DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 386

SURFACE WATER SUPPLY OF THE UNITED STATES

1914

PART VI. MISSOURI RIVER BASIN

NATHAN C. GROVER, Chief Hydraulic Engineer

W. A. LAMB and ROBERT FOLLANSBEE, District Engineers

Prepared in cooperation with the States of
Colorado, Montana, Nebraska, and South Dakota

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SURFACE WATER SUPPLY OF MISSOURI RIVER BASIN, 1914.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of fourteen reports presenting results of measurements of flow of streams in the United States during the year ending September 30, 1914.

The data presented in these reports were collected by the United States Geological Survey under the following authority contained in the organic law (20 Stat. L., p. 394):

Provided, That this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies relating to irrigation in the arid West. Since the fiscal year ending June 30, 1895, successive sundry civil bills passed by Congress have carried the following item and appropriations:

For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods and utilizing the water resources.

Annual appropriations for the fiscal years ending June 30, 1895–1915.

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1915, inclusive	150,000

In the execution of the work many private and State organizations have cooperated, either by furnishing or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on page 14.

Measurements of stream flow have been made at about 3,400 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1914, 1,480 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are made at other points.

In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time.

Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those that represent the rate of flow, as second-feet, gallons per minute, miner's inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in depth of inches, acre-feet, and millions of cubic feet. The principal terms used in this series of reports are second-feet, second-feet per square mile, run-off in inches, acre-feet, and millions of cubic feet. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (pp. 12–14).

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off (depth in inches)" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth of inches.

An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

"Millions of cubic feet" is applied to quantities of water stored in reservoirs, most frequently in connection with studies of flood control.

The following terms not in common use are here defined:

"Discharge relation," an abbreviation for the term "relation of gage height to discharge."

"Control," "controlling section," and "point of control," terms used to designate the section or sections of the stream below the gage which determine the discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a given gaging station is that point on the gage—the gage height—to which the surface of the river would fall if there were no flow.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge in second-feet per square mile.	Run-off in inches.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.03719	1.041	1.079	1.116	1.153
2	.07438	2.083	2.157	2.231	2.306
3	.11157	3.124	3.236	3.347	3.459
4	.14876	4.165	4.314	4.463	4.612
5	.18595	5.207	5.393	5.578	5.764
6	.22314	6.248	6.471	6.694	6.917
7	.26033	7.289	7.550	7.810	8.070
8	.29752	8.331	8.628	8.926	9.223
9	.33471	9.372	9.707	10.041	10.376

NOTE.—For part of a month multiply run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge in second-feet.	Run-off in acre-feet.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	1.983	55.54	57.52	59.50	61.49
2	3.967	111.1	115.0	119.0	123.0
3	5.950	166.6	172.6	178.5	184.5
4	7.934	222.1	230.1	238.0	246.0
5	9.917	277.7	287.6	297.5	307.4
6	11.90	333.2	345.1	357.0	368.9
7	13.88	388.8	402.6	416.5	430.4
8	15.87	444.3	460.2	476.0	491.9
9	17.85	499.8	517.7	535.5	553.4

NOTE.—For part of a month multiply run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of cubic feet.

Discharge in second-feet.	Run-off in millions of cubic feet.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.0864	2.419	2.506	2.592	2.678
2	.1728	4.838	5.012	5.184	5.356
3	.2592	7.257	7.518	7.776	8.034
4	.3456	9.676	10.024	10.368	10.712
5	.4320	12.095	12.530	12.960	13.390
6	.5184	14.514	15.036	15.552	16.068
7	.6048	16.933	17.542	18.144	18.746
8	.6912	19.352	20.048	20.736	21.424
9	.7776	21.771	22.554	23.328	24.102

NOTE.—For part of a month multiply run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of gallons.

Discharge in second-feet.	Run-off in millions of gallons.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.....	0.6463	18.10	18.74	19.39	20.04
2.....	1.293	36.20	37.48	38.78	40.08
3.....	1.939	54.30	56.22	58.17	60.12
4.....	2.585	72.40	74.96	77.56	80.16
5.....	3.232	90.50	93.70	96.95	100.2
6.....	3.878	108.6	112.4	116.3	120.2
7.....	4.524	126.7	131.2	135.7	140.3
8.....	5.171	144.8	149.9	155.1	160.3
9.....	5.817	162.9	168.7	174.5	180.4

NOTE.—For part of a month multiply run-off for one day by the number of days.

Table for converting velocity in feet per second into velocity in miles per hour.

[1 foot per second=0.681818 mile per hour, or two-thirds mile per hour, very nearly; 1 mile per hour=1.4666 feet per second. In computing the table the figures 0.68182 and 1.4667 were used.]

Feet per second (units).	Tenths.									
	0	1	2	3	4	5	6	7	8	9
0.....	0.000	0.068	0.136	0.205	0.273	0.341	0.409	0.477	0.545	0.614
1.....	.682	.750	.818	.886	.995	1.02	1.09	1.16	1.23	1.30
2.....	1.36	1.43	1.50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
3.....	2.05	2.11	2.18	2.25	2.32	2.39	2.45	2.52	2.59	2.66
4.....	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5.....	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6.....	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7.....	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8.....	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9.....	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

Table for converting discharge in second-feet into theoretical horsepower per foot of fall.

[1 second-foot=0.1136 theoretical horsepower per foot of fall. Weight of 1 cubic foot of water=62.5 pounds.]

Tens.	Units.									
	0	1	2	3	4	5	6	7	8	9
0.....	0.00	0.114	0.227	0.341	0.454	0.568	0.682	0.795	0.909	1.02
1.....	1.14	1.25	1.36	1.48	1.59	1.70	1.82	1.93	2.04	2.16
2.....	2.27	2.39	2.50	2.61	2.73	2.84	2.95	3.07	3.18	3.29
3.....	3.41	3.52	3.64	3.75	3.86	3.98	4.09	4.20	4.32	4.43
4.....	4.54	4.66	4.77	4.88	5.00	5.11	5.23	5.34	5.45	5.57
5.....	5.68	5.79	5.91	6.02	6.13	6.25	6.36	6.48	6.59	6.70
6.....	6.82	6.93	7.04	7.16	7.27	7.38	7.50	7.61	7.72	7.84
7.....	7.95	8.07	8.18	8.29	8.41	8.52	8.63	8.75	8.86	8.97
8.....	9.09	9.20	9.32	9.43	9.54	9.66	9.77	9.88	10.0	10.1
9.....	10.2	10.3	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2

1 second-foot equals 40 California miner's inches (law of Mar. 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.

1 second-foot for one year (365 days) covers 1 square mile 1.131 feet or 13.572 inches deep.

1 second-foot for one year (365 days) equals 31,536,000 cubic feet.

1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one year (365 days) equals 724 acre-feet.
1 second-foot for one day equals 86,400 cubic feet.
1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for one day.
1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.
1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.
1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.
1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-foot.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Second-feet} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1913, and ending September 30, 1914. At the first of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water, in the form of snow, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up; at the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for a year beginning with October 1 is practically all derived from precipitation in that year.

The base data collected at gaging stations (Pl. I, *B*) consist of records of stage, measurements of discharge, and general information

used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder (Pl. II) that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. The general methods are outlined in standard textbooks on the measurement of river discharge.

From the discharge measurements rating tables are prepared that give the discharge for any stage, and these rating tables, when applied to the gage heights, give the daily discharge from which the monthly and yearly mean discharge is determined.

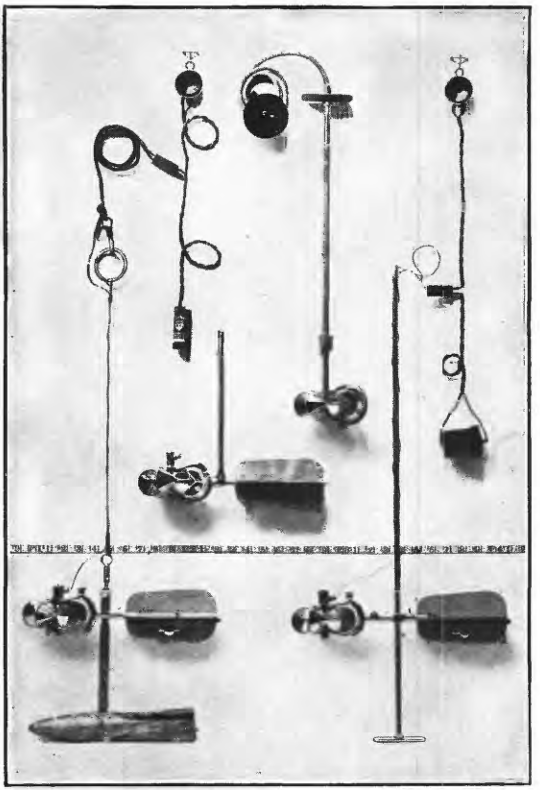
The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

If the base data are insufficient to determine the daily discharge, tables giving daily gage heights and results of discharge measurements are published.

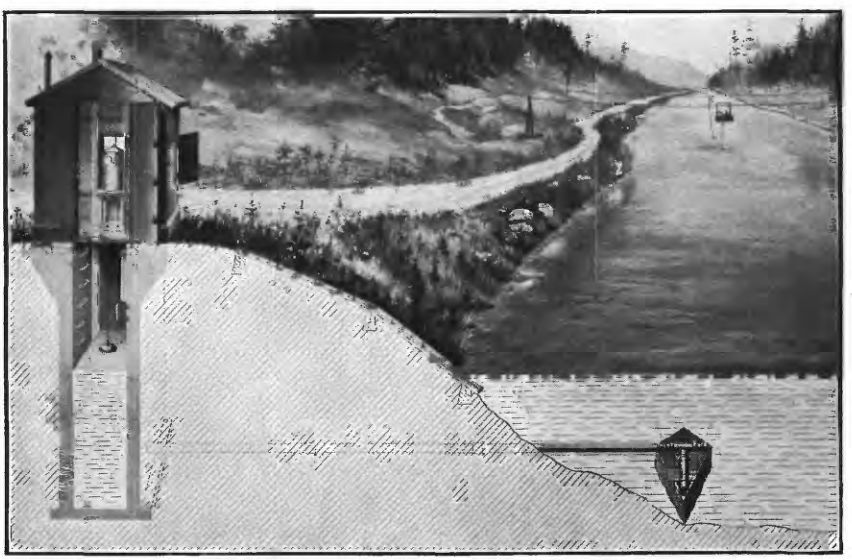
The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the constancy of the discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of channel, and the cause and effect of backwater; it gives also information as to diversions that decrease the flow at the gage, artificial regulation, maximum and minimum recorded stages, and the accuracy of the records.

The table of daily discharge gives the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage heights may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the true mean daily discharge may be obtained by averaging the discharge at regular intervals during the day or by use of the discharge integrator.

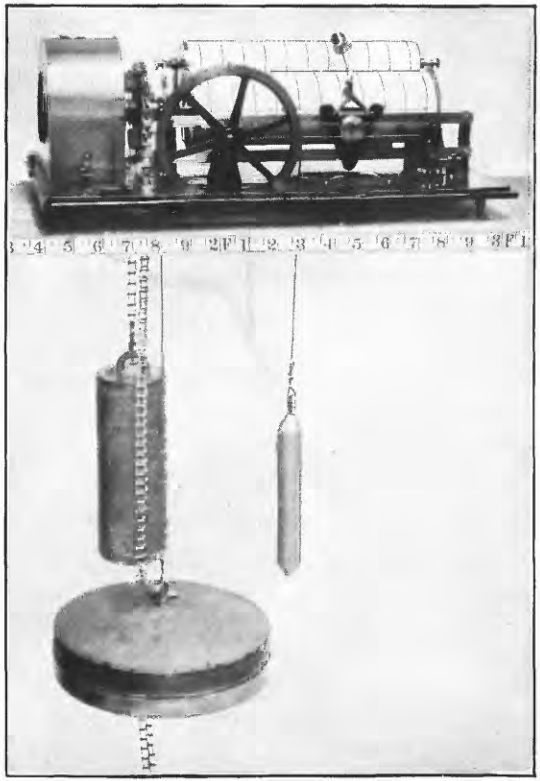
In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on pages 11–12, are based.



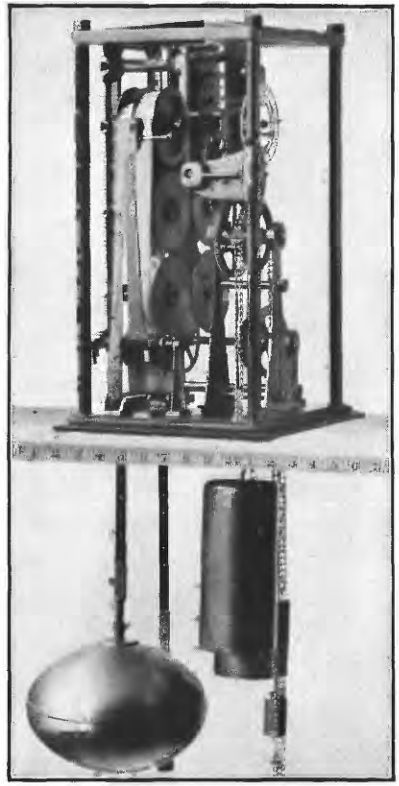
A. PRICE CURRENT METERS.



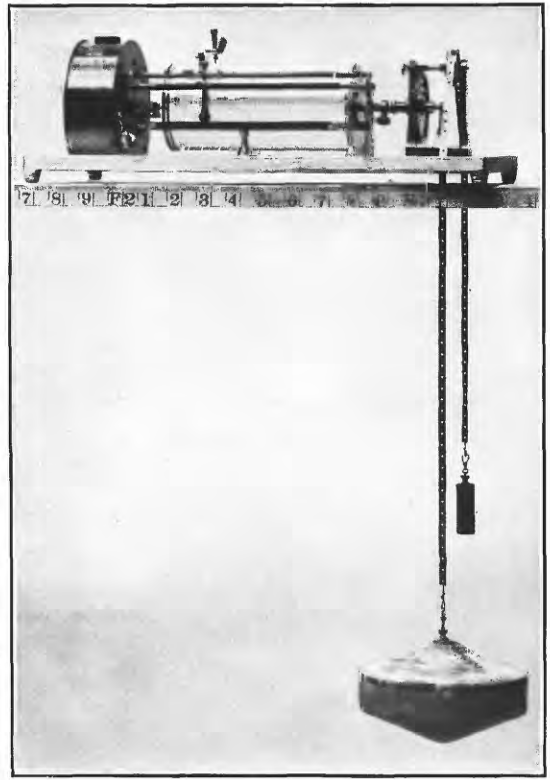
B. TYPICAL GAGING STATION.



A. STEVENS.



B. GURLEY PRINTING.



C. FRIEZ.

WATER-STAGE RECORDERS.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

The accuracy of stream-flow data depends primarily (1) on the permanency of the discharge relation and (2) on the accuracy of observation of stage, measurements of flow, and interpretation of records.

In order to give information regarding the probable accuracy of the computed results footnotes are added to the daily discharge tables, stating the probable accuracy of the rating tables used, and an accuracy column is inserted in the monthly discharge table. For the rating tables, "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate" within 15 to 25 per cent. These notes are general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The accuracy column in the monthly discharge table does not apply to the estimate of maximum or minimum discharge nor to that for any one day, but to the monthly mean. It is based on the accuracy of the rating curve, the probable reliability of the observer, the number of gage readings per day, the range of the fluctuation in stage, and knowledge of local conditions. In this column A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

Even though the monthly means for any station may represent with a high degree of accuracy the quantity of water flowing past the gage, the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors which result from including in the measured drainage area large noncontributing districts or omitting estimates of water diverted for irrigation or other use. "Second-feet per square mile" and "run-off (depth in inches)" have therefore not been computed for streams draining areas in which the annual rainfall is less than 20 inches nor for streams draining areas in which the precipitation exceeds 20 inches if such computations might be uncertain or misleading because of the presence of large noncontributing districts in the measured drainage area, because of the omission of estimates of water diverted for irrigation or other use, or because of artificial control or unusual natural control of the flow of the river above the gaging station. All values of "second-feet per square mile" and "run-off (depth in inches)" previously published by the Survey should be used with care because of possible inherent sources of error not known to the Survey.

The table of monthly discharge is so arranged as to give only a general idea of the flow at the station and should not be used for other than the preliminary estimates; the tables of daily discharge allow more detailed studies of the variation in flow. It should be borne in mind, however, that the observations in each succeeding year may be expected to throw new light on data already collected and published.

