251	14,940
May	401.5	35	4.6	13.0	796
June	67.8	6.1	.7	2.26	134
July	11.4	1.0	.1	.37	23
August	1.3	.2	0	.04	2.6
September	4.4	.2	0	.15	8.7
Water Year 1948-49	8,050.8	1,110	0	22.1	15,970

RED RIVER OF THE NORTH BASIN

Park River at Grafton, N. Dak.

Location.—Wire-weight gage, lat. 48°25′, long. 97°24′, in NE¼ sec. 13, T. 157 N., R. 53 W., in Grafton. Rubble masonry control dam 2 miles downstream. Datum of gage is 807.39 feet above mean sea level, adjustment of 1929.

Drainage area.—753 square miles.

Records available.—April 1931 to September 1949 (incomplete prior to 1937).

Average discharge.—13 years (1936-49), 46.2 second-feet.

Extremes.—Maximum discharge during year, 2,530 second-feet Apr. 11; maximum gage height, 17.25 feet Apr. 9 (affected by ice); no flow Sept. 18-30.

1931-49: Maximum discharge, 11,700 second-feet Apr. 19, 1948 (gage height, 20.06 feet); no flow at times in most years.

Remarks.—Records good except those for period of ice effect, which are fair. Gage read once or twice daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	11.8	1.9	0	0.38	23
November	5.7	.5	.1	.19	11
December	1.2	.1	0	.04	2.4
January	0	0	0	0	0
February	0	0	0	0	0
March	147	60	0	4.7	292
April	5,095	500	26	170	10,110
May	302.3	26	2.2	9.75	600
June	625.1	40	1.5	20.8	1,240
July	1,921.5	375	1.0	62.0	3,810
August	394.3	55	.8	12.7	782
September	112.3	30	.1	3.74	223
Water Year 1946-47	8,616.2	500	0	23.6	17,090

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	39.8	3.3	0.3	1.28	79
November	75.3	5.3	1.0	2.51	149
December	74.6	3.3	1.0	2.41	148
January	15.0	1.0	.3	.48	30
February	3.4	.2	.1	.12	6.7
March	14.4	1.5	.1	.46	29
April	54,257.4	10,500	1.5	1,809	107,600
May	6,744	868	47	218	13,380
June	1,134	88	14	37.8	2,250
July	1,400	80	23	45.2	2,780
August	945.1	261	7.5	30.5	1,870
September	70.0	7.5	.9	2.33	139
Water Year 1947-48	64,773.0	10,500	.1	177	128,500

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	15.0	2.2	.1	.48	30
November	31.0	2.2	.5	1.03	61
December	11.9	.5	.3	.38	24
January	7.0	.3	.2	.23	14
February	5.6	.2	.2	.20	11
March	9.6	1	.2	.31	19
April	23,065	2,500	2	769	45,750
May	1,592	122	17	51.4	3,160
June	344.8	21	4.6	11.5	684
July	70.6	3.9	1.0	2.28	140
August	35.8	4.6	.2	1.15	71
September	1.8	.2	0	.06	3.6
Water Year 1948-49	25,190.1	2,500	0	69.0	49,970

RED RIVER OF THE NORTH BASIN
Pembina River near Manitou, Manitoba

Location.—Chain gage, lat. 49°08'50", long. 98°23'30", on bridge near Lea's farm, 9 miles south of Manitou.

Drainage area.—2,060 square miles.

Records available.—October 1929 to September 1949 (incomplete) in reports of Geological Survey. April 1921 to September 1949 in reports of Dominion Water and Power Bureau, Department of Mines and Resources, Canada.

Extremes.—Maximum discharge observed during year, 5,030 second-feet Apr. 17 (gage height, 101.68 feet); minimum discharge not determined.

1921-49: Maximum daily discharge observed, that of Apr. 17, 1949; no flow on many days in 1934, 1937, 1939-41.