COOPERATION.

Much of the work in Montana has been carried on under cooperative agreement with the United States Reclamation Service, the work being done by the Geological Survey and the expense borne by the Reclamation Service. The Legislature of the State of Montana made an appropriation for stream-gaging work, which was expended by the State engineer, as provided in the act, in accordance with paragraph 3, section 2244, of the Revised Codes of 1907 of the State of Montana, which reads as follows:

> The State engineer shall become conversant with the waterways of the State and the needs of the State as to irrigation matters, shall make, or cause to be made, measurements and calculations of the ordinary and flood discharge of streams, cooperating in this work as much as possible with the United States Geological Survey and the Montana Experiment Station; such measurements to be made on streams in order of their importance, provided that measurements already made, if deemed reliable, may be adopted.

This fund was expended largely on work in connection with the several Carey projects in Montana and in computing data on water-right filings and adjudications. A State hydrographer was employed who worked directly with the Geological Survey.

The expense of work on the Crow Reservation in Montana, the Standing Rock Reservation in North and South Dakota, and the Pine Ridge and Rosebud reservations in South Dakota was borne by the Office of Indian Affairs.

In Wyoming and South Dakota the Reclamation Service also cooperated, paying for the maintenance of stations on the North Platte above Pathfinder and the Sweetwater near Alcova and furnishing complete records for the North Platte at Pathfinder at Whalen, Wyo., and for the Belle Fourche at Belle Fourche, S. Dak.

Additional pecuniary assistance in South Dakota was rendered by the State engineer, Mr. Homer M. Derr. Transportation in Yellowstone National Park was furnished by the Superintendent of National Parks. Other assistance in collecting records in the Missouri River basin is acknowledged in connection with the descriptions of the stations.

Field work in Nebraska was carried on by the State engineer, D. D. Price, who paid all field expenses.

DIVISION OF WORK.

Data pertaining to the streams of the Missouri River basin were collected and prepared for publication under the direction of W. A. Lamb, Robert Follansbee, and G. C. Baldwin, district engineers, assisted by B. E. Jones, C. G. Paulsen, H. J. Dean, R. H. Fletcher, A. B. Purton, A. W. Harrington, M. D. Anderson, and C. S. Heidel. Field work in North Dakota was carried on by E. F. Chandler. Field work in Nebraska was carried on under the supervision of D. D. Price, State engineer, by D. P. Weeks, jr.

The manuscript was assembled by H. J. Jackson. The work was completed April 15, 1916, and for some of the stations records available up to that date were used notwithstanding the fact that strictly speaking they pertain to a period not covered by the report.

GAGING-STATION RECORDS.

MISSOURI RIVER PROPER.

RED ROCK RIVER ABOVE RED ROCK RESERVOIR, NEAR MONIDA, MONT.

LOCATION.—In NE. ¼ sec. 8, T. 14 S., R. 4 W., at county road bridge at Lyon's ranch, about 12 miles above the dam of the Red Rock Reservoir & Irrigation Co., and about 11 miles northeast of Monida.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May to October, 1911; April 15 to September 30, 1914.

GAGE.—Vertical staff on downstream side of pier, about 10 feet from left shore. Earlier records were obtained from staff gage at about the same site, but the gage was on a bridge that has been replaced by the one now in use. The bench mark has been destroyed, so no determined relation exists between the datum of the former gage and that of the present gage. Observer, Mark Lyons.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge at gage section.

CHANNEL AND CONTROL.—The stream is extremely sluggish, sediment is apt to accumulate, and aquatic growth on the bed causes backwater. Water begins to overflow the right bank a couple of hundred feet above the gage at a gage height of about 5.5 feet, and the overflow passes under several small bridges along the road.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 6.4 feet, April 21–28 (discharge, 1,030 second-feet); minimum stage recorded, 2.5 feet August 9–17 (discharge, 100 second-feet).

May to October, 1911, and April 15 to September 30, 1914: Maximum stage recorded, 6.4 feet April 21–28, 1914 (discharge, 1,030 second-feet); minimum 2.8 feet August 23, 24, and 26, 1911 (discharge, 65 second-feet). See paragraph on gage.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—None from the river itself above the station, but numerous small tributaries are used for irrigating meadows and hay fields.

ACCURACY.—Records good.

Discharge measurements of Red Rock River above Red Rock reservoir, near Monida, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
April 15	4.56	461
June 5	4.68	492
July 17	3.06	190

Daily discharge, in second-feet, of Red Rock River above Red Rock reservoir, near Monida, Mont., from Apr. 15 to Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	805	427	275	130	122	16	494	471	427	194	100	146
2	.....	805	406	258	130	122	17	541	566	427	186	100	146
3	.....	770	517	242	130	122	18	620	592	406	178	108	146
4	.....	740	517	226	130	122	19	680	620	347	178	115	146
5	.....	620	471	258	130	122	20	840	620	427	178	115	154
6	.....	592	471	226	115	122	21	.....	650	471	178	115	186
7	.....	592	494	250	115	122	22	.....	650	406	178	115	186
8	.....	566	517	226	115	122	23	.....	620	406	178	115	162
9	.....	566	494	226	100	122	24	.....	592	386	162	115	146
10	.....	517	471	310	100	122	25	.....	566	386	146	115	154
11	.....	517	427	328	100	122	26	.....	541	386	130	115	178
12	.....	517	427	258	100	122	27	.....	517	347	146	115	162
13	.....	494	494	234	100	122	28	.....	494	310	138	115	170
14	.....	471	566	226	100	130	29	840	471	310	130	122	170
15	471	449	566	226	100	130	30	840	427	275	138	122	170
							31	.....	427	.....	130	122	.....

NOTE.—Discharge determined from a well-defined rating curve. Water over gage Apr. 21–28; mean discharge 1,030 second-feet, from observer's notes as to estimated height of water above gage.

Monthly discharge of Red Rock River above Red Rock reservoir near Monida, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April 15–30	1,030	471	[a]848	26,900	B.
May	805	427	576	35,400	A.
June	566	275	433	25,800	A.
July	328	130	204	12,500	A.
August	130	100	114	7,010	A.
September	186	122	142	8,450	A.
The period	.....	.....	.....	116,000	

[a] Partly estimated; see footnote to table of daily discharge.

RED ROCK RIVER BELOW RED ROCK RESERVOIR, NEAR MONIDA, MONT.

LOCATION.—In sec. 32, T. 13 S., R. 6 W., just below the reservoir of the Red Rock Reservoir & Irrigation Co., 8 miles northeast of Monida, and 15 miles east of Lima.

DRAINAGE AREA.—About 560 square miles.

RECORDS AVAILABLE.—July 22, 1911, to September 30, 1914. Also miscellaneous measurements made in summer of 1910.

GAGE.—Gage heights indicate head on crest of a 40-foot weir about 150 yards below the dam. The observer reads with a graduated rod the depth on a peg set with its top at the elevation of the crest of the weir. Observer, P. V. Maxwell.

DISCHARGE MEASUREMENTS.—Made from footbridge about 40 feet above the weir at ordinary and high stages; at low stages made by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel, pebbles, and bowlders; banks are high and neither is subject to overflow. Current is so swift during high water that if the channel is cleaned out above the weir it soon becomes partly filled with rocks and pebbles which cause a considerable velocity of approach. Rating curve apparently indicates little change after the natural deposit has been allowed to rest undisturbed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.2 feet at 8 a. m. April 28 (discharge, 1,220 second-feet); minimum stage, 0.22 foot at 8 a. m. and 5 p. m. January 19 to February 9, February 11–26, March 14, 16, 29 to April 3 (discharge, 15 second-feet).

1911–1914: Maximum stage recorded, 3.2 feet April 28, 1914 (discharge, 1,220 second-feet); minimum stage, 0.10 foot January 1 to April 10, 1913 (discharge, 5 second-feet).

WINTER FLOW.—Discharge relation probably affected by ice.

REGULATION.—The Red Rock dam is used to store flood waters to be released as required during the last part of the irrigating season.

ACCURACY.—Gage readings reliable; results considered good.

COOPERATION.—Gage height record furnished by the Red Rock Reservoir & Irrigation Co.

Discharge measurements of Red Rock River below Red Rock reservoir, near Monida, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
April 16	1.80	451
June 5	2.08	604
July 17	1.27	251

Daily discharge, in second-feet, of Red Rock River below Red Rock reservoir, near Monida, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	252	280	149	30	15	17	15	1,100	540	360	133	104
2	276	280	86	30	15	17	15	1,040	540	340	128	106
3	266	280	84	30	15	17	15	1,040	540	320	126	106
4	266	280	58	29	15	17	17	975	540	320	126	106
5	262	280	58	30	15	17	17	915	565	320	126	106
6	262	280	58	24	15	17	20	915	590	320	126	104
7	262	280	58	19	15	17	28	860	590	320	125	106
8	262	280	30	18	15	17	49	860	590	266	102	106
9	262	280	30	18	15	17	86	860	590	219	81	106
10	262	165	30	18	17	17	124	860	590	219	79	106
11	262	149	30	18	15	17	160	860	590	219	77	106
12	280	149	30	18	15	17	219	805	590	225	79	106
13	280	149	30	18	15	17	266	722	590	232	81	106
14	273	149	30	18	15	15	312	590	590	232	81	106
15	280	151	30	18	15	17	400	590	590	245	81	106
16	280	149	30	18	15	15	445	590	590	232	81	108
17	312	149	30	18	15	18	490	590	590	232	81	108
18	336	146	30	17	15	18	590	540	590	228	81	110
19	340	146	30	15	15	17	640	540	590	182	81	110
20	312	146	30	15	15	17	722	540	565	182	81	110
21	292	149	30	15	15	17	778	565	565	185	81	110
22	288	149	29	15	15	17	860	590	540	182	81	110
23	288	149	30	15	15	17	975	590	540	185	81	113
24	280	151	30	15	15	17	975	590	540	182	81	115
25	280	151	30	15	15	17	1,040	590	540	182	81	115
26	300	149	30	15	15	17	1,100	590	540	182	94	117
27	300	149	30	15	17	17	1,160	590	540	182	106	117
28	280	151	30	15	17	17	1,220	590	515	160	106	117
29	280	149	30	15	.....	15	1,160	590	468	141	106	117
30	280	151	30	15	.....	15	1,160	590	468	141	106	119
31	280	.....	30	15	.....	15	.....	590	.....	141	106	.....

NOTE.—Daily discharge determined from a well-defined rating curve.

Monthly discharge of Red Rock River below Red Rock reservoir, near Monida, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	340	252	282	17,300	A.
November	280	146	189	11,200	A.
December	149	29	41.0	2,520	B.
January	30	15	18.8	1,160	B.
February	17	15	15.2	844	B.
March	18	15	16.7	1,030	A.
April	1,220	15	502	29,900	A.
May	1,100	540	718	44,100	A.
June	590	468	560	33,300	A.
July	360	141	228	14,000	A.
August	133	77	96.3	5,920	A.
September	119	104	109	6,490	A.
The year	1,220	15	232	168,000	

BEAVERHEAD RIVER AT BARRATTS, MONT.

LOCATION.—In the SW. ¼ SW. ¼ sec. 20, T. 8 S., R. 9 W., a mile above Barratts and 10 miles southwest of Dillon.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 12, 1907, to September 30, 1914.

GAGE.—A standard chain gage was installed on the downstream side of the bridge June 22, 1908, to replace the ordinary staff gage which had previously been used; datum of chain gage the same as that of the staff gage. Observer, M. E. Meeds.

DISCHARGE MEASUREMENTS.—Made from downstream side of the bridge.

CHANNEL AND CONTROL.—Slightly shifting; rocky at the measuring section.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.15 feet at 6 p. m. May 11 (discharge, 1,410 second-feet); minimum stage recorded, 0.6 foot at 7 a. m. and 6 p. m. August 25–31 (discharge, 151 second-feet).

1907–1914: Maximum stage recorded, 6.0 feet June 19 and 20, 1908 (discharge, 3,640 second-feet); minimum stage recorded, 0.42 foot June 23, 1910 (discharge, 114 second-feet).

Records include winter flow for years 1908 to 1910, inclusive. For the remainder of the period winter records are not available and a flow lower than that recorded may have occurred.

WINTER FLOW.—Discharge relation sometimes affected by ice.

DIVERSIONS.—A large number of diversions are made above the station. Decreed water rights, aggregating 85,866 inches of water, are filed on from Lima on Red Rock River to a point 10 miles above Twin Bridges. The three largest canals diverted below the station are Canyon Creek canal, appropriating 6,000 inches; Union canal, appropriating 4,000 inches; and Beaverhead canal, diverted just north of Dillon, appropriating 5,000 inches. The Union Electric Co., of Dillon, has a canal with a carrying capacity of 6,000 inches.

ACCURACY.—Results good.

Beaverhead River is called Red Rock River from its source in Red Rock Lakes to the post office of Red Rock, below which it is called the Beaverhead. The principal tributaries to the Beaverhead above the station are Grasshopper Creek, 12 miles south of Dillon; Horse Prairie Creek, 20 miles south; and Rattlesnake and Blacktail Deer Creeks. Irrigation has probably been practiced in Beaverhead Valley longer than in any other valley in Montana, ditches constructed in the early seventies being still in operation.

Discharge measurements of Beaverhead River at Barratts, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Apr. 16	2.15	816
June 4	2.92	1,270
July 16	1.28	405

Daily discharge, in second-feet, of Beaverhead River at Barratts, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	600	675	500	.....	299	1,220	869	447	299	166
2	600	700	450	.....	318	1,220	869	447	280	175
3	600	700	450	.....	318	1,290	1,040	447	280	181
4	600	700	400	.....	359	1,350	1,220	402	280	196
5	625	675	400	.....	359	1,290	1,350	402	262	196
6	650	675	400	.....	402	1,290	1,410	402	245	196
7	650	675	375	.....	494	1,220	1,350	402	245	196
8	650	700	350	.....	543	1,160	1,220	402	245	196
9	650	700	350	.....	518	1,220	1,100	402	228	196
10	650	700	305	.....	494	1,290	986	447	228	206
11	675	675	305	.....	470	1,410	869	402	245	212
12	675	650	305	.....	518	1,290	869	402	219	228
13	675	650	305	.....	543	1,100	927	402	212	252
14	700	650	305	.....	647	1,100	869	402	212	280
15	700	650	305	.....	728	1,040	869	402	212	299
16	700	675	305	.....	812	1,100	869	402	181	318
17	700	675	305	.....	869	1,140	869	402	181	338
18	675	650	305	.....	869	1,140	812	402	181	359
19	700	650	305	.....	869	1,100	756	402	181	359
20	700	650	305	.....	986	1,100	701	402	181	359
21	700	650	285	.....	1,100	1,040	647	402	181	359
22	700	600	285	280	1,160	1,040	756	402	181	338
23	675	600	285	280	1,220	986	756	402	166	338
24	650	600	285	280	1,160	927	701	359	166	359
25	675	575	285	280	1,160	927	674	359	151	359
26	650	550	265	280	1,160	927	647	359	151	359
27	650	550	265	280	1,160	956	594	359	151	359
28	650	550	265	280	1,160	898	594	338	151	359
29	650	500	265	299	1,160	869	518	318	151	368
30	650	500	265	299	1,220	869	494	318	151	380
31	650	.....	265	318	.....	869	.....	318	151	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Dec. 31, form a rating curve well defined between 500 and 1,400 second-feet; Mar. 22 to Sept. 30, from a rating curve well defined between 150 and 1,400 second-feet; Dec. 20–31 estimated.

Monthly discharge of Beaverhead River at Barratts, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	700	600	660	40,600	A.
November	700	500	638	38,000	A.
December	500	265	324	19,900	B.
March 22–31	318	280	288	5,710	A.
April	1,220	299	769	45,800	A.
May	1,410	869	1,110	68,300	A.
June	1,410	494	874	52,000	A.
July	447	318	392	24,100	A.
August	299	151	205	12,600	A.
September	380	166	283	16,800	A.

JEFFERSON RIVER NEAR SILVERSTAR, MONT.

LOCATION.—In sec. 23, T. 2 S., R. 6 W., at the big highway bridge on the road from Silverstar to Iron Rod, a station on the Alder branch of the Northern Pacific Railway. The principal tributaries below the station are Pipestone and Whitetail creeks and Boulder River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 11, 1910, to September 30, 1914.

GAGE.—Standard staff gage fastened to pier on downstream side. Observer, C. A. Barkell.

DISCHARGE MEASUREMENTS.—Made from the lower side of highway bridge.

CHANNEL AND CONTROL.—Gravel; control probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.25 feet at 8 a. m., June 6 (discharge, 9,030 second-feet); minimum stage, 2.0 feet at 8 a. m., August 29–30 (discharge, 460 second-feet).

1910–1914: Maximum stage recorded, 8.8 feet June 15, 1913 (discharge, 16,500 second-feet); minimum stage, 1.7 feet August 22, 1910 (discharge, 320 second-feet).

Open-season records only; a flow lower than that recorded may have occurred during the winter months.

WINTER FLOW.—Discharge relation affected by ice; observations discontinued during winter.

DIVERSION.—Irrigation is carried on extensively from the headwaters of this stream to its mouth.

ACCURACY.—Results good.

Discharge measurements of Jefferson River near Silverstar, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Oct. 10	3.10	1,610
Apr. 18	3.70	2,730
June 9	5.27	6,200

Daily discharge, in second-feet, of Jefferson River near Silverstar, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,380	1,760	805	.....	1,060	2,980	4,700	3,990	670	520
2	1,310	1,840	.....	.....	1,060	2,870	5,190	3,990	670	520
3	1,240	2,000	.....	.....	1,060	2,870	5,690	3,990	670	555
4	1,240	1,840	.....	.....	1,120	3,090	6,730	3,990	670	555
5	1,310	1,760	.....	.....	1,180	3,090	8,340	3,990	630	555
6	1,310	1,760	.....	.....	1,760	3,200	8,610	3,990	630	555
7	1,310	1,680	.....	.....	2,360	3,200	7,530	3,310	630	590
8	1,380	1,600	.....	.....	2,560	3,310	6,990	2,980	590	590
9	1,450	1,600	.....	.....	2,460	3,530	6,470	2,460	520	590
10	1,600	1,600	.....	.....	2,090	3,990	5,950	2,180	520	670
11	1,450	1,600	.....	.....	2,270	4,940	5,190	1,760	520	715
12	1,450	1,680	.....	.....	2,460	5,190	4,940	1,920	520	805
13	1,600	1,680	.....	.....	2,460	3,990	4,700	2,000	555	900
14	1,600	1,760	.....	.....	2,560	3,990	4,700	1,920	555	950
15	1,600	1,840	.....	.....	2,660	4,700	4,700	1,840	555	1,000
16	1,680	1,920	.....	1,180	3,090	5,190	4,700	1,760	555	1,060
17	1,760	1,920	.....	1,180	2,980	5,690	4,460	1,760	555	1,120
18	1,920	1,840	.....	1,180	2,760	6,210	4,460	1,760	555	1,120
19	1,840	1,760	.....	1,240	2,760	6,470	4,940	1,450	555	1,180
20	1,760	1,680	.....	1,240	2,870	6,990	5,190	1,380	520	1,310
21	1,760	1,450	.....	1,310	2,980	7,260	5,190	1,310	520	1,310
22	1,680	1,450	.....	1,380	3,200	7,260	5,190	1,240	520	1,450
23	1,680	1,450	.....	1,310	3,310	7,260	5,190	1,060	520	1,380
24	1,680	1,450	.....	1,310	3,530	7,530	4,940	1,060	520	1,310
25	1,680	1,450	.....	1,240	3,200	7,530	4,940	1,060	520	1,310
26	1,760	1,380	.....	1,180	3,200	6,730	4,940	900	520	1,240
27	1,760	1,380	.....	1,180	3,200	6,210	4,700	850	520	1,240
28	1,840	1,310	.....	1,180	3,200	5,950	4,700	760	490	1,240
29	1,840	1,310	.....	1,120	3,090	5,190	4,460	760	460	1,310
30	1,760	1,380	.....	1,120	3,090	4,940	4,220	760	460	1,310
31	1,680	.....	.....	1,060	.....	4,700	.....	715	490	.....

NOTE.—Discharge computed from a well-defined rating curve.

Monthly discharge of Jefferson River near Silver Star, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	1,920	1,240	1,590	97,800	A.
November	2,000	1,310.	1,640	97,600	A.
March 16-31	1,380	1,060	1,210	38,400	A.
April	3,530	1,060	2,520	150,000	A.
May	7,530	2,870	5,030	309,000	A.
June	8,610	4,220	5,420	323,000	A.
July	3,990	715	2,030	125,000	A.
August	670	460	554	34,100	A.
September	1,450	520	965	57,400	A.

MISSOURI RIVER AT TOSTON, MONT.

LOCATION.—In the SW. ¼ sec. 23, T. 5 N., R. 2 E., at the highway bridge crossing Missouri River at Toston, about 25 miles below the union of Gallatin, Jefferson, and Madison rivers. Only important tributary between gaging station and the headwater forks is Sixteenmile Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 5, 1910, to September 30, 1914.

GAGE.—Standard chain gage attached to downstream side of bridge. Observer, W. B. Lorentz.

DISCHARGE MEASUREMENTS.—Made from cable 200 feet above bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.5 feet at 8 a. m. May 26 (discharge, 19,900 second-feet); minimum stage recorded, February 10 (discharge estimated 1,100 second-feet, from discharge at Canyon Ferry dam). Discharge relation of gage at Toston affected by ice.

1910–1914: Maximum stage recorded, 9.4 feet June 1, 1913 (discharge, 29,800 second-feet); minimum stage recorded, February 10, 1914 (discharge estimated 1,100 second-feet).

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—A number of diversions are made from tributaries above the station.

ACCURACY.—No discharge measurements made during year ending September 30, 1914, but results of a measurement made October 8, 1914, and the permanency of the discharge relation indicates that the records are good.

Daily discharge, in second-feet, of Missouri River at Toston, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,890	5,230	4,250	3,520	2,960	4,890	3,950	7,480	15,400	7,080	2,850	2,360
2	4,250	5,230	3,950	3,380	2,080	4,560	4,250	7,890	15,400	6,690	2,130	2,480
3	4,250	5 230	3,660	3,950	2,620	5,230	3,950	7,890	15,900	5,580	2,600	2,240
4	4,250	5,230	3,380	3,950	3,180	4,890	3,950	8,300	17,400	5,070	2,600	2,480
5	4,400	5,580	3,380	4,250	3,470	4,560	3,660	9,130	18,900	4,560	2,600	2,480
6	4,400	5,580	3,110	4,560	3,550	4,890	4,890	9,130	19,900	4,560	2,360	2,360
7	4,890	5,230	3,110	3,660	3,270	4,560	5,230	8,300	18,900	5,230	2,240	2,130
8	4,890	5,230	3,240	3,950	3,880	4,890	5,230	7,890	16,400	4,250	2,130	1,820
9	5,230	5,230	3,660	3,950	1,780	4,890	5,580	7,890	15,000	4,560	2,360	2,480
10	4,890	5,230	3,110	3,110	1,100	4,250	4,890	8,300	13,100	3,950	2,130	2,480
11	4,890	5,580	3,520	3,110	2,230	4,250	5,230	11,300	12,200	4,250	2,240	2,850
12	4,890	5,230	3,380	2,480	3,350	3,950	5,230	11,700	10,800	4,890	2,130	2,850
13	5,230	5,230	3,380	2,850	4,150	4,250	5,230	11,300	10,400	4,890	2,130	2,720
14	5,580	5,230	3,520	3,110	4,280	4,250	5,900	11,700	10,400	5,230	1,920	2,850
15	5,580	5,230	3,800	3,110	4,060	4,250	6,560	11,300	10,800	4,560	1,920	2,980
16	5,580	5,230	3,800	3,950	3,530	4,560	7,220	11,700	11,300	4,250	1,920	2,980
17	5,580	5,230	3,660	4,250	4,870	4,250	7,890	13,100	10,800	3,950	1,730	2,720
18	5,230	4,890	3,800	3,950	5,250	4,250	7,080	14,000	9,990	3,660	1,820	2,720
19	4,890	5,230	4,560	3,660	6,160	4,250	7,080	15,400	10,400	3,660	2,130	2,850
20	4,890	5,230	4,100	3,380	5,510	3,950	6,690	15,900	9,990	3,380	2,130	2,720
21	5,230	5,230	4,250	3,950	1,650	4,250	7,890	16,900	10,800	3,110	2,240	3,660
22	5,230	4,560	4,100	3,660	5,260	3,950	8,300	17,400	11,700	3,110	2,360	3,660
23	4,890	4,560	4,250	3,950	5,060	4,250	7,480	17,400	11,300	2,850	2,360	3,380
24	4,560	4,560	4,100	3,660	4,700	4,250	8,300	19,400	11,300	2,850	2,130	3,660
25	5,230	4,250	3,950	3,380	6,140	3,950	7,890	18,900	9,560	3,110	2,130	3,380
26	5,230	4,560	3,520	4,250	5,360	4,250	8,710	19,900	9,990	3,110	2,240	3,110
27	4,890	4,560	3,950	3,950	5,820	3,950	8,300	18,400	9,990	3,110	2,360	3,110
28	4,890	4,560	4,560	4,560	5,610	4,100	7,890	16,900	9,130	3,110	2,360	3,380
29	5,230	4,250	3,950	3,950	.....	4,250	7,890	17,400	8,710	3,110	2,360	3,660
30	5,230	4,560	3,660	3,110	.....	3,660	7,480	15,900	7,080	3,380	2,130	3,950
31	5,230	.....	3,660	3,380	.....	4,100	.....	15,400	.....	2,850	2,600	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve. Discharge relation affected by ice during February. Daily discharge record for February was supplied by engineers of the Montana Power Co., and represents the flow at Canyon Ferry. The monthly flow at Toston is practically the same as that at Canyon Ferry, but the diurnal flow at Canyon Ferry is regulated by the dam and reservoir and therefore differs somewhat from that at Toston. Discharge interpolated Apr. 14-16 and Sept. 29.

Monthly discharge of Missouri River at Toston, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	5,580	4,250	4,980	306,000	B.
November	5,580	4,250	5,030	299,000	B.
December	4,560	3,110	3,750	231,000	B.
January	4,560	2,480	3,680	226,000	B.
February	.....	.....	3,960	220,000	C.
March	5,230	3,660	4,350	267,000	B.
April	8,710	3,660	6,330	377,000	B.
May	19,900	7,480	13,000	799,000	B.
June	19,900	7,080	12,400	738,000	B.
July	7,080	2,850	4,130	254,000	B.
August	2,850	1,730	2,240	138,000	B.
September	3,950	1,820	2,880	171,000	B.
The year	19,900	.....	5,570	4,030,000	

NOTE.—See footnote to table of daily discharge.

MISSOURI RIVER AT CASCADE, MONT.

LOCATION.—In sec. 35, T. 18 N., R. 1 W., at the highway bridge, 100 yards from the Great Northern Railway, on the east side of the town of Cascade.

DRAINAGE AREA.—18,300 square miles.

RECORDS AVAILABLE.—July 20, 1902, to September 30, 1914.

GAGE.—Standard chain gage attached to the bridge; datum unchanged. Observers, W. W. Doan and R. E. Wahn.

DISCHARGE MEASUREMENTS.—Made from lower side of bridge.

CHANNEL AND CONTROL.—Probably permanent except at extreme flood stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.9 feet at 11.45 a. m., May 27 and June 9 (discharge, 22,800 second-feet); minimum stage recorded, 3.1 feet at 7.15 a. m., September 2 (discharge, 800 second-feet).

1902–1914: Maximum stage recorded, 15.45 feet June 5, 1908 (discharge, 49,300 second-feet); minimum stage recorded, 3.1 feet September 2, 1914 (discharge, 800 second-feet). Open-season records. Estimates of mean monthly discharge only are available for the winter months.

WINTER FLOW.—Discharge relation affected by ice.

STORAGE.—The Montana Power Co. has a large reservoir near Helena, between the stations at Toston and Cascade.

ACCURACY.—Results good.

REMARKS.—The most important tributaries between this station and the station at Toston, above, are Dearborn River, Little Prickly Pear Creek, and Prickly Pear Creek. Although irrigation is extensively practiced in the Missouri River valley, the water is taken from the tributary streams, the Missouri itself being little used because of its high banks, great variation in flow, and difficulty of diversion.

No discharge measurement was made in the year ending September 30, 1914.

Daily discharge, second-feet, of Missouri River at Cascade, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,650	6,750	5,510	.....	4,930	9,530	17,900	11,800	3,340	1,260
2	4,110	6,750	5,810	.....	5,220	6,750	17,100	10,300	3,100	800
3	4,380	7,080	5,510	.....	4,930	11,400	16,700	9,900	3,340	3,850
4	5,510	7,080	5,510	.....	5,510	11,800	17,900	9,160	3,340	3,590
5	5,510	6,750	4,930	.....	5,510	10,700	18,600	6,750	3,340	2,410
6	5,510	6,430	4,110	6,120	5,810	11,400	19,800	7,410	3,100	1,610
7	4,930	6,120	3,850	6,430	6,430	12,900	20,900	6,120	2,630	1,610
8	5,220	6,120	3,340	6,750	7,410	11,800	21,700	5,810	2,000	1,430
9	5,510	7,080	3,850	6,120	7,750	9,900	22,800	5,810	3,100	1,800
10	5,220	6,750	3,850	5,810	7,410	10,300	21,300	5,220	2,630	3,100
11	5,510	6,430	3,590	6,750	7,750	4,930	19,800	5,220	2,000	3,100
12	6,750	6,430	3,850	6,120	7,750	11,800	17,900	5,220	2,200	2,200
13	7,080	6,430	3,590	6,430	8,100	14,800	13,700	5,220	2,000	1,800
14	7,410	6,120	3,590	5,810	8,100	16,000	18,300	5,220	2,410	2,200
15	6,750	5,810	3,340	4,930	8,800	17,100	17,500	5,220	2,630	3,100
16	6,750	6,120	2,860	5,510	9,160	15,600	16,700	5,510	1,800	4,380
17	6,750	6,120	3,340	6,120	10,300	15,600	16,000	5,510	1,260	4,380
18	6,750	6,750	3,850	6,750	11,800	16,000	15,200	4,380	1,800	3,340
19	6,750	6,430	4,380	5,510	11,000	17,900	14,800	4,110	3,590	3,850
20	6,430	6,430	4,380	5,810	11,400	18,300	14,100	4,110	3,340	3,340
21	5,810	6,430	4,930	5,510	11,800	20,900	13,700	3,850	2,630	3,100
22	6,120	5,220	.....	5,220	11,000	19,400	12,900	4,110	2,630	2,410
23	5,810	4,220	.....	5,510	10,300	19,800	13,700	3,850	2,200	2,630
24	6,120	4,930	.....	5,510	10,300	21,300	13,700	3,850	1,800	3,850
25	6,750	5,510	.....	5,220	9,900	20,900	14,500	3,850	1,430	4,650
26	6,120	5,510	.....	5,510	9,160	21,700	12,900	3,850	1,430	4,380
27	5,220	4,510	.....	5,220	9,530	22,800	12,200	3,340	1,430	3,850
28	6,120	5,220	.....	4,930	10,700	22,400	12,600	3,590	2,200	2,860
29	6,430	5,510	.....	5,220	10,700	22,400	12,600	3,590	2,200	3,850
30	6,120	5,510	.....	3,850	9,960	20,900	12,200	3,340	2,000	4,110
31	6,120	.....	.....	4,930	.....	19,400	.....	3,590	1,800	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined above 2,000 second-feet and poorly defined at lower stages. Discharge relation affected by ice Dec. 22 to Mar. 5, and mean discharge estimated from flow at Toston and Canyon Ferry as follows: Dec. 22–31, 4,500 second-feet; Jan. 1–31, 3,900 second-feet; Feb. 1–28, 4,550 second-feet; Mar. 1–5, 6,200 second-feet.

Monthly discharge of Missouri River at Cascade, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	7,410	4,110	5,940	365,000	B.
November	7,080	4,930	6,150	366,000	B.
December	5,810	.....	a 4,290	264,000	C.
January	.....	.....	a 3,900	240,000	C.
February	.....	.....	a 4,550	253,000	C.
March	6,750	3,850	a 5,760	354,000	B.
April	11,800	4,930	8,610	512,000	B.
May	22,800	4,930	15,700	965,000	B.
June	22,800	12,200	16,300	970,000	B.
July	11,800	3,340	5,450	335,000	B.
August	3,590	1,260	2,410	148,000	B.
September	4,650	800	2,960	176,000	B.
The year	22,800	.....	6,840	4,950,000	

a Estimated or partly estimated; see footnote to table of daily discharge.