Remarks.—Records good except those for period of ice effect, which are poor. Gage read once daily.

Cooperation.—Records furnished by Dominion Water and Power Bureau, Department of Mines and Resources, Canada.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,032.5	40.8	28.0	33.3	2,050
November 1-7	210.5	31.5	29.0	30.1	418
December	------	------	------	------	------
January	------	------	------	------	------
February	------	------	------	------	------
March	------	------	------	------	------
April 12-30	9,839	1,190	10.0	518	19,520
May	18,194	684	413	587	36,090
June	7,884	399	172	263	15,640
July	4,928	258	131	159	9,780
August	4,287	199	106	138	8,500
September	2,576	113	58	86	5,110
Water Year 1947-48	------	------	------	------	------

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,269.3	55	29.5	40.9	2,520
November 1-13	392.5	31.5	29.0	30.2	779
December	------	------	------	------	------
January	------	------	------	------	------
February	------	------	------	------	------
March	------	------	------	------	------
April 5-30	60,790	5,030	20	2,340	120,600
May	33,667	1,950	641	1,090	66,780
June	14,122	795	272	471	28,010
July	6,009	262	144	194	11,920
August	2,892	138	65	93	5,740
September	1,592.4	74	32	53	3,160
Water Year 1948-49	------	------	------	------	------

RED RIVER OF THE NORTH BASIN
Pembina River near Walhalla, N. Dak.

Location.—Water-stage recorder, lat. 48°53'32", long. 97°59'09", in SE¼SW¼ sec. 35, T. 163 N., R. 57 W., 1½ miles downstream from Little Pembina River and 3½ miles southwest of Walhalla.

Drainage area.—3,020 square miles.

Records available.—October, 1939 to September 1949.

Average discharge.—10 years, 210 second-feet.

Extremes.—Maximum discharge during year, 5,840 second-feet Apr. 19 (gage height, 13.18 feet), minimum discharge, 4 second-feet Mar. 5-22; minimum gage height, 1.97 feet Nov. 9.

1939-49: Maximum discharge, 7,280 second-feet Apr. 19, 1948 (gage height, 14.94 feet); no flow during parts of 1940, 1941, 1947.

Remarks.—Records good except those for period of ice effect, which are fair.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,416	64	38	45.7	2,810
November	780	37	16	26.0	1,550
December	445	18	11	14.4	883
January	375	14	8	12.1	744
February	150	7	5	5.2	298
March	213	10	5	6.9	422
April	29,315	4,340	11	977	58,150
May	25,826	1,050	603	833	51,230
June	10,833	580	230	361	21,490
July	8,493	504	171	274	16,850
August	5,896	260	154	190	11,690
September	3,324	154	76	111	6,590
Water year 1947-48	87,066	4,340	5	238	172,700

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,887	74	47	60.9	3,740
November	1,119	56	26	37.3	2,220
December	597	30	14	19.3	1,180
January	510	18	14	16.5	1,010
February	258	14	6	9.2	512
March	174	14	4	5.6	345
April	81,079	5,740	16	2,703	160,800
May	43,667	2,550	830	1,409	86,610
June	18,068	969	342	602	35,840
July	7,156	330	177	231	14,190
August	3,713	175	76	120	7,360
September	1,748	74	41	58.3	3,470
Water Year 1948-49	159,976	5,740	4	438	317,300

RED RIVER OF THE NORTH BASIN

Pembina River at Neche, N. Dak.

Location.—Water-stage recorder 60 feet upstream from concrete dam, lat. 48°59'20", long. 97°33'05", in SE¼NW¼ sec. 31, T. 164 N., R. 53 W., in Neche.

Drainage area.—3,080 square miles.

Records available.—May 1903 to September 1915, April 1919 to September 1949.

Average discharge.—30 years (1919-49), 142 second-feet.