MISSOURI RIVER AT FORT BENTON, MONT.

LOCATION.—In the NE. ¼ sec. 26, T. 24 N., R 8 E., at the public highway bridge at Fort Benton.

DRAINAGE AREA.—24,600 square miles.

RECORDS AVAILABLE.—July 1, 1902, to April 27, 1910, gage heights recorded by United States Weather Bureau; April 28, 1910, to September 30, 1914, United States Geological Survey records, including partial estimates of run-off for the years 1910 to 1914.

GAGE.—A Mott gage installed April 11, 1907, on upstream side of bridge; gage heights for 1911 to 1914 are referred to the datum used by the United States Army engineers from 1881 to 1890, which is 0.43 feet higher than that used by the United States Geological Survey in 1910. Observer, W. P. Ward.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.9 feet, September 15–16 (discharge 28,900 second-feet); minimum stage recorded, —0.2 foot September 10 (discharge, 2,250 second-feet).

1881–1914: Maximum stage recorded, 6.4 feet June 16 and 20, 1912 (discharge, 31,900 second-feet); maximum gage height reported by United States Weather Bureau, 15.3 feet June 7, 1908 (discharge not computed); minimum stage recorded, —0.2 foot September 10, 1914 (discharge, 2,250 second-feet); minimum gage height, reported by United States Weather Bureau, —0.5 foot August 7–10, 17 and 18, 1910 (discharge not computed).

Open season records only; flow may have been lower at times during winter months.

WINTER FLOW.—Discharge relation affected by ice.

ACCURACY.—Results good.

Discharge measurements of Missouri River at Fort Benton, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 14	W. A. Lamb	1.72	7,360	Apr. 25	B. E. Jones	2.65	11,600
Apr. 11	.....do	1.93	8,050	July 16	.....do	1.31	6,480

Daily discharge, in second-feet, of Missouri River at Fort Benton, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5,000	8,100	6,700	.....	5,650	12,000	25,300	13,500	3,000	2,750
2	5,000	8,100	6,700	.....	6,000	12,000	25,300	13,000	3,000	3,000
3	5,000	8,450	6,700	.....	6,350	12,000	25,300	12,000	3,000	2,750
4	5,300	8,450	6,350	.....	6,350	12,000	25,300	11,200	2,750	2,750
5	5,650	8,100	6,350	.....	6,700	13,000	25,300	10,400	2,750	4,250
6	5,650	8,100	5,000	.....	7,400	13,500	25,900	9,200	2,750	4,000
7	6,000	8,100	4,500	.....	7,750	14,000	25,900	8,100	2,750	3,500
8	6,350	8,450	4,750	.....	8,100	14,500	25,900	8,100	2,750	2,500
9	6,700	8,450	5,000	.....	8,450	15,000	25,900	7,400	2,750	2,500
10	7,050	8,450	5,650	.....	8,450	16,000	25,900	7,050	2,500	2,250
11	7,400	8,450	4,750	.....	8,450	16,500	25,900	6,700	2,750	2,500
12	7,750	8,100	5,000	.....	8,800	17,500	26,500	6,350	2,750	3,000
13	7,750	8,100	5,000	.....	9,200	18,500	27,100	6,000	2,750	3,000
14	8,100	8,100	5,300	.....	9,600	19,200	28,300	5,650	2,750	3,000
15	8,450	7,750	5,650	.....	10,400	19,600	28,900	5,650	2,750	2,750
16	9,200	7,750	5,650	.....	10,800	20,600	28,900	5,300	2,750	3,000
17	9,600	7,750	5,650	.....	11,200	21,200	28,300	7,400	2,750	3,250
18	10,400	7,750	5,300	.....	11,600	22,300	27,100	6,700	2,750	4,250
19	9,600	7,750	5,000	.....	12,000	22,900	25,900	6,000	2,500	4,250
20	9,600	7,050	5,000	.....	12,500	24,100	24,700	5,000	2,500	3,500
21	9,600	6,000	4,750	.....	13,000	25,300	23,500	5,300	3,000	3,750
22	9,200	5,650	4,500	6,350	12,500	25,300	22,300	5,000	3,250	3,750
23	9,200	5,650	4,500	6,700	12,500	26,500	21,200	5,000	3,250	3,750
24	8,800	6,000	4,250	6,700	12,500	27,100	20,100	5,000	3,250	3,750
25	8,800	6,000	4,250	6,700	12,500	27,700	19,000	5,000	2,750	3,750
26	8,450	6,000	4,250	6,700	12,500	27,700	17,500	4,000	2,750	4,000
27	8,450	6,350	4,500	6,700	12,500	28,300	17,000	4,000	2,750	4,250
28	8,450	6,700	4,500	6,700	12,500	27,700	16,000	4,000	2,750	4,500
29	8,100	6,700	4,500	6,350	12,000	27,100	15,000	4,000	2,750	5,000
30	8,100	6,700	4,500	6,000	12,000	26,500	14,000	4,000	2,750	4,250
31	7,750	.....	4,500	5,650	.....	25,900	.....	3,750	2,500	.....

NOTE.—Daily discharge determined from a well-defined rating curve. Discharge interpolated Nov. 16. Discharge after July 7 determined from gage readings furnished by Weather Bureau and may be considerably in error owing to an unknown correction apparently applied to gage readings by the observer; monthly means are fair, however, as shown by comparison with record obtained at Cascade.

Monthly discharge of Missouri River at Fort Benton, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	10,400	5,000	7,760	477,000	B.
November	8,450	5,650	7,440	443,000	B.
December	6,700	4,250	5,130	315,000	B.
March 22–31	6,700	5,650	6,460	128,000	B.
April	13,000	5,650	10,000	595,000	B.
May	28,300	12,000	20,400	1,250,000	B.
June	28,900	14,000	23,800	1,420,000	B.
July	13,500	3,750	6,770	416,000	C.
August	3,250	2,500	2,800	172,000	C.
September	5,000	2,250	3,450	205,000	C.

TRIBUTARY BASINS.

PASSAMARI RIVER[1] NEAR ALDER, MONT.

LOCATION.—At the private bridge on Lauterbach's ranch, about 8 miles south of Alder.

DRAINAGE AREA.—About 540 square miles.

[1] Known locally as Ruby River.

RECORDS AVAILABLE.—April 27, 1911, to June 30, 1914, when station was discontinued.

GAGE.—Vertical staff spiked to bridge pile 4 feet from right bank. Observer, Fred Broers.

DISCHARGE MEASUREMENTS.—At low and ordinary stages made by wading on riffle at control 200 feet below gage; high-stage measurements made from downstream side of bridge.

CHANNEL AND CONTROL.—Slightly shifting. Bed of stream below the gage composed of gravel and pebbles. At the gage the water is deeper and the material of the bed is finer than below.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—A number of small diversions are made for irrigation.

ACCURACY.—Results good.

Discharge measurements of Passamari River at Alder, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Oct. 8	4.30	184
Apr. 20	4.50	225
June 8	5.40	552

Daily discharge, in second-feet, of Passamari River near Alder, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	Day.	Oct.	Nov.	Dec.	Apr.	May.	June.
1	.....	192	166	.....	275	780	16	.....	192	.....	.....	628	552
2	.....	219	166	.....	337	856	17	.....	192	.....	.....	704	514
3	.....	206	166	.....	372	895	18	.....	192	.....	.....	818	514
4	.....	219	166	.....	442	935	19	192	192	.....	.....	780	552
5	.....	219	141	.....	372	895	20	192	179	.....	275	818	590
6	.....	219	141	.....	372	856	21	192	166	.....	305	818	666
7	.....	219	.....	.....	337	818	22	192	166	.....	275	856	704
8	.....	219	.....	.....	407	704	23	192	166	.....	275	935	666
9	.....	192	.....	.....	407	590	24	192	166	.....	337	895	628
10	.....	179	.....	.....	590	590	25	192	166	.....	337	856	666
11	.....	179	.....	.....	666	552	26	192	166	.....	305	856	666
12	.....	179	.....	.....	552	552	27	192	166	.....	290	818	628
13	.....	179	.....	.....	407	552	28	192	166	.....	290	780	600
14	.....	179	.....	.....	514	590	29	198	166	.....	245	780	600
15	.....	179	.....	.....	628	628	30	192	166	.....	245	742	500
							31	192	.....	.....	.....	780	.....

NOTE.—Discharge computed from a fairly well defined rating curve. Mean discharge Oct. 1–18 estimated 170 second-feet. Discharge June 28–30, estimated.

Monthly discharge of Passamari River near Alder, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	.....	.....	179	11,000	C.
November	219	166	186	11,100	B.
December 1–6	166	141	159	1,890	B.
April 20–30	337	245	289	6,300	C.
May	935	275	630	38,700	B.
June	935	.....	661	39,300	B.

MUSKRAT CREEK NEAR BOULDER, MONT.

LOCATION.—In sec. 6, T. 6 N., R. 3 W., 1,000 feet above Boulder Nursery, near Boulder.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 27, 1912, to September 30, 1914.

GAGE.—Staff gage fastened to a flume 2.5 feet upstream from crest of weir. Gage heights give the head on the weir. Observer, C. O. Hanson.

DISCHARGE MEASUREMENTS.—Flow measured by a sharp-crested weir 4.85 feet long with end contractions. Discharge computed by Francis formula, correcting for end contractions and velocity of approach.

CHANNEL AND CONTROL.—Flume; principal control is sharp-crested weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.65 feet at 6 p. m., June 4 (discharge, 34 second-feet); minimum stage recorded, 0.13 foot at 8 a. m. and 6 p. m., April 10 (discharge, 0.8 second-foot).

1912–1914: Maximum stage recorded, 1.65 feet June 4, 1914 (discharge, 34 second-feet); minimum stage recorded, 0.13 foot March 24–27, April 1–4, 1913, and April 10, 1914 (discharge, 0.8 second-foot).

WATER FLOW.—Discharge relation affected by ice.

REGULATION.—No regulation or diversion above the station.

ACCURACY.—Results good.

Daily discharge, in second-feet, of Muskrat Creek near Boulder, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1....	1.9	.....	2.6	30	7.6	2.4	1.4	16....	.....	1.9	12	15	4.8	1.8	2.0
2....	1.9	.....	3.6	30	7.0	2.4	1.4	17....	.....	1.4	13	15	4.0	1.8	2.2
3....	1.9	.....	3.4	27	6.8	2.4	1.4	18....	.....	1.6	14	15	3.8	1.8	2.4
4....	1.6	.....	3.2	33	6.8	2.2	1.4	19....	.....	1.8	15	13	3.8	1.8	2.5
5....	1.4	.....	3.5	30	6.3	2.2	1.4	20....	.....	2.0	16	13	4.1	1.8	2.6
6....	1.9	.....	3.8	22	6.3	2.1	1.4	21....	.....	2.1	15	12	4.1	1.8	2.3
7....	2.2	.....	4.5	18	5.5	2.1	1.4	22....	.....	2.2	16	12	3.5	1.8	2.6
8....	3.2	.....	7.0	15	5.2	2.1	1.4	23....	.....	2.4	23	11	3.4	1.6	2.5
9....	4.1	.....	7.4	14	5.2	2.0	1.4	24....	.....	3.2	25	11	3.0	1.6	3.2
10....	4.1	0.8	9.0	13	5.5	2.0	1.4	25....	.....	2.5	19	10	2.9	1.6	.....
11....	3.8	.9	9.4	13	6.7	2.0	1.4	26....	.....	2.4	20	9.7	2.9	1.5	.....
12....	3.5	.9	8.2	14	6.3	2.0	1.4	27....	.....	2.4	23	9.4	2.8	1.5	.....
13....	3.4	1.0	8.6	21	7.6	1.9	1.9	28....	.....	2.4	25	9.1	2.8	1.5	.....
14....	2.0	1.5	9.0	28	6.8	1.9	2.0	29....	.....	1.9	26	8.8	2.8	1.5	.....
15....	.....	1.6	9.4	20	5.2	1.8	1.8	30....	.....	1.9	27	8.6	2.8	1.4	.....
								31....	.....	.....	27	.....	2.5	1.4	.....

NOTE.—Daily discharge determined from a rating curve prepared from Francis's formula, and corrected for end contractions and velocity of approach. Uncertainty as to the velocity of approach reduces the accuracy.

Discharge interpolated Apr. 26, May 3, June 7, 26, 27, 28, July 4, 5, Aug. 9 and Sept. 16 to 18.

Monthly discharge of Muskrat Creek near Boulder, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October 1–14	4.1	1.4	2.71	75.2	B.
April 10–30	3.2	.8	1.85	77.1	B.
May	27	2.6	13.2	812	B.
June	33	8.6	16.7	994	B.
July	7.6	2.5	4.80	295	B.
August	2.4	1.4	1.86	114	B.
September 1–24	3.2	1.4	1.88	89.5	B.

GIBBON RIVER NEAR YELLOWSTONE, MONT.

LOCATION.—In sec. 6, T. 14 S., R. 8 E., Montana meridian, about 500 feet northeast of the Wylie-Gibbon lunch station, 2 miles below Gibbon Falls, 4 miles above confluence of Gibbon with Firehole River to form Madison River, and 16 miles east of Yellowstone and the west boundary of Yellowstone Park.

DRAINAGE AREA.—117 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 22, 1913, to September 30, 1914.

GAGE.—Vertical staff on left bank about 50 feet below concrete highway bridge; read once daily during summer months by privates or noncommissioned officers attached to the Fountain soldier station, and during the rest of the year by patrols at intervals varying from three to four days to a week. Present gage used since September 14, 1913. Original gage used June 22 to August 30, 1913, was a vertical staff attached to downstream side of left abutment of old highway bridge, about 40 feet above site of present gage. A temporary gage installed by the observer at the site of the present gage was read August 31 to September 14, 1913; readings on temporary gage have been reduced to datum of permanent gage.

DISCHARGE MEASUREMENTS.—Made by wading at low and medium stages at a solid-rock section about 30 feet above the highway bridge. High-stage measurements can probably be made from downstream side of highway bridge, although conditions at this section are unfavorable for measurements.

CHANNEL AND CONTROL.—One channel at all stages. Bed of stream rocky and rough; control consists largely of solid rock and should be permanent; practically no aquatic growth in stream near gage at any time. Control for present gage not the same as that for original gage; relation of the rating curves for the two gages not known.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.3 feet at 3 p. m., June 1; minimum, 1.35 feet August 9–12 (discharge, 66 second-feet).

1913–14: Maximum stage recorded, 3.3 feet at 3 p. m., June 1, 1914; minimum, 1.35 feet August 9–12, 1914 (discharge, 66 second-feet).

WINTER FLOW.—Discharge relation not seriously affected by ice, as river is fed largely from geysers and hot springs; open-channel rating curve assumed to be applicable.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Results good except from October to April, when gage readings are infrequent and much interpolation is necessary.

COOPERATION.—Station maintained in cooperation with superintendent of the Yellowstone National Park.

Discharge measurements of Gibbon River near Yellowstone, Mont., during the year ending Sept. 30, 1914.