Extremes.—Maximum discharge during year, 5,010 second-feet Apr. 22 (gage height, 20.83 feet); minimum discharge, 10 second-feet Mar. 28 to Apr. 2; minimum gage height, 5.88 feet Dec. 17-24, Jan. 16.

1903-15, 1919-49: Maximum discharge, that of Apr. 22, 1949; no flow at times during each year, 1932-41.

Remarks.—Records excellent except those for periods of ice effect, which are fair.

Cooperation.—This station is one of the international gaging stations maintained by the United States under agreement with Canada.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	2,064	82	51	66.6	4,090
November	1,371	64	33	45.7	2,720
December	640	33	12	20.6	1,270
January	397	14	12	12.8	787
February	336	12	12	12.0	666
March	355	12	10	11.5	704
April	72,838	4,910	10	2,428	144,500
May	48,650	3,070	857	1,569	96,500
June	19,708	970	401	657	39,090
July	8,448	388	215	273	16,760
August	4,413	208	88	142	8,750
September	2,073	88	56	69.1	4,110
Water Year 1948-49	161,293	4,910	10	442	319,900

RED RIVER OF THE NORTH BASIN

Tongue River at Cavalier, N. Dak.

Location.—Staff gage and concrete control, lat. 48°47'55", long. 97°37'35", in SE¼NE¼ sec. 4, T. 161 N., R. 54 W., half a mile upstream from State Highway 5 in Cavalier.

Drainage area.—135 square miles.

Records available.—October 1938 to September 1949.

Average discharge.—11 years, 18.7 second-feet.

Extremes.—Maximum discharge observed during year, 681 second-feet Apr. 11; maximum gage height observed, 3.60 feet Apr. 9 (affected by ice); minimum discharge not determined.

1938-49: Maximum discharge, 1,300 second-feet Apr. 21, 1948 (gage height, 4.38 feet); no flow for several months in some years.

Remarks.—Records good Apr. 10 to June 11, poor at other times. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	157.7	7.9	1.5	5.09	313
November	120.3	8.9	1.5	4.01	239
December	94.0	3.1	3.0	3.03	186
January	69.6	2.8	1.0	2.25	138
February	17.0	1.0	.5	.59	34
March	26.9	2.2	.5	.87	53
April	8,190.6	1,100	2.2	273	16,250
May	1,996	138	25	64.4	3,960
June	460	24	10	15.3	912
July	613.7	56	6.0	19.8	1,220
August	236.4	21	3.8	7.63	469
September	61.6	3.8	1.1	2.05	122
Water Year 1947-48	12,043.8	1,100	.5	32.9	23,900

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	93.4	5.2	.7	3.01	185
November	92.2	6.9	1.5	3.07	183
December	31.0	------	------	1.0	61
January	15.5	------	------	.5	31
February	2.8	------	------	.1	5.6
March	45.6	6.9	.1	1.47	90
April	5,276.5	676	5.2	176	10,460
May	698	41	13	22.5	1,380
June	263.3	21	3.1	8.78	522
July	77.5	3.8	.7	2.50	154
August	40.3	3.1	.4	1.30	80
September	43.4	3.8	.4	1.45	86
Water Year 1948-49	6,678.5	676	.1	18.3	13,240

RED RIVER OF THE NORTH BASIN
Souris River near Sherwood, N. Dak.
(International gaging station)

Location.—Water-stage recorder and concrete control, lat. 48°59′, long. 101°58′, in NE¼ sec. 33, T. 164 N., R. 87 W., three-quarters of a mile south of international boundary and 16 miles northwest of Sherwood. Datum of gage is 1,604.00 feet (revised) above mean sea level, datum of 1929.

Drainage area.—9,570 square miles.

Records available.—March 1930 to September 1949.

Average discharge.—15 years (1934-49), 95.9 second-feet.

Extremes.—Maximum discharge during year, 2,720 second-feet Apr. 11 (gage height, 20.56 feet); minimum 1 second-foot Jan. 22-28, Feb. 4, 5, 15-22; minimum gage height, 1.39 feet Sept. 18-19.

1930-49: Maximum discharge, 7,400 second-feet Apr. 28, 1948 (gage height, 23.80 feet); no flow for periods in most years.

Remarks.—Records good except those for period of ice effect, which are fair.

Cooperation.—This is one of the international gaging stations maintained by the United States under agreement with Canada.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	295.5	14	7.5	9.53	586
November	459.7	27	9.7	15.3	912
December	228	12	3	7.4	452
January	76	4	1	2.5	151
February	67	6	1	2.4	133
March	147	8	3	4.7	292
April	24,675	2,700	7	822	48,940
May	2,386	180	41	77.0	4,730
June	1,614	116	30	53.8	3,200
July	567	39	11	18.3	1,120
August	356.2	21	5.2	11.5	707
September	111.1	5.2	2.1	3.70	220
Water Year 1948-49	30,982.5	2,700	1	84.9	61,440

RED RIVER OF THE NORTH BASIN
Souris River near Foxholm, N. Dak.

Location.—Water stage recorder and artificial control, lat. 48°22′, long. 101°30′, in SW¼SE¼ sec. 34, T. 157 N., R. 84 W., 3 miles east of Foxholm. Datum of gage is 1,560.73 feet above mean sea level, datum of 1929.

Drainage area.—10,100 square miles.

Records available.—June 1904 to November 1905, April 1937 to September 1949.

Average discharge.—12 years (1937-49) 93.3 second-feet.

Extremes.—Maximum discharge during year, 690 second-feet Apr. 15; maximum gage-height, 10.63 feet about Mar. 22 (high water mark; affected by ice); maximum reverse flow, 25 second-feet April 4; minimum gage height, 5.05 feet Aug. 9, 10.

1904-05, 1937-49: Maximum discharge, 3,040 second-feet May 16, 1948 (gage height, 14.79 feet); maximum reverse flow, that of Apr. 4, 1949.

Remarks.—Records good. Flow completely regulated by Lake Darling and several smaller reservoirs.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	340.5	91	0.2	11.0	675
November	4.6	.3	.1	.15	9.1
December	4.4	.3	0	.14	8.7
January	4.7	.3	.1	.15	9.3
February	2,301.6	200	.1	82.2	4,570
March	13,400	600	250	432	26,580
April	9,275.0	681	—5	309	18,400
May	6,161.2	614	2.0	199	12,220
June	306.2	37	2.0	10.2	607
July	130.3	25	.1	4.20	258
August	393.8	26	0	12.7	781
September	380.5	24	.8	12.7	755
Water Year 1948-49	32,702.8	681	—5	89.6	64,870

RED RIVER OF THE NORTH BASIN
Souris River above Minot, N. Dak.

Location.—Water-stage recorder and concrete control, lat. 48°14′45″, long. 101° 22′15″, near center of sec. 17, T. 155 N., R. 83 W., 3½ miles west of Minot. Datum of gage is 1,545.75 feet above mean sea level, datum of 1929.

Drainage area.—11,300 square miles.

Records available.—May 1903 to March 1924, April 1927 to September 1928, and October 1929 to September 1934 at site at Minot) 10 miles downstream, and October 1934 to September 1949 at present site, in reports of Geological Survey. May 1903 to September 1949 in reports of State Engineer. Records equivalent except those for periods of low flow, when considerable industrial and sanitary waste enters river between the two sites.

Average discharge.—36 years (1913-49), 121 second-feet.

Extremes.—Maximum discharge during year, 2,250 second-feet April 6 (gage height, 16.56 feet, backwater from ice); minimum, 1 second-foot Jan. 20 to Feb. 18.

1903-49: Maximum discharge, 12,000 second-feet Apr. 20, 1904 (gage height, 21.9 feet at site at Minot), from rating curve extended above 8,100 second-feet; no flow at times in many years.