[Made by C. G. Paulsen.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 2	1.57	96
Sept. 13	1.52	87

Daily discharge, in second-feet, of Gibbon River near Yellowstone, Mont., Sept. 3, 1913, to Sept. 30, 1914.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	123	123	132	112	90	88	94	a 116	.....	(a)	162	148	92
2	123	a 123	130	112	91	86	a 96	117	.....	.....	162	136	92
3	148	126	129	112	91	a 84	93	119	(a)	.....	162	123	92
4	123	130	127	112	a 92	84	90	120	.....	.....	162	92	92
5	123	133	125	a 112	a 92	84	a 87	121	.....	.....	162	92	92
6	123	137	a 123	109	92	84	87	123	.....	.....	148	77	92
7	123	141	123	105	92	84	87	124	.....	(a)	136	71	92
8	123	144	123	102	92	84	87	125	.....	.....	136	71	92
9	148	a 148	123	99	a 92	84	87	127	.....	.....	123	66	84
10	123	142	123	95	92	a 84	87	a 128	(a)	.....	123	66	84
11	123	136	123	a 92	92	85	87	129	.....	.....	112	66	92
12	123	130	a 123	92	a 92	85	87	131	.....	.....	112	66	90
13	123	125	120	92	92	85	87	132	.....	.....	112	71	a 87
14	123	119	118	92	92	86	a 87	134	.....	.....	101	71	101
15	.....	113	115	92	92	86	87	135	.....	190	101	71	116
16	.....	107	a 112	92	92	86	87	137	(a)	190	101	71	130
17	.....	a 101	110	92	92	86	a 87	138	.....	190	101	92	145
18	.....	108	109	a 92	92	a 87	87	a 140	.....	162	101	92	160
19	.....	116	107	91	92	87	87	156	.....	219	101	92	a 175
20	.....	a 123	106	90	92	87	87	172	.....	250	136	71	164
21	.....	124	104	89	92	87	87	188	(a)	219	162	71	154
22	.....	126	103	88	92	87	87	a 204	.....	204	148	92	143
23	.....	127	a 101	a 87	92	87	a 87	a 219	.....	190	136	92	133
24	.....	128	102	87	a 92	87	90	219	.....	190	136	92	122
25	.....	130	104	87	92	87	94	219	.....	175	136	92	112
26	.....	131	a 105	87	92	a 87	98	a 219	.....	175	136	92	a 101
27	.....	132	107	a 87	92	89	101	219	.....	162	148	84	100
28	.....	133	108	88	92	91	a 105	219	.....	162	148	84	100
29	.....	135	110	88	92	.....	108	219	(a)	162	162	84	100
30	.....	a 136	a 112	89	a 92	.....	110	219	.....	162	162	92	100
31	.....	134	.....	89	90	.....	113	.....	.....	.....	148	92	.....

a Gage read on days thus indicated, and also daily Sept. 1–14, 1913, and June 15 to Sept. 11, 1914 (see note, below). The following gage readings were recorded in period for which discharge is not published: May 3, 2.55 feet; May 10, 2.75 feet; May 16, 2.9 feet; May 21, 3.2 feet; May 29, 2.55 feet; June 1, 3.3 feet; and June 7, 2.35 feet.

NOTE.—Discharge computed from a rating curve well defined between 70 and 150 second-feet, but poorly defined above 240 second-feet. Discharge interpolated for days on which gage was not read, except Sept. 15–30, 1913, Apr. 27–30, 1914, and Sept. 27–30, 1914, when discharge was estimated from discharge of Madison River. Mean discharge Sept. 15–30, 1913, estimated 120 second-feet; Apr. 27–30, 1914, 219 second-feet; and Sept. 27–30, 100 second-feet Discharge not computed May 1 to June 14, because rating curve is not considered sufficiently well defined and because of the comparatively large diurnal fluctuation.

Monthly discharge of Gibbon River near Yellowstone, Mont., for the period Sept. 1, 1913, to Sept. 30, 1914.

[Drainage area, 117 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
September	.....	.....	123	1.05	1.17	7,320	C.
October	148	101	128	1.09	1.26	7,870	C.
November	132	101	115	.983	1.10	6,840	C.
December	112	87	95.3	.815	.94	5,860	C.
January	92	90	91.8	.785	.905	5,640	C.
February	91	84	86.0	.735	.765	4,780	C.
March	113	87	91.8	.785	.905	5,640	C.
April	219	116	159	1.36	1.52	9,460	D.
June 15–30	250	162	188	1.61	.958	5,970	C.
July	162	101	135	1.15	1.33	8,300	B.
August	148	66	86.2	.737	.85	5,300	B.
September	175	84	111	.949	1.06	6,600	C.

MADISON RIVER NEAR YELLOWSTONE, MONT.

LOCATION.—In (approximately) sec. 5, T. 14 S., R. 6 E., Montana meridian, 250 feet downstream from the old footbridge at the fording place of the old Gallatin Trail, 300 feet north of the stage road to Yellowstone, and almost immediately in front of the Riverside soldier station; about 4 miles east of Yellowstone and the west boundary of Yellowstone National Park. Gibbon and Firehole rivers unite to form the Madison about 8 miles upstream.

DRAINAGE AREA.—410 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 16, 1913, to September 30, 1914.

GAGE.—Vertical staff on left bank; read once daily by non-commissioned officers attached to the Riverside soldier station.

DISCHARGE MEASUREMENTS.—High-stage measurements made from the old footbridge 250 feet upstream from gage; medium and low stage measurements made by wading at the gage.

CHANNEL AND CONTROL.—One channel at all stages. Bottom is composed of gravel and bowlders and is somewhat rough, but the control is believed to be permanent. A slight growth of weeds is usually present during the greater part of the year, but the discharge relation is apparently not seriously affected.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.25 feet 6 p. m. May 21 (discharge, 1,400 second-feet); minimum stage recorded, 1.35 feet March 19–21 (discharge, 471 second-feet).

1913–14: Maximum stage recorded, 2.4 feet July 30, 1913 (discharge, 1,570 second-feet); minimum stage recorded, 1.35 feet March 19–21, 1914 (discharge, 471 second-feet).

WINTER FLOW.—Discharge relation not seriously affected by ice. Temperature of the water in the river is kept well above the freezing point, except during extremely cold weather, by the numerous hot springs and geysers in the drainage basin.

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Results considered good. Gage-height record obtained by at least four different observers and is not quite so good as would be expected from one man.

COOPERATION.—Station maintained in cooperation with the superintendent of the Yellowstone National Park.

Discharge measurements of Madison River near Yellowstone, Mont., during the year ending Sept. 30, 1914.

[Made by C. G. Paulsen.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 1	1.42	567
Sept. 13	1.41	528

Daily discharge, in second-feet, of Madison River near Yellowstone, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	625	676	625	522	574	543	522	625	1,040	676	625	522
2	625	676	625	522	574	574	522	625	1,040	625	574	522
3	625	728	625	522	574	574	522	676	1,090	625	574	522
4	625	728	625	574	.....	574	522	728	1,240	625	574	522
5	676	730	574	574	.....	574	522	728	1,140	625	574	522
6	728	728	574	625	.....	574	574	780	1,090	625	574	522
7	728	728	574	676	.....	574	574	780	934	625	574	322
8	780	676	574	676	.....	574	574	831	934	625	574	522
9	780	676	574	625	574	574	574	831	882	625	522	522
10	831	676	574	574	574	522	574	986	882	676	522	522
11	831	728	584	574	574	522	574	1,040	882	625	522	522
12	780	728	584	574	574	522	625	934	882	625	522	522
13	780	728	584	574	574	522	625	882	882	625	522	522
14	728	728	574	522	574	522	625	934	831	625	522	522
15	728	728	574	574	574	522	625	986	882	625	522	522
16	728	676	574	625	574	522	676	1,090	831	625	522	574
17	676	676	563	625	574	522	676	1,090	831	574	522	625
13	676	676	563	625	574	522	676	1,140	831	574	522	728
19	676	728	563	574	522	471	728	1,240	882	574	522	780
20	728	728	563	574	574	471	780	1,290	882	574	522	882
21	728	728	522	574	625	471	831	1,400	986	574	522	780
22	676	728	574	574	574	522	831	1,350	934	574	522	676
23	676	676	574	574	574	522	882	1,350	780	574	522	574
24	676	676	574	574	522	522	831	1,350	780	574	522	574
25	676	625	574	574	574	522	780	1,350	780	574	522	574
26	676	625	522	574	574	522	728	1,290	831	574	522	574
27	676	625	522	574	574	522	728	1,240	728	574	522	574
28	728	676	522	574	574	522	676	1,190	728	574	522	574
29	728	676	522	574	.....	522	676	1,090	728	574	522	522
30	728	676	522	574	.....	522	625	986	676	574	522	522
31	676	.....	522	574	.....	522	.....	1,040	.....	625	522	.....

NOTE.—Discharge computed from a well-defined rating curve. Discharge relation affected by ice about Feb. 4–8; mean discharge estimated at 574 second-feet.

Monthly discharge of Madison River near Yellowstone, Mont., for the year ending Sept. 30, 1914.

[Drainage area 410 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	831	625	710	1.73	1.99	43,700	B.
November	780	625	697	1.70	1.90	41,500	B.
December	625	522	568	1.39	1.60	34,900	B.
January	676	522	582	1.42	1.64	35,800	B.
February	625	522	572	1.40	1.46	31,800	B.
March	574	471	531	1.30	1.50	32,600	B.
April	882	522	656	1.60	1.78	39,000	B.
May	1,400	625	1,030	2.51	2.89	63,300	B.
June	1,240	676	895	2.18	2.43	53,300	B.
July	676	574	605	1.48	1.71	37,200	B.
August	625	522	537	1.31	1.51	33,000	B.
September	882	522	579	1.41	1.57	34,500	A.
The year	1,400	471	664	1.62	22.0	481,000	

DEEP CREEK NEAR TOWNSEND, MONT.

LOCATION.—In sec. 29, T. 7 N., R. 4 E., Montana principal meridian, unsurveyed, 12 miles from Townsend, directly back of the ranger station in the canyon of Deep Creek, approximately 10 miles above the confluence with the Missouri River.

DRAINAGE AREA.—89 square miles.

RECORDS AVAILABLE.—October 9, 1910, to June 30, 1911, and fragmentary gage heights in 1912, 1913, and 1914.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Small rock; probably permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year, 2.0 feet at 8 a. m. and 6 p. m., June 1 and 2; minimum stage recorded, 0.7 foot at 9 a. m. December 2, 5, 6, and 8.

1910–1914: Maximum stage recorded, 2.5 feet May 28, 1913; minimum stage recorded, 0.64 foot October 30 to November 8; December 4–6 and 11–21, 1912.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSION.—Small quantities of water are diverted for irrigation on small flats above the gage. Below the gage nearly the entire flow is diverted, or will eventually be diverted, for irrigation on the land adjoining this creek and Missouri River.

No discharge measurement was made at this station in year ending September 30, 1914. Data inadequate for estimates of discharge.

Daily gage height, in feet, of Deep Creek near Townsend, Mont., for the year ending Sept. 30, 1914.

[O. C. Bradeen, observer.]

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.8	0.8			1.4	2.0		1.0	0.95
2	.8		0.7	0.9		2.0	1.35		.95
3		.8		.9		1.95	1.35	1.0	.95
4		.8		.85	1.5	1.9		1.0	.95
5	.85	.8	.7	.85	1.38	1.9			.95
6	.85	.8	.7	1.28	1.35	1.8	1.35	1.0	
7	.85	.8		1.05	1.3	1.8		1.0	
8	.85	.8	.7	1.0		1.7		1.0	
9	.8			.92				1.0	
10	.8	.8		.9	1.6		1.25	1.0	
11	.85	.8		1.0	1.6		1.25	1.0	
12	.9			1.0		1.5	1.25		
13	.9	.8		1.1	1.5		1.1		
14	.9	.8		1.2		1.6			
15		.8		1.2		1.6	1.1	1.0	
16		.8			1.6		1.1		
17		.8		1.3	1.6	1.7	1.1	1.0	
18	.8	.8		1.2		1.7		1.0	
19	.8			1.2			1.1		
20	.8	.8		1.4					
21		.8		1.3	1.7			.95	
22		.8		1.3	1.8	1.5		.95	
23				1.3	1.78		1.2	.95	
24	.8	.8		1.35	1.75		1.15		
25	.8	.8		1.4	1.8		1.15		
26	.8			1.38		1.4			
27		.75		1.35		1.4	1.1	.95	
28					1.8	1.4	1.1	.95	
29					1.8	1.4	1.1	.95	
30	.8								
31	.8						1.1	.95	

PRICKLY PEAR CREEK NEAR CLANCY, MONT.

LOCATION.—In sec. 33, T. 9 N., R. 3 W., on the private wagon bridge back of the ranch buildings on the Stafford ranch, and just to the right of the Great Northern Railway, about 2 miles below Clancy, and 1 mile below the mouth of Lump Gulch Creek. This station was established to take the place of the one previously maintained about a mile below. The same amount of water passes both stations.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 12, 1910, to September 30, 1914 (present site); July 15, 1908, to June 30, 1909 (old site).

GAGE.—Staff nailed to bridge abutment, right bank, downstream side. Observer, J. J. Haab, jr.

DISCHARGE MEASUREMENTS.—Made from the wagon bridge or by wading.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.3 feet at 7 a. m. and 4 p. m. June 5 (discharge, 306 second-feet); minimum stage recorded, 1.3 feet at 8 a. m. and 5 p. m. September 1–5 (discharge, 23 second-feet).

1909–1914: Maximum stage recorded, 3.5 feet June 11, 1913 (discharge, 420 second-feet); minimum stage recorded, 1.4 feet August 4–26, 1910 (discharge, 12 second-feet).

WINTER FLOW.—Discharge relation probably affected by ice; data insufficient for estimating discharge.

DIVERSIONS.—Few above station; entire summer flow is appropriated and used for irrigation below the station.

ACCURACY.—Discharge, March to November, 1914, computed from a rating curve based principally upon measurements of discharge made in 1915, which reduces the probable accuracy of the computed discharge, owing to the shifting character of the stream bed.

Discharge measurements of Prickly Pear Creek near Clancy, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 23	B. E. Jones	1.80	73
July 9	W. A. Lamb	1.82	78
Sept. 10	B. E. Jones	1.40	29.1

Daily discharge, in second-feet, of Prickly Pear Creek near Clancy, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	36	75	.....	38	59	211	102	34	23
2	36	60	.....	36	102	246	102	34	23
3	30	55	.....	36	102	265	95	30	23
4	36	51	.....	34	95	285	83	30	23
5	36	44	.....	34	89	306	83	30	23
6	36	44	.....	38	95	246	83	30	30
7	44	36	.....	43	89	246	71	30	30
8	44	36	.....	34	89	195	71	30	30
9	44	36	.....	34	102	164	71	30	30
10	44	36	.....	36	228	164	71	30	30
11	40	36	.....	38	164	164	71	30	30
12	51	36	.....	38	172	179	71	30	38
13	51	65	.....	43	195	246	71	30	59
14	51	44	.....	38	195	285	77	30	59
15	51	44	36	43	237	246	71	30	59
16	44	40	30	59	285	211	71	30	59
17	36	40	34	59	265	179	59	30	59
18	36	40	30	54	246	164	59	30	59
19	36	36	26	59	285	164	48	34	71
20	36	30	38	108	285	172	48	34	65
21	44	24	34	83	265	149	48	30	71
22	44	27	34	83	246	149	48	30	59
23	40	30	38	71	246	149	48	30	48
24	47	36	34	108	285	149	34	30	48
25	51	36	34	95	265	108	30	26	48
26	40	36	30	83	285	108	30	23	48
27	44	40	30	71	246	108	34	23	48
28	44	40	30	71	228	108	38	23	48
29	44	36	30	71	195	108	38	23	48
30	40	36	34	59	187	108	38	23	48
31	36	.....	34	.....	187	.....	38	23	.....

NOTE.—Daily discharge determined from two rating curves applicable Oct. 1 to Dec. 1, 1913, and Mar. 15 to Sept. 30, 1914, respectively. See "Accuracy," in station description.

Monthly discharge of Prickly Pear Creek near Clancy, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	51	30	41.7	2,560	C.
November	75	24	40.8	2,430	C.
March 15-31	38	26	32.7	1,100	B.
April	108	34	56.6	3,370	B.
May	285	59	194	11,900	B.
June	306	108	186	11,100	B.
July	102	30	61.4	3,780	B.
August	34	23	29.0	1,780	B.
September	71	23	44.6	2,650	B.

TENMILE CREEK NEAR HELENA, MONT.

LOCATION.—In SW. ¼ SE. ¼ sec. 22, T. 10 N., R. 4 W., opposite the Broadwater Hotel near Helena.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 8, 1908, to September 30, 1914.

GAGE.—Staff on right bank; datum unchanged. Observer, J. W. Jackson.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Shifts during flood stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.8 feet at 12 m. May 16 (discharge, 424 second-feet); minimum stage, 1.3 feet at 12.30 p. m. September 2, 4, 5 (discharge 0.2 second-foot).

1908–1914: Maximum stage recorded, 4.7 feet May 28, June 11 and 12, 1909 (discharge, 477 second-feet); minimum stage, 1.15 feet August 5 to September 10, 1910 (discharge, 0.15 second-foot).

Datum unchanged; difference in discharge relation due to shifting of channel.

WINTER FLOW.—Discharge relations affected by ice.

DIVERSIONS.—Part of the water supply for the city of Helena is taken from Tenmile Creek above the station. Two irrigation ditches also take water from the creek above the gage. The entire low-water flow is appropriated and used before it reaches the mouth of the creek.