Maximum stage known at present site, about 23 feet in April 1904.

Remarks.—Records good except those for periods of ice effect or no gage height record, which are fair. Flow of Souris and Des Lacs Rivers completely regulated by Fish and Wildlife Service dams above station.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	828.0	97	9.8	26.7	1,640
November	390.0	20	7	13.0	774
December	117.8	7	2	3.80	234
January	50	------	------	1.6	99
February	1,818	200	1	64.9	3,610
March	12,950	600	200	418	25,690
April	24,275	2,200	265	809	48,150
May	7,673	646	45	248	15,220
June	2,032	158	39	67.7	4,030
July	728	37	14	23.5	1,440
August	457.8	31	2.3	14.8	908
September	320.6	21	1.8	10.7	636
Water Year 1948-49	51,640.2	2,200	1	141	102,400

RED RIVER OF THE NORTH BASIN
Souris River near Verendrye, N. Dak.

Location.—Water-stage recorder, lat. 48°09′, long. 100°44′, in NW¼SW¼ sec. 17, T. 154 N., R. 78 W., 3 miles northeast of Verendrye and 7½ miles southwest of (19 miles upstream from) mouth of Wintering River. Datum of gage is 1,464.87 feet above mean sea level, datum of 1929.

Drainage area.—12,200 square miles.

Records available.—February to June 1933 (gage heights only), April 1937 to September 1949 (winter records incomplete prior to 1945).

Extremes.—Maximum discharge during year, about 4,200 second-feet Apr. 8 (gage height, 17.7 feet, high water mark, backwater from ice); minimum not determined.

1937-49: Maximum discharge, that of Apr. 8, 1949; minimum discharge recorded, 0.3 second-foot Aug. 11-19, 1937, Oct. 10-21, 1939.

Remarks.—Records good except those for Apr. 6-26, Sept. 15-30, which are fair, and those for Dec. 1 to Apr. 5, which are poor. Flow regulated by Fish and Wildlife Service dams on Souris and Des Lacs Rivers.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	1,448	97	21	46.7	2,870
November	830	38	16	27.7	1,650
December	268	15	5	8.6	532
January	219	15	4	7.1	434
February	84	------	------	3	167
March	10,510	500	5	339	20,850
April	43,154	4,000	500	1,438	85,590
May	10,426	599	104	336	20,680
June	4,164	342	80	139	8,260
July	1,591	76	35	51.3	3,160
August	993	52	15	32.0	1,970
September	515	24	14	17.2	1,020
Water Year 1948-49	74,202	4,000	------	203	147,200

RED RIVER OF THE NORTH BASIN
Souris River near Bantry, N. Dak.

Location.—Water-stage recorder, lat. 48°30′, long. 100° 45′, in SE¼ sec. 14, T. 158 N., R. 76 W., 8 miles east of Bantry.

Drainage area.—13,400 square miles.

Records available.—March 1937 to September 1949 (no winter records prior to 1945).

Extremes:—Maximum discharge during year, 4,760 second-feet Apr. 10 (gage height, 13.76 feet, high water mark); minimum not determined; minimum gage height, 1.03 feet Sept. 26, 27.

1937-49: Maximum discharge, that of Apr. 10, 1949; no flow at times in each year 1937-40.

Remarks.—Records good except those for Apr. 6-11, June 19-28, Aug. 2-17, Aug. 28 to Sept. 7, which are fair, and those for Nov. 2 to Apr. 5, which are poor. Water diverted for irrigation at Eaton Dam about 42 miles above station. Flow regulated by Fish and Wildlife Service dams on Souris and Des Lacs Rivers.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	2,290	106	47	73.9	4,540
November	1,378	65	25	45.9	2,730
December	463	25	8	14.9	918
January	289	15	6	9.3	573
February	144	.....	.....	5.10	286
March	7,244	500	5	234	14,370
April	57,420	4,560	500	1,914	113,900
May	18,767	1,230	198	605	37,220
June	7,160	440	116	239	14,200
July	2,334	109	54	75.3	4,530
August	1,227	60	21	39.6	2,430
September	599	40	12	20.0	1,190
Water Year 1948-49	99,315	4,560	.....	272	197,000

RED RIVER OF THE NORTH BASIN
Souris River near Westhope, N. Dak.
(International gaging station)

Location.—Water-stage recorder and concrete control, lat. 49°00′, long. 100°57′, in SW¼SE¼ sec. 30, T. 164 N., R. 79 W., 1,200 feet upstream from International Boundary, 1 mile downstream from Fish and Wildlife Service dam 357, and 7 miles northeast of Westhope. Datum of gage is 1,401.74 feet above mean sea level, datum of 1929.

Drainage area.—17,600 square miles.

Records available.—October 1937 to September 1949, July 1929 to September 1937, at site 6¼ miles upstream.

Average discharge.—14 years (1935-49), 145 second-feet.

Extremes.—Maximum discharge during year, 6,400 second-feet Apr. 18, maximum gage height, 16.9 feet (floodmark) Apr. 20; minimum discharge, 7 second-feet Mar. 11-25, minimum gage-height, 5.24 feet July 15, 16.

1929-49: Maximum discharge, that of Apr. 18, 1949; maximum gage height, that of Apr. 20, 1949; no flow during several periods.

Remarks.—Records fair. Flow regulated by Fish and Wildlife Service dams on Souris and Des Lacs Rivers.

Cooperation.—This station is one of the international gaging stations maintained by the United States under agreement with Canada.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	618	30	17	19.9	1,230
November	1,409	80	10	47.0	2,790
December	2,065	80	50	66.6	4,100
January	1,000	50	20	32.3	1,980
February	377	18	9	13.5	748
March	233	8	7	7.5	462
April	96,696	6,300	9	3,223	191,800
May	45,143	3,400	550	1,456	89,540
June	18,374	900	345	612	36,440
July	1,221.5	247	9.5	39.4	2,420
August	1,224	44	36	39.5	2,430
September	971	38	18	32.4	1,930
Water Year 1948-49	169,331.5	6,300	7	464	335,900

RED RIVER OF THE NORTH BASIN
Long Creek near Crosby, N. Dak.

Location.—Wire-weight gage, lat. 48°58′30″, long. 103°15′40″, in NW¼ sec. 3, T. 163 N., R. 97 W., on county highway bridge 5 miles northeast of Crosby.

Records available.—March to April 1943, April 1944 to September 1949.

Extremes.—Maximum discharge during year, about 500 second-feet Apr. 3; maximum gage height, 10.5 feet Apr. 1 (affected by ice); no flow during several months.

1943-49: Maximum discharge, 6,240 second-feet Apr. 23, 1948; maximum gage height, 16.10 feet Apr. 22, 23, 1948; no flow during part of each year.

Remarks.—Records fair. Gage read once daily.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	0	0	0	0	0
November	1.3	.2	0	.04	2.6
December	1.6	.6	0	.05	3.2
January	0	0	0	0	0
February	0	0	0	0	0
March	252	200	0	8.1	500
April	3,883	480	15	129	7,700
May	197.3	14	.8	6.36	391
June	69.5	11	.1	2.32	138
July	0	0	0	0	0
August	0	0	0	0	0
September	0	0	0	0	0
Water Year 1948-49	4,404.7	480	0	12.1	8,730

RED RIVER OF THE NORTH BASIN
Des Lacs River at Foxholm, N. Dak.

Location.—Water-stage recorder, lat. 48°22′, long. 101°34′, in NW¼ sec. 2, T. 156 N., R. 85 W., at county highway bridge in Foxholm. Datum of gage is 1,632.98 feet above mean sea level, datum of 1929. Prior to Aug. 31, 1948, staff gage at same site and datum.

Drainage area.—973 square miles.