ACCURACY.—At low and medium stages conditions favor accurate determination of discharge. Gage is difficult to read, which lessens the probable accuracy of the computed discharge.

Discharge measurements of Tenmile Creek near Helena, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 29	J. M. Ray	2.18	17.7	July 7	W. A. Lamb	2.27	23.9
Nov. 29	W. A. Lamb	1.90	5.9	Aug. 19	Lamb & Jones	1.43	.7
Jan. 3	.....do	1.75	4.9				

Daily discharge, in second-feet, of Tenmile Creek near Helena, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.2	18	9.0	8	7	6	11	106	210	58	1.2	0.4
2	2.9	16	7.4	7	6	5	11	99	201	48	.6	.2
3	2.9	14	4.8	7	7	6	13	106	192	48	.9	.4
4	3.6	14	4.8	6	6	5	11	130	183	44	.6	.2
5	4.8	16	4.8	6	6	5	11	148	201	39	.4	.2
6	4.8	16	4.8	7	7	6	13	156	210	35	.6	.4
7	9.0	14	4.8	7	6	5	13	165	201	28	.4	.4
8	11	14	4.8	8	7	6	17	174	192	28	.6	.6
9	11	14	4.8	7	5	6	15	183	165	24	.4	.4
10	9.0	16	4.8	5	5	6	17	256	148	22	.4	.4
11	7.4	21	5.9	6	6	7	24	266	130	24	.9	.6
12	14	18	5.9	6	5	6	24	238	122	22	.6	1.8
13	24	16	5.9	8	6	8	28	228	174	19	.9	4
14	18	16	5.9	7	4	7	31	256	238	15	.6	5
15	18	16	5.9	6	4	7	44	304	219	13	.6	6
16	14	16	5.0	7	5	10	58	424	174	11	.6	8
17	9.0	16	4.2	6	4	8	64	384	148	8	.4	7
18	9.0	16	5.4	7	5	10	74	384	139	8	.4	8
19	11	14	5.6	6	4	8	86	344	99	5	.4	7
20	14	14	5.8	6	4	8	114	324	86	4	.6	7
21	16	9.0	6.0	7	5	10	148	324	92	4	.9	8
22	16	7.4	7.2	5	4	8	130	304	80	3.2	.6	7
23	18	7.4	7.4	6	5	10	106	304	80	4	.9	7
24	18	9.0	7.6	5	4	8	148	285	74	2.5	.6	5
25	38	9.0	7.8	5	4	8	148	285	114	2.5	.6	5
26	30	9.0	8.0	6	6	10	156	285	92	3.2	.9	5
27	24	9.0	8.0	6	5	8	130	256	64	2.5	.4	3.2
28	21	7.4	8.0	7	6	10	106	247	69	3.2	.6	4
29	18	7.4	8.0	6	.....	10	99	238	64	1.8	.4	3.2
30	18	7.4	7.0	6	.....	10	99	228	58	1.8	.4	4
31	18	.....	7.0	7	.....	11	.....	210	.....	1.8	.4	.....

NOTE.—Discharge determined as follows: Oct. 1 to Dec. 15, from a fairly well defined rating curve; Dec. 16 to 25, by indirect method for shifting channels; Dec. 26 to Sept. 30, from a rating curve well defined between 0.6 and 300 second-feet. Record Dec. 15 to 31 differs from that published in Water Supply Paper 356; discharge recomputed so as to more nearly agree with results of measurements of discharge made in 1914.

Monthly discharge of Tenmile Creek near Helena, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	38	2.2	14.0	861	C.
November	21	7.4	13.2	786	B.
December[a]	9.0	4.2	6.2	381	C.
January	8.0	5.0	6.4	394	C.
February	7.0	4.0	5.3	294	C.
March	11	5.0	7.7	473	C.
April	156	11	65.0	3,870	B.
May	424	99	246	15,100	B.
June	238	58	141	8,390	B.
July	58	1.8	17.2	1,060	B.
August	1.2	.4	.61	37.5	B.
September	8	.2	3.65	217	B.
The year	424	0.2	44.3	31,900	

[a] Results differ from those published in Water Supply Paper 356; see footnote to table of daily discharge.

LITTLE PRICKLY PEAR CREEK NEAR MARYSVILLE, MONT.

LOCATION.—At highway bridge on ranch of Casper Traufer, about 5 miles west and 3 miles north of Marysville; about one-fourth mile below mouth of Deadman Creek.

DRAINAGE AREA.—49 square miles; measured from topographic map of Helena quadrangle.

RECORDS AVAILABLE.—April 12, 1913, to September 30, 1914, at present site; May 18, 1909, to December, 1911, at station above mouth of Deadman Creek.

GAGE.—Standard staff spiked to upstream side of bridge abutment on left shore. From April 12 to May 23, 1913, gage was about one-fourth mile farther upstream at a different datum, but where flow is practically the same as at site now used. Datum unchanged since May 24, 1913. Observer, Casper Traufer.

DISCHARGE MEASUREMENTS.—Made from bridge during high water and by wading at ordinary stages.

CHANNEL AND CONTROL.—Bed of channel composed of sand and gravel; may shift during high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.5 feet at 7 a. m. and 6 p. m. May 17–18 (discharge, 196 second-feet); minimum stage recorded, 0.9 foot at 9 a. m. March 1–11 (discharge, 2 second-feet).

1909–1911 and 1913–14: Maximum stage recorded, 3.2 feet May 28, 1913 (discharge, 315 second-feet); minimum stage recorded (old station), 2.28 feet March 8–13, 1911 (discharge, 1.2 second-feet).

See "Records available" and "Gage."

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Numerous small ditches take water from the stream, practically the entire normal flow being appropriated.

ACCURACY.—Results good.

Discharge measurements of Little Prickly Pear Creek near Marysville, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Oct. 3	1.10	14.7
May 16	2.40	171
Aug. 4	1.18	20.5

Daily discharge, in second-feet, of Little Prickly Pear Creek near Marysville, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	15	15	15	8	.....	2	8	50	84	50	26	15
2	15	15	12	8	.....	2	8	50	84	48	22	12
3	15	15	12	8	.....	2	8	72	84	45	22	12
4	18	15	12	8	.....	2	8	87	80	45	22	12
5	18	15	12	8	.....	2	8	87	90	45	22	8
6	18	15	12	8	.....	2	18	84	87	45	22	8
7	18	15	12	8	.....	2	18	74	77	40	22	8
8	18	15	12	8	.....	2	18	72	74	40	22	8
9	18	15	12	8	.....	2	18	72	72	40	22	8
10	18	15	12	8	.....	2	18	102	68	40	22	8
11	18	15	12	8	.....	2	18	94	62	40	22	8
12	18	15	12	8	.....	5	18	99	62	40	22	12
13	18	15	12	8	.....	5	18	102	80	38	22	12
14	18	15	12	8	.....	5	24	114	99	36	22	12
15	18	15	8	8	.....	5	29	132	102	31	22	15
16	18	15	8	8	.....	8	31	180	102	31	18	15
17	18	15	8	8	.....	8	31	196	94	31	18	12
18	18	15	8	8	.....	8	31	196	84	31	18	12
19	18	15	8	8	.....	8	31	180	77	26	18	8
20	18	15	8	5	.....	8	52	164	74	26	15	12
21	18	15	8	5	.....	8	50	148	74	26	15	12
22	18	15	8	5	.....	8	50	132	68	26	15	12
23	18	15	8	5	.....	8	50	132	68	26	15	8
24	18	15	8	5	.....	8	52	132	62	26	15	8
25	18	15	8	5	.....	8	60	124	62	26	15	8
26	18	15	8	5	.....	8	60	117	62	26	15	8
27	18	15	8	5	.....	8	60	114	62	26	15	8
28	18	15	8	5	.....	8	52	110	62	26	15	8
29	15	15	8	5	.....	8	50	99	56	26	15	8
30	15	15	8	5	.....	8	50	94	56	26	15	8
31	15	.....	8	.....	.....	8	.....	87	.....	26	15	.....

NOTE.—Discharge determined from a well-defined rating curve. Feb. 1–28, creek frozen, gage not read. Mean discharge estimated at 4 second-feet.

Monthly discharge of Little Prickly Pear Creek near Marysville, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	18	15	17.4	1,070	A.
November	15	15	15.0	893	A.
December	15	8	9.9	609	B.
January	8	5	6.8	418	C.
February	.....	.....	[a] 4.0	222	D.[a]
March	8	2	5.5	338	C.
April	60	8	31.6	1,880	B.
May	196	50	113	6,950	A.
June	102	56	75.6	4,500	A.
July	50	26	34.0	2,090	A.
August	26	15	18.9	1,160	B.
September	15	8	10.2	607	B.
The year	196	.....	28.6	20,700	

[a] Monthly mean discharge estimated.

LITTLE PRICKLY PEAR CREEK NEAR CANYON CREEK, MONT.

LOCATION.—In the NW. ¼ sec. 9, T. 12 N., R. 5 W., below the mouth of Canyon Creek, near Canyon Creek post office.

DRAINAGE AREA.—180 square miles (measured on topographic map of Helena quadrangle).

RECORDS AVAILABLE.—April 1, 1909, to December 31, 1911, and April 12, 1913, to September 30, 1914.

GAGE.—Staff on right bank. Observers, W. J. and E. D. Carbis.

DISCHARGE MEASUREMENTS.—Made by wading at ordinary stages; from a footbridge at the gage or from a wagon bridge above the gage during high water.

CHANNEL AND CONTROL.—Slightly shifting; banks are overgrown with brush.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.0 feet at 8 a. m. May 19–20 (discharge, 296 second-feet); minimum stage recorded, 1.5 feet at 8 a. m. July 16–18 (discharge, 0.3 second-foot).

1909–1911 and 1913–1914: Maximum stage recorded, 4.8 feet May 29, 1913 (discharge, 665 second-feet); minimum stage recorded June 21–28, July 1–9, 21, 22, and August 1–2, 1910, and July 22–27, 29, and 31, 1911, when creek was reported dry.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Many small ditches divert water from the stream; low-water flow practically all appropriated.

ACCURACY.—Results fair.

Discharge measurements of Little Prickly Pear Creek near Canyon Creek, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Oct. 3	2.15	26
May 16	3.90	257
Aug. 4	1.59	1.5

Daily discharge, in second-feet, of Little Prickly Pear Creek near Canyon Creek, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	23	30	17	53	125	139	53	1.5	12
2	25	30	17	45	111	155	49	1.5	9.5
3	26	34	17	45	125	104	45	1.5	12
4	30	37	23	41	139	92	45	1.5	12
5	30	37	23	37	139	111	37	1.5	12
6	34	37	26	37	155	125	30	1.5	12
7	37	45	23	41	155	111	23	1.5	14
8	37	45	30	45	155	98	17	1.5	17
9	37	53	30	45	155	92	17	1.5	17
10	41	53	30	45	173	86	12	1.5	12
11	37	45	30	49	192	74	7	1.5	12
12	37	45	37	53	173	63	3.5	1.5	14
13	30	37	37	63	192	74	3.5	1.5	14
14	30	30	37	63	211	230	3.5	1.5	17
15	23	30	30	68	230	211	1.5	1.5	17
16	17	34	30	74	250	211	.3	1.5	12
17	17	30	37	86	272	192	.3	1.5	12
18	23	30	37	80	272	155	.3	3.5	12
19	23	23	37	86	296	139	.9	3.5	12
20	17	23	45	111	296	111	1.5	3.5	12
21	20	30	37	139	272	111	1.5	3.5	12
22	17	37	37	125	230	98	1.5	3.5	14
23	17	37	34	111	211	86	1.5	3.5	17
24	23	34	34	111	211	74	1.5	3.5	17
25	23	30	23	125	211	68	1.5	3.5	17
26	26	23	23	111	192	63	1.5	5.2	17
27	23	23	17	86	192	63	1.5	7.0	17
28	30	30	17	111	192	63	.9	7.0	12
29	30	23	23	80	173	53	1.5	12	12
30	23	17	23	92	155	53	1.5	12	9.5
31	23	.....	23	.....	147	.....	1.5	12	.....

NOTE.—Daily discharge determined from two well-defined rating curves applicable Oct. 1 to Dec. 31 and Apr. 1 to Sept. 30. Discharge relation probably affected by ice Jan. 1 to Mar. 31; gage-height record available for this period but not considered sufficient basis for estimates of discharge.

Monthly discharge of Little Prickly Pear Creek near Canyon Creek, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	41	17	26.8	1,650	A.
November	53	17	33.7	2,010	A.
December	45	17	28.5	1,750	C.
April	139	37	75.3	4,480	B.
May	296	111	194	11,900	B.
June	230	53	110	6,540	A.
July	53	0.3	11.8	726	A.
August	12	1.5	3.47	213	A.
September	17	9.5	13.6	809	A.

NORTH FORK OF SUN RIVER NEAR AUGUSTA, MONT.

LOCATION.—In sec. 33, T. 22 N., R. 7 W., near the Hennessy Co.'s ranch, 12 miles northwest of Augusta, 21 miles southwest of Chouteau.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 31, 1903, to September 30, 1914. August 5, 1889, to December 31, 1890, near present site, at station called "Sun River above Augusta, Mont."

GAGE.—Chain gage. Observers, Mrs. Nora Duncan and P. L. Espensen.

DISCHARGE MEASUREMENTS.—Made from cable.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.35 feet at 7 p. m. May 17 (discharge 4,540 second-feet); minimum stage recorded, 0.4 foot at 1 p. m. February 10 (discharge 130 second-feet).

1889–1914: Maximum stage recorded, 9.5 feet June 6, 7, and 8, 1908 (discharge 15,000 second-feet); minimum stage recorded, 0.2 foot March 8, 9, and 11, 1913 (discharge 80 second-feet).

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Water is diverted below the station for irrigation of the valley lands, but no water is diverted above the station.

ACCURACY.—Conditions for accurate determination of discharge are excellent except during winter months.

Discharge measurements of North Fork of Sun River near Augusta, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 13	B. E. Jones	2.80	1,950
June 8	W. A. Lamb	2.94	2,030

Daily discharge, in second-feet, of North Fork Sun River near Augusta, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	325	410	350	280	220	.....	182	1,000	3,480	1,080	418	285
2	325	410	300	290	200	.....	200	925	4,240	1,080	390	254
3	325	410	250	305	200	.....	200	1,820	4,040	1,080	390	262
4	350	350	230	320	200	.....	220	1,820	4,040	1,080	379	240
5	300	410	250	330	165	.....	285	1,700	3,660	1,040	335	249
6	300	410	250	330	165	.....	362	1,270	3,300	1,040	379	262
7	300	380	250	330	148	.....	310	1,270	2,350	1,080	346	249
8	300	380	250	320	165	.....	262	1,370	2,210	1,000	335	254
9	300	350	250	305	165	.....	310	1,480	1,940	1,000	379	285
10	300	350	230	280	130	.....	285	2,500	1,700	885	320	240
11	300	380	210	258	148	220	262	2,080	1,700	925	362	276
12	350	410	190	236	148	200	472	1,940	1,940	845	335	262
13	410	380	190	216	220	200	500	1,940	2,080	845	325	285
14	470	350	190	196	240	200	592	2,080	2,500	770	310	276
15	440	350	210	.....	262	220	660	2,640	2,350	808	300	240
16	410	380	210	.....	.....	240	732	3,850	2,210	732	310	276
17	380	380	210	.....	.....	240	695	4,440	2,350	695	272	240
18	410	380	210	.....	.....	220	592	4,040	2,500	625	310	285
19	350	350	190	.....	.....	220	695	3,480	2,640	592	325	295
20	350	350	170	.....	.....	220	1,180	3,660	2,500	592	300	254
21	350	325	170	.....	.....	220	1,000	2,960	2,080	560	310	285
22	350	300	170	.....	.....	220	1,370	2,800	1,700	560	300	254
23	350	325	170	.....	.....	200	1,700	3,130	1,370	560	310	285
24	380	300	.....	.....	.....	200	1,700	3,850	1,480	560	325	262
25	380	300	.....	.....	.....	148	1,820	3,660	1,370	530	310	254
26	410	325	.....	.....	.....	165	1,080	2,960	1,270	500	325	249
27	410	300	.....	.....	.....	240	1,080	2,800	1,270	472	310	240
28	440	300	.....	.....	.....	200	1,000	2,800	1,270	472	295	240
29	440	300	.....	.....	.....	262	965	2,640	1,270	445	310	249
30	410	325	.....	.....	.....	220	808	2,640	1,180	418	262	254
31	380	.....	.....	.....	.....	200	.....	2,960	.....	418	262	.....