Records available.—June 1904 to July 1906, October 1945 to September 1949.

Extremes.—Maximum discharge during year, 2,000 second-feet Apr. 4 (gage height, 18.04 feet, backwater from ice); minimum not determined.

1904-6, 1945-49: Maximum discharge, that of Apr. 4, 1949; no flow at times in most years.

Flood in June 1944 reached a stage of 19.0 feet, from floodmarks.

Remarks.—Records fair.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	289.5	15	4.5	9.34	574
November	206.6	11	4.5	6.89	410
December	68.2	5.2	.8	2.20	135
January	8.1	.5	.1	.26	16
February	2.8	.....	.....	.1	5.6
March	5.0	1	.....	.16	9.9
April	10,822	1,800	5	361	21,470
May	1,340	63	19	43.2	2,660
June	1,284	76	30	42.8	2,550
July	530.8	25	9.8	17.1	1,050
August	127.9	10	1.2	4.13	254
September	23.1	1.5	.4	.77	46
Water Year 1948-49	14,708.0	1,800	.....	40.3	29,180

RED RIVER OF THE NORTH BASIN
Wintering River near Karlsruhe, N. Dak.

Location.—Water-stage recorder and concrete control, lat. 48°10′, long. 100°32′, on line between secs. 10 and 11, T. 154 N., R. 77 W., 80 feet upstream from highway bridge, 4 miles upstream from mouth, and 7 miles northeast of Karlsruhe.

Drainage area.—675 square miles.

Records available.—March 1937 to September 1949 (no winter records prior to 1945).

Extremes.—Maximum discharge during year, 3,000 second-feet Apr. 7; maximum gage height, 12.0 feet Apr. 7 (affected by ice); no flow Jan. 16 to Feb. 28.

1937-49: Maximum discharge, that of Apr. 7, 1949; maximum gage height, that of Apr. 7, 1949; no flow at times in many years.

Remarks.—Records fair except those for period of ice effect, which are poor.

Month	Second Foot Days	Maximum	Minimum	Mean	Run-off in Acre-Feet
October	131.8	7.6	2.9	4.25	261
November	155.0	7.6	4	5.17	307
December	49.8	4	.6	1.61	99
January	3.9	.5	0	.13	7.7
February	0	0	0	0	0
March	3.1	.....	.....	.1	6.1
April	11,591.7	2,500	.1	386	22,990
May	834	67	15	26.9	1,650
June	420.8	36	9.0	14.0	835
July	176.5	7.9	4.5	5.69	350
August	84.0	4.0	2.1	2.71	167
September	88.5	3.6	2.2	2.95	176
Water Year 1948-49	13,539.1	2,500	0	37.1	26,850

RED RIVER OF THE NORTH BASIN
Devils Lake near Devils Lake, N. Dak.

Location.—Temporary staff gage, lat. 48°03′45″, long. 98°56′30″, in SW¼ sec. 18, T. 153 N., R. 64 W., at Lakewood, on east bank at mouth of Creel Bay and 6 miles southwest of city of Devils Lake. Creel Bay, which is half a mile wide, is an arm of Devils Lake and extends 2 miles to the north of the lake. Datum of present gage is 1,400.00 feet above mean sea level, datum of 1929.

Drainage area.—3,940 square miles (including lake surface).

Records available.—1867, 1879, 1883, 1887, 1890, 1895 (one gage height for each year) and 1901-48 (fragmentary).

Extremes.—1867-1948: Maximum elevation observed, 1,438.40 feet in 1867, present datum; minimum observed, 1,400.87 feet Oct. 24, 1940.

Remarks.—Elevations of lake determined from temporary gage. To refer elevations obtained during period 1867 to 1938 to datum of 1929, subtract 0.56 foot.

Elevation, in feet, 1947-48

1947		1948		1948	
Oct. 13	1402.98	June 11	1405.25	Aug. 31	1404.65
		July 3	1405.22	Sept. 28	1404.44
		Aug. 2	1404.97		

RED RIVER OF THE NORTH BASIN
Devils Lake near Devils Lake, N. Dak.

Location.—Temporary staff gage, lat. 48°03′45″, long. 98°56′30″, in SW¼ sec. 18, T. 153 N., R. 64 W., at Lakewood, on east bank at mouth of Creel Bay and 6 miles southwest of city of Devils Lake. Creel Bay, which is half a mile wide, is an arm of Devils Lake and extends 2 miles to the north of the lake. Elevations are referred to mean sea level, datum of 1929.

Drainage area.—3,940 square miles (including lake surface).

Records available.—1867, 1879, 1883, 1887, 1890, 1896 (one gage height for each year) and 1901-49 (fragmentary).

Extremes.—1867-1949: Maximum elevation observed, 1,438.40 feet in 1867, present datum; minimum observed, 1,400.87 feet Oct. 24, 1940.

Remarks.—Elevations of lake determined from temporary gage. To refer elevations obtained during period 1867 to 1938 to datum of 1929, subtract 0.56 foot.

Elevation, in feet, 1948-49

1948		1949		1949	
Oct. 2	1404.37	May 10	1405.58	Aug. 9	1407.02
Oct. 17	1404.22	May 26	1405.88	Aug. 22	1406.89
Oct. 24	1404.17	June 4	1406.26	Aug. 31	1406.77
		June 17	1406.58	Sept. 14	1406.57
		June 28	1406.88	Sept. 25	1406.42
		July 9	1407.20		
		July 16	1407.25		
		July 29	1407.18		

Note.—Readings other than those shown above were made.

RED RIVER OF THE NORTH BASIN
Lake Darling near Foxholm, N. Dak.

Location.—Staff gage, lat. 48°27′, long. 101°35′, in NE¼NE¼ sec. 1, T. 157 N., R. 85 W., on control dam of Lake Darling, reservoir of Fish and Wildlife Service on Souris River, about 6 miles north of Foxholm. Datum of gage is 1,577.00 feet above mean sea level (Fish and Wildlife Service bench mark).

Records available.—April 1937 to September 1949.

Extremes.—Maximum gage height observed during year, 18.40 feet Apr. 19, 22; minimum observed, 12.21 feet Mar. 31, Apr. 4.

1937-49: Maximum gage height observed, 22.83 feet Apr. 23, 24, 1943; minimum observed, 1.53 feet Mar. 1, 1938.

Remarks.—Reservoir is formed by concrete dam; storage began in April 1936; dam completed in July 1936. Capacity 128,500 acre-feet between gage heights 0.0 foot (sill of control gates) and 23.0 feet (top of 2-foot flashboards). Dead storage 3,500 acre-feet. Water is used during periods of low flow at wildlife refuges downstream. Gage read from 1 to 15 times per month.

Cooperation.—Gage height record furnished by Fish and Wildlife Service.

LAKE DARLING NEAR FOXHOLM, N. DAK.
Monthly gage heights and contents, water year October, 1948 to September, 1949

Date	Gage-height (feet)	Contents (acre-feet)	Change in Contents during mo. or year (acre-feet)
Sept. 30	16.96	75,200	.....
Oct. 31	16.68	72,800	—2,400
Nov. 30	16.80	73,800	+1,000
Dec. 31	16.80	73,800	0
Calendar year 1948	.....	.....	.....
Jan. 31	16.80	73,800	0
Feb. 28	16.68	72,800	—1,000
Mar. 31	12.21	41,300	—31,500
Apr. 30	18.08	84,700	+43,400
May 31	17.46	79,400	—5,300
June 30	17.76	82,000	+2,600
July 31	17.58	80,400	—1,600
Aug. 31	17.26	77,700	—2,700
Sept. 30	16.70	73,000	—4,700
Water year 1948-49	.....	.....	—2,200