NOTE.—Daily discharge determined from two well-defined rating curves, applicable Oct. 1 to Dec. 23, and Jan. 1 to Sept. 30, respectively. Discharge relation affected by ice and mean discharge estimated as follows: Dec. 24 to 31, 160 second-feet; Jan. 15 to 31, 175 second-feet; Feb. 16 to 28, 190 second-feet; Mar. 1 to 10, 200 second-feet. Ice jam Mar. 24 and 25.

Monthly discharge of North Fork Sun River near Augusta, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	470	300	364	22,400	A.
November	410	300	356	21,200	A.
December	350	.....	206	12,700	B.
January	330	.....	225	13,800	D.
February	.....	130	187	10,400	C.
March	.....	148	208	12,800	A.
April	1,820	182	717	42,700	A.
May	4,440	925	2,530	156,000	B.
June	4,240	1,180	2,270	135,000	B.
July	1,080	418	751	46,200	A.
August	418	262	327	20,100	A.
September	295	240	261	15,500	A.
The year	4,440	130	702	509,000	

SUN RIVER AT FORT SHAW, MONT.

LOCATION.—In the SW. ¼ sec. 1, T. 20 N., R. 2. W., at Fort Shaw.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 16, 1912, to September 30, 1914. Prior to 1912 records which are directly comparable with those obtained at Fort Shaw were obtained on Sun River at Sun River

GAGE.—Staff gage on right bank about 700 feet above new highway bridge. Prior to September 1, 1913, chain gage at different datum was at the footbridge about 1,000 feet farther downstream. Observer, C. G. Peterson.

DISCHARGE MEASUREMENTS.—At high and medium stages made from footbridge 1,000 feet below gage; at low stages made by wading.

CHANNEL AND CONTROL.—Shifting.

WINTER FLOW.—Discharge relation affected by ice.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.7 feet at 7 a. m. May 17 and 18 (discharge, 5,480 second-feet); minimum stage recorded, 1.65 feet at 6 a. m. August 5, 6, and 8 (discharge, 95 second-feet). Open season only.

1905–1914: Maximum stage recorded, 13.4 feet June 7, 1908 (discharge, 18,400 second-feet); minimum stage recorded at Sun River, 1.3 feet September 14, 1906 (discharge, 47 second-feet); minimum stage recorded at Fort Shaw, 1.65 feet August 5, 6, and 8, 1914 (discharge, 95 second-feet).

The high-water discharge at Fort Shaw is practically the same as at Sun River, but at low stages water taken out between the two stations by Sun River canal may cause a material difference.

DIVERSIONS.—There are adjudicated rights for diverting 248 second-feet from Sun River direct and 664 second-feet from tributaries above this station; in addition, about 200 second-feet of water is diverted during the irrigation season by the Fort Shaw canal of the United States Reclamation Service.

STORAGE.—Willow Creek reservoir has a capacity of 84,300 acre-feet.

ACCURACY.—Conditions favor accurate determination of discharge; records considered good.

Discharge measurements of Sun River at Fort Shaw, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 14	W. A. Lamb	2.34	279	June 10	W. A. Lamb	3.38	2,070
May 14	B. E. Jones	3.58	2,490	Aug. 14	do	1.87	225

Daily discharge, in second-feet, of Sun River at Fort Shaw, Mont., from Apr. 1 to Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	330	1,120	3,380	1,390	150	208	16	740	3,380	3,140	520	150	243
2	250	1,120	4,470	1,390	180	243	17	740	5,480	2,910	470	180	282
3	250	1,530	5,130	1,250	150	208	18	860	5,480	2,910	375	150	243
4	250	2,120	5,130	1,250	120	236	19	860	4,790	2,910	375	180	274
5	250	1,960	4,470	1,180	95	201	20	630	3,890	2,580	290	215	236
6	420	1,810	4,470	1,180	95	201	21	1,250	4,170	2,580	215	215	236
7	420	1,530	3,140	1,180	120	229	22	1,120	3,380	2,120	250	250	266
8	420	1,390	2,690	925	95	194	23	1,120	3,380	2,040	215	215	306
9	420	1,530	2,100	925	120	229	24	1,120	3,890	1,740	180	330	348
10	330	1,960	2,040	800	150	187	25	1,250	4,470	1,810	150	290	298
11	420	2,910	2,040	800	150	187	26	1,390	4,170	1,810	150	290	298
12	420	2,480	1,960	860	180	222	27	1,250	3,380	1,600	180	330	339
13	520	2,290	2,480	685	150	250	28	1,250	3,140	1,670	150	215	290
14	630	2,290	4,470	740	180	290	29	1,250	3,140	1,530	120	250	330
15	630	2,290	3,380	575	150	250	30	990	2,910	1,460	120	215	290
							31	.....	2,910	.....	150	215	.....

NOTE.—Daily discharge April to August computed from a fairly well defined rating curve; discharge for September computed by indirect method for shifting channels. Discharge relation probably affected by ice in January, February, and March; records of daily gage height are available, but the data are considered insufficient for estimating discharge.

Monthly discharge of Sun River at Fort Shaw, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April	1,390	250	726	43,200	B.
May	5,480	1,120	2,910	179,000	B.
June	5,130	1,460	2,810	167,000	B.
July	1,390	120	614	37,800	B.
August	330	95	186	11,400	B.
September	420	215	298	15,100	C.
The period				454,000	

WILLOW CREEK NEAR AUGUSTA, MONT.

LOCATION.—In the NW. ¼ SW. ¼ sec. 26, T. 21 N., R. 7 W., at the Clark Co. ranch, just below the mouth of Little Willow Creek, and about 7 miles northwest of Augusta.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 8, 1905, to May 14, 1911, and April 1, 1912, to September 30, 1914.

GAGE.—A standard chain on right bank near observer's house. Observer, Elizabeth Ireland.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.3 feet at 6 p. m. June 13 (discharge, 109 second-feet); minimum stage recorded, 0.6 foot at 6 p. m. August 13–15 (discharge, 6.3 feet).

1905–1914: Maximum stage recorded, 9.5 feet June 5, 1908 (discharge, 564 second-feet); channel reported dry, July 17, 1910.

WINTER FLOW.—No ice forms at this station, as a large spring discharges into the creek just above the gage.

DIVERSIONS.—The adjudicated water rights above this station amount to 36.2 second-feet from Willow Creek proper and 42.26 second-feet from tributaries. The United States Reclamation Service has an old right of 2.1 second-feet and also has filed on the total flow of the creek, subject to the above prior appropriations. No water is diverted from Willow Creek proper below the station, the amount used by the United States Reclamation Service being diverted from Sun River below the mouth of Willow creek.

STORAGE.—Willow Creek dam, about 2 miles below the station, provides a reservoir with a capacity of 84,300 acre-feet for use on the Fort Shaw unit of Sun River project.

ACCURACY.—Results considered fair.

Discharge measurements of Willow Creek near Augusta, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 13	B. E. Jones	1.93	54
June 8	W. A. Lamb	1.99	42

Daily discharge, in second-feet, of Willow Creek near Augusta, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6.5	15	11	.....	14	29	45	33	8.1	7.0
2	6.5	15	9.8	.....	11.9	32	44	33	8.6	7.0
3	6.5	15	9.8	.....	11.4	38	42	29	8.1	7.0
4	6.5	19	9.8	.....	14	36	46	27	7.5	7.0
5	6.5	15	9.8	.....	15	33	80	27	7.0	7.0
6	6.5	14	9.8	.....	17	32	54	24	6.6	7.0
7	6.5	11	.....	.....	13.5	29	44	21	6.6	7.0
8	7.2	15	.....	.....	12.7	31	38	19	6.6	7.0
9	8.0	15	.....	.....	14	33	38	19	6.6	7.0
10	8.5	15	.....	.....	14	48	38	19	6.6	7.0
11	19	14	.....	.....	14	53	38	17	6.6	7.0
12	31	13	.....	.....	18	48	36	17	6.6	7.0
13	25	15	.....	.....	18	53	109	17	6.3	7.0
14	21	15	.....	.....	22	53	100	17	6.3	7.0
15	17	17	.....	.....	22	60	85	17	6.3	7.0
16	15	14	.....	.....	24	70	76	16	6.6	7.0
17	13	13	.....	.....	21	72	64	16	6.6	7.8
18	13	13	.....	.....	18	66	59	16	7.0	7.8
19	13	11	.....	.....	18	63	54	16	6.6	7.8
20	13	13	.....	.....	31	62	56	15	6.6	7.8
21	13	11	.....	.....	26	60	56	14	6.6	7.8
22	13	11	.....	.....	22	59	55	15	6.6	7.8
23	15	15	.....	11.4	22	68	54	14	6.6	7.8
24	15	15	.....	10.4	24	72	57	14	7.0	7.8
25	15	15	.....	8.6	22	67	53	14	7.0	7.8
26	15	15	.....	8.6	19	62	49	13.5	7.0	7.8
27	13	15	.....	10.4	20	61	45	13.5	7.0	7.8
28	11	13	.....	11.4	27	55	41	13.5	7.0	7.8
29	11	13	.....	13.5	24	50	42	11.9	7.0	7.8
30	9.8	11	.....	13.5	27	46	38	11.9	7.0	7.8
31	17	.....	.....	16	.....	46	.....	11.0	7.0	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Dec. 6, from a rating curve fairly well defined above 7.5 second-feet; Mar. 23 to May 14, and July 1 to Sept. 30, from a fairly well defined rating curve; May 15 to June 30, by the indirect method for shifting channels.
No gage readings available Dec. 7 to Mar. 22.

Monthly discharge of Willow Creek near Augusta, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	31	6.5	12.8	787	B.
November	19	11	14.0	833	B.
December 1–6	11	9.8	10.0	119	B.
March 23–31	16	8.6	11.5	205	B.
April	31	11.4	19.2	1,140	B.
May	72	29	51.2	3,150	C.
June	109	36	54.5	3,240	C.
July	33	11	18.1	1,110	B.
August	8.6	6.3	6.89	424	B.
September	7.8	7.0	7.37	439	B.

SOUTH FORK OF SUN RIVER AT AUGUSTA, MONT.

LOCATION.—In the NW. ¼ SE. ¼ sec. 17, T. 20 N., R. 6 W., at the highway bridge on the road from Augusta to Craig, about half a mile from Augusta.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 2, 1904, to September 30, 1914.

GAGE.—The original gage was spiked to the cribwork of the right abutment on the downstream side of the bridge; a new gage was installed April 17, 1907, at a different datum and was used during 1907 and 1908; records for 1909–1914 are referred to the old gage. Observer, W. J. Auchard.

DISCHARGE MEASUREMENTS.—High-stage measurements are made from the bridge at the gage. Low-stage measurements are made by wading.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.1 feet at 8 a. m. June 14 (discharge, 1,180 second-feet); minimum stage recorded, 0.75 foot at 9 a. m. September 20–27 (discharge 7.5 second-feet).

1905–1914: Maximum stage recorded, 6.8 feet June 2, 1908 (discharge, 4,300 second-feet); channel reported dry, July 28–30, 1910. See Gage.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Water is diverted to irrigate the valley lands both above and below the station. During dry seasons the entire summer flow is utilized. Adjudicated water rights above the station amount to 70.16 second-feet from South Fork of Sun River proper and 196.68 second-feet from tributaries. Below the station there are adjudicated rights amounting to 50.70 second-feet, all from South Fork of Sun River direct.

ACCURACY.—Results good.

Discharge measurements of South Fork of Sun River at Augusta, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 6	W. A. Lamb	1.26	63	June 8	W. A. Lamb	1.96	274
May 14	B. E. Jones	2.10	342	Aug. 13	do	.90	21

Daily discharge, in second-feet, of South Fork of Sun River, near Augusta, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	30	53	53	.....	40	106	282	106	20	20
2	30	53	62	.....	35	106	282	106	20	20
3	30	53	70	.....	35	150	282	119	20	20
4	43	53	92	.....	40	150	305	119	20	20
5	40	56	70	.....	40	150	410	106	20	20
6	40	62	70	.....	53	150	410	106	20	10
7	40	56	70	.....	46	150	330	106	20	10
8	46	53	.....	.....	40	150	296	81	20	10
9	46	53	.....	.....	40	150	240	81	20	10
10	46	53	.....	.....	40	157	220	81	20	10
11	53	53	.....	.....	40	305	220	81	20	10
12	56	53	.....	.....	62	305	192	70	20	10
13	62	53	.....	.....	70	355	570	70	20	10
14	70	53	.....	.....	70	355	1,180	62	20	10
15	70	53	.....	.....	70	470	775	62	20	10
16	70	53	.....	.....	70	685	685	62	18	10
17	70	53	.....	40	70	775	470	62	18	10
18	70	53	.....	40	70	645	410	62	18	10
19	56	53	.....	35	74	502	355	53	18	10
20	53	53	.....	32	81	470	305	53	18	7.5
21	53	62	.....	32	81	470	305	53	18	7.5
22	53	46	.....	30	74	470	260	53	18	7.5
23	53	53	.....	30	70	470	220	53	20	7.5
24	53	53	.....	30	70	440	220	40	20	7.5
25	53	53	.....	30	70	410	220	40	20	7.5
26	70	53	.....	40	70	410	220	40	20	7.5
27	70	53	.....	53	70	410	220	40	20	7.5
28	70	53	.....	30	92	355	220	40	20	30
29	70	53	.....	30	92	305	150	40	20	30
30	62	53	.....	40	92	305	150	30	20	30
31	53	.....	.....	40	.....	282	.....	20	20	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Dec. 7, from a well-defined rating curve; Mar. 17 to Sept. 30, from a rating curve fairly well defined above and poorly defined below 20 second-feet. Discharge estimated Mar. 24–25.

Monthly discharge of South Fork of Sun River near Augusta, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	70	30	54.2	3,330	B.
November	62	46	53.6	3,190	B.
December 1–7	92	53	69.6	966	C.
March 17–31	53	30	35.5	1,060	B.
April	92	35	62.2	3,700	B.
May	775	106	342	21,000	B.
June	1,180	150	347	20,600	B.
July	119	20	67.6	4,160	B.
August	20	18	19.5	1,200	C.
September	30	7.5	13.0	774	C.

CUT BANK CREEK AT CUT BANK, MONT.

LOCATION.—In the SW. ¼ SW. ¼ sec. 1, T. 33 N., R. 6 W., half a mile west of Cut Bank, at the Great Northern Railway bridge, 12 miles above the mouth of Two Medicine River.

DRAINAGE AREA.—971 square miles.

RECORDS AVAILABLE.—August 4, 1905, to September 30, 1914.

GAGE.—A staff gage spiked to a pier 100 feet above the Great Northern Railway pump house on the left bank; present gage installed August 31, 1911, at a section 200 yards above the original gage, which was an overhanging chain gage on left bank. Observers, Edward Freed and Charles Ferres.

DISCHARGE MEASUREMENTS.—At high stages made from a cable 300 yards below the gage; low-stage measurements made by wading.

CHANNEL AND CONTROL.—Gravel; shifts in flood.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.2 feet at 6 a. m. May 18 (discharge, 545 second-feet); minimum stage recorded, 3.9 feet at 6 a. m. and 5 p. m. August 13–16 (discharge, 25 second-feet).

1905–1914, maximum stage recorded, 10.0 feet June 5, 1908 (approximate discharge computed from extension of rating curve, 8,810 second-feet); minimum stage recorded, 2.5 feet November 29–30, 1905 (discharge, 5 second-feet). See Gage.

These are open-season records, only estimates being available for winter periods.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—The intake of the Great Northern Railway's pumping station is 100 feet below the gage; the average quantity pumped is about 14,000 gallons an hour for 18 hours a day, equivalent to a continuous flow of 0.4 second-feet.

ACCURACY.—Results as a whole good.

Discharge measurements of Cut Bank Creek at Cut Bank, Mont., during the year ending Sept. 30, 1914.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 27	4.28	98	July 23	4.20	76
Dec. 22	[a] 4.40	18	Sept. 11	4.01	41

[a] Discharge relation affected by ice.

Daily discharge, in second-feet, of Cut Bank Creek at Cut Bank, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	40	105	.....	190	305	152	40	50
2	40	92	.....	202	345	170	40	50
3	40	92	.....	295	415	170	40	44
4	60	92	.....	429	485	170	40	40
5	60	80	.....	415	471	170	40	40
6	64	80	210	315	429	170	32	44
7	64	80	210	295	345	170	32	60
8	64	80	190	255	305	163	32	60
9	60	80	178	246	246	142	32	50
10	60	80	170	246	219	142	37	50
11	60	80	152	367	202	135	32	40
12	70	70	135	345	190	129	32	40
13	70	70	178	330	202	129	25	50
14	80	70	219	345	295	120	25	76
15	92	80	246	345	450	105	25	92
16	92	80	232	415	367	105	25	105
17	105	80	219	500	330	105	28	92
18	105	80	232	545	330	100	56	85
19	105	80	190	500	315	92	60	76
20	105	80	178	485	305	85	56	70
21	105	80	246	471	295	80	50	60
22	105	76	265	415	265	76	40	64
23	105	70	202	367	219	70	40	70
24	105	70	219	355	202	64	56	80
25	105	70	255	403	190	60	70	92
26	105	80	246	485	219	60	60	100
27	105	80	246	403	190	50	60	92
28	105	80	246	345	178	44	60	92
29	105	70	232	295	163	40	60	92
30	105	70	219	280	170	40	60	80
31	105	.....	.....	280	.....	40	60	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve. Discharge estimated November 28–30.

Monthly discharge of Cut Bank Creek at Cut Bank, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	105	40	83.6	5,140	B.
November	105	70	79.2	4,710	B.
April 6–30	265	135	213	10,600	B.
May	545	190	360	22,100	B.
June	485	163	288	17,100	B.
July	170	40	108	6,640	B.
August	70	25	43.4	2,670	B.
September	105	40	67.9	4,040	B.

MARIAS RIVER NEAR SHELBY, MONT.

LOCATION.—In sec. 20, T. 31 N., R. 2 W., at the highway bridge near James A. Johnson's ranch, 7 miles south of Shelby.

DRAINAGE AREA.—2,610 square miles.

RECORDS AVAILABLE.—April 4, 1902, to January 12, 1908; April 23, 1911, to September 30, 1914.

GAGE.—A standard chain gage fastened to downstream side of bridge. From April 4, 1902, to January 12, 1908, a chain gage on highway bridge about 100 feet below present bridge was used. A Bristol water-stage recorder was used in 1911 and 1912; all gages at practically same datum as present gage. Observers, Andy La Prarie and G. J. Moser.

CHANNEL AND CONTROL.—Channel straight for 100 yards above and 200 yards below the station; right bank sandy, sloping, and likely to overflow; left bank high. Bed composed of sand and gravel with some cobblestones; likely to shift after freshets. Only one channel at all stages. Current is of moderate velocity and sets toward the left bank as it rounds a sharp curve some distance above.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.5 feet, May 20 (discharge, 4,430 second-feet); minimum stage recorded, 2.4 feet at 9 a. m. August 27, 29, 31, September 3, 6, 9, 13 (discharge, 170 second-feet).

1902–1907 (January only in 1908): Maximum stage recorded, 14.9 feet June 24, 1907 (discharge, 29,500 second-feet); minimum stage recorded, 1.7 feet November 16–20, 1904 (discharge, 150 second-feet).

Open-season records only; flow may have been lower during winter season.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

WINTER FLOW.—Discharge relation affected by ice.

REGULATION.—None.

ACCURACY.—Results good.

Discharge measurements of Marias River near Shelby, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 28	W. A. Lamb	3.60	699	June 23	W. A. Lamb	4.00	1,120
May 12	C. S. Heidel	4.85	2,050	Sept. 5	.....do	2.52	203

Daily discharge, in second-feet, of Marias River near Shelby, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	May.	June.	July.	Aug.	Sept.
1	265	700	585	.....	.....	770	195	*a* 170
2	265	700	550	.....	.....	695	*a* 182	*a* 170
3	290	660	550	.....	.....	*a* 660	170	170
4	290	660	550	.....	.....	625	*a* 182	*a* 182
5	290	660	550	.....	.....	*a* 625	195	195
6	320	620	550	.....	.....	625	*a* 195	170
7	350	620	480	.....	1,330	*a* 560	195	*a* 170
8	350	620	480	.....	*a* 1,330	500	170	*a* 170
9	350	620	550	.....	1,330	*a* 530	*a* 170	170
10	350	620	550	.....	*a* 1,260	560	170	*a* 170
11	350	620	480	.....	*a* 1,190	*a* 530	*a* 170	*a* 170
12	350	620	480	2,140	1,120	500	*a* 170	*a* 170
13	480	620	480	2,020	*a* 1,260	*a* 500	170	170
14	620	620	.....	2,020	*a* 1,400	500	*a* 170	*a* 182
15	780	620	.....	2,270	*a* 1,530	*a* 472	170	195
16	825	620	.....	2,270	1,660	445	*a* 170	*a* 195
17	780	620	.....	2,790	*a* 1,500	345	170	*a* 195
18	700	585	.....	2,530	1,330	*a* 322	*a* 170	*a* 195
19	700	585	.....	4,110	*a* 1,260	300	170	195
20	660	550	.....	4,430	*a* 1,190	395	195	*a* 210
21	620	550	.....	4,110	1,120	*a* 345	260	225
22	620	550	.....	3,950	*a* 1,120	300	*a* 248	*a* 242
23	620	585	.....	.....	1,120	300	*a* 237	260
24	620	620	.....	.....	935	*a* 300	225	*a* 273
25	620	620	.....	.....	*a* 978	300	225	*a* 286
26	700	620	.....	.....	1,020	*a* 260	*a* 195	300
27	780	620	.....	.....	*a* 935	225	170	345
28	780	620	.....	.....	850	*a* 210	*a* 170	*a* 345
29	740	620	.....	.....	*a* 850	195	170	345
30	700	585	.....	.....	850	*a* 195	*a* 170	*a* 345
31	700	.....	.....	.....	.....	195	170	.....

a Discharge interpolated; gage not read.

NOTE.—Daily discharge determined as follows: Oct. 1 to Dec. 13, from a fairly well-defined rating curve; May 12 to Sept. 30, from a rating curve well defined between 200 and 3,650 second-feet.

Monthly discharge of Marias River near Shelby, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	825	265	544	33,400	B.
November	700	550	618	36,800	B.
December 1–13	585	480	52.6	13,600	B.
June 7–30	1,660	850	1,190	56,600	B.
July	770	195	428	26,300	B.
August	260	170	187	11,500	B.
September	345	170	219	13,000	B.

TWO MEDICINE RIVER AT FAMILY, MONT.

LOCATION.—In the NE. ¼ NE. ¼ sec. 2, T. 31 N., R. 9 W., at the Holy Family Mission, 16 miles southeast of Browning and about 6 miles above mouth of Badger Creek, the nearest tributary.

DRAINAGE AREA.—368 square miles.

RECORDS AVAILABLE.—April, 1907, to September 30, 1914.

GAGE.—Overhanging gage installed September 18, 1913, on left bank directly back of the mission buildings. Datum of original gage, which was at the same site as present gage, was lowered 0.95 foot July 21, 1908. The original chain gage and bench marks were destroyed by flood June 2, 1913, and on June 10, 1913, a staff gage at a different datum on the left bank about 125 feet above site of chain gage. On July 23, 1913, this staff gage was removed to location of chain gage and was set to read 1.85 feet higher than the staff gage installed June 10, 1913. The present chain gage, installed September 18, 1913, was set to read 1.00 foot higher than the staff gage installed July 23, 1913, at the same site. Observers, Hugh Neubert and J. L. Gobert.

DISCHARGE MEASUREMENTS.—Low-water measurements made by wading at section near gage; high-water measurements must be made from the old wagon bridge about 3 miles above the mission.

CHANNEL AND CONTROL.—Gravel; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.9 feet at 7 a. m. May 17 (discharge, 1,640 second-feet); minimum stage recorded, 1.3 feet at 7 a. m. and 6 p. m. August 6–10, 14–16, and September 6 (discharge, 18 second-feet).

1907–1914: Maximum stage recorded, 8.15 feet June 9, 1909 (discharge, 7,600 feet); undoubtedly higher in June, 1908, but gage was washed out and no estimate is on record; minimum stage recorded, 1.3 feet January 12 to March 8, 1908 (discharge, 17 second-feet). See Gage.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS AND STORAGE.—Water is diverted at a point about 2 miles above the gage by a ditch which supplies water for about 100 acres of land on the farm at the Holy Family Mission. Diversions in 1914 amounted to 15,800 acre-feet. The United States Reclamation Service has furnished the following estimates of water diverted from Two Medicine River by the Reclamation Service canal, which heads above the gaging station: May 24–31, 714 acre-feet; June, 3,880 acre-feet; July, 5,680 acre-feet; August, 4,480 acre-feet; September 1–18, 1,070 acre-feet.

ACCURACY.—Results good except for winter months.

Discharge measurements of Two Medicine River at Family, Mont., during the year ending Sept. 30, 1914.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 22	2.50	178	May 20	4.60	1,420	July 24	1.84	74
Dec. 22	1.53	38	June 19	3.70	684	Sept. 6	1.40	26

Daily discharge, in second-feet, of Two Medicine River at Family, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	55	88	102	.....	118	960	886	291	35	35
2	55	88	102	.....	118	1,280	886	258	26	35
3	55	95	102	.....	136	1,460	1,040	258	26	35
4	55	88	102	.....	156	1,460	1,040	229	26	26
5	55	75	102	.....	202	1,280	1,040	202	26	26
6	65	70	102	.....	365	1,120	1,040	229	18	18
7	125	65	102	.....	326	1,120	886	229	18	26
8	150	65	102	.....	291	1,120	630	229	18	35
9	150	65	102	.....	291	1,120	549	229	18	26
10	198	65	102	.....	291	1,280	498	202	18	26
11	340	65	102	.....	291	1,280	451	202	26	35
12	360	55	102	.....	575	1,120	451	178	26	35
13	402	55	102	.....	816	1,120	498	156	26	26
14	402	55	102	.....	960	1,120	719	136	18	26
15	380	55	88	.....	1,120	1,280	659	146	18	35
16	360	55	88	.....	960	1,460	659	146	18	35
17	360	172	88	102	816	1,640	659	146	26	56
18	340	172	88	102	688	1,460	602	127	35	68
19	322	172	88	118	688	1,460	602	127	95	95
20	322	150	88	118	1,280	1,280	549	110	81	110
21	322	150	66	102	1,120	1,200	549	95	68	127
22	322	150	43	110	1,120	1,200	498	81	45	127
23	322	132	.....	110	1,120	1,040	549	81	35	146
24	340	125	.....	110	960	1,040	365	81	35	146
25	360	118	.....	110	1,120	1,200	406	68	45	127
26	360	118	.....	102	960	1,200	451	56	45	127
27	360	118	.....	118	816	1,040	326	45	35	127
28	255	118	.....	136	816	1,040	326	45	26	127
29	255	118	.....	118	1,120	886	291	45	26	110
30	132	118	.....	102	1,120	886	291	45	35	110
31	118	.....	.....	102	.....	750	.....	35	35	.....

NOTE.—See "Diversions and storage" in station description.
Daily discharge determined as follows: Oct. 1 to Dec. 22, from a rating curve well defined between 26 and 1,700 second-feet, and fairly well defined at other stages; Mar. 17 to Sept. 30, from a well-defined rating curve. Discharge interpolated Dec. 21.

Monthly discharge of Two Medicine River at Family, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	402	55	248	15,200	C.
November	172	55	101	6,010	B.
December (22 days)	102	43	93.9	4,100	B.
March 17-31	136	102	111	3,300	A.
April	1,280	118	692	41,200	A.
May	1,640	750	1,190	73,200	A.
June	1,040	291	613	36,500	A.
July	291	35	145	8,920	A.
August	95	18	33.2	2,040	A.
September	146	18	69.4	4,130	A.

NOTE.—See "Diversions and storage" in station description.

BADGER CREEK NEAR FAMILY, MONT.

LOCATION.—In the NE. ¼ sec. 19, T. 31 N., R. 8 W., near the road crossing at the Old Piegan subagency, 4 miles east of Family.

DRAINAGE AREA.—224 square miles.

RECORDS AVAILABLE.—April 20, 1907, to September 30, 1914.

GAGE.—An overhanging chain gage on the right bank. The original staff gage, established April 20, 1907, and bench marks were washed out in June, 1908, and a new gage was established July 22, 1908, about 400 feet farther upstream and at a different datum; as the bench mark was also destroyed the relation between the two gages could not be determined. The gage was again washed out on May 25, 1909, and was reset at a different datum and 400 feet below the old Piegan Mission crossing. Observer, O. J. Racine.

DISCHARGE MEASUREMENTS.—High-water measurements made from a cable, 4 miles above the gage; low-water measurements can be made by wading at the ford above the gage.

CHANNEL AND CONTROL.—Two channels at both medium and low stages; at high stages the stream flows in several channels. Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.00 feet at 6 p. m. June 2 (discharge, 677 second-feet); minimum stage recorded, 3.45 feet at 10 a. m. September 25, 28, and 30 (discharge, 92 second-feet). Open-season record only; flow probably lower at times in the winter months.

1907–1914: Maximum stage recorded, 5.85 feet May 27, 1913 (discharge, 1,780 second-feet); minimum stage recorded, 3.45 feet September 25, 28, and 30, 1914 (discharge 92 second-feet). Open-season records only. Mean discharge for February, 1911, estimated 25 second-feet.

DIVERSIONS.—The United States Reclamation Service proposes to divert the natural flow of Badger Creek to irrigate land in the eastern part of the Blackfeet Indian Reservation north of Birch Creek.

ACCURACY.—High-water measurements only fair; low-water records good.

Discharge measurements of Badger Creek, near Family, Mont., during the year ending Sept. 30, 1914.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 22	3.88	162	Mar. 17	3.63	68	July 24	3.88	141
Dec. 22	a 3.28	33	June 19	4.61	391	Sept. 6	3.57	102

a Discharge relation affected by ice.

Daily discharge, in second-feet, of Badger Creek, near Family, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	129	158	.....	.....	592	262	133	106
2	129	158	.....	.....	677	262	133	106
3	122	168	.....	.....	634	244	126	101
4	126	158	.....	.....	634	244	126	106
5	129	158	101	.....	554	244	118	96
6	138	147	106	.....	592	244	126	101
7	129	147	118	.....	554	244	118	96
8	147	147	112	.....	554	212	112	112
9	147	147	118	.....	592	227	118	112
10	129	147	133	.....	554	212	112	106
11	129	147	126	.....	554	212	126	106
12	147	147	.....	.....	517	197	118	106
13	138	138	.....	.....	484	184	112	101
14	147	138	.....	.....	517	197	118	106
15	147	147	.....	.....	484	172	112	106
16	147	147	.....	.....	484	172	118	106
17	158	147	.....	.....	517	172	118	106
18	168	147	.....	.....	424	162	112	101
19	168	147	.....	.....	424	162	118	106
20	168	147	.....	.....	372	151	112	101
21	168	147	.....	.....	372	151	118	106
22	168	.....	.....	.....	347	151	112	101
23	168	.....	.....	.....	302	142	106	96
24	168	.....	.....	.....	302	151	112	101
25	180	.....	.....	.....	282	133	106	92
26	192	.....	.....	.....	302	142	112	96
27	206	.....	.....	.....	262	133	112	96
28	206	.....	.....	.....	244	126	106	92
29	192	.....	.....	.....	262	133	112	96
30	192	.....	.....	.....	244	126	106	92
31	180	.....	.....	592	.....	133	106	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Nov. 21, from a fairly well defined rating curve; Apr. 5 to Sept. 30, from a well-defined rating curve. Discharge interpolated Oct. 4. Mean discharge Nov. 22 to 30 estimated at 135 second-feet. Gage not read Apr. 12 to May 30, as an observer could not be obtained.

Monthly discharge of Badger Creek, near Family, Mont., for the year ending Sept. 30, 1914.

[Drainage area, 224 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	206	122	157	0.701	0.81	9,650	B.
November	168	.....	145	.647	.72	8,630	C.
June	677	244	454	2.03	2.26	27,000	A.
July	262	126	184	.821	.95	11,300	A.
August	133	106	116	.518	.60	7,130	A.
September	112	92	102	.455	.52	6,070	A.

BIRCH CREEK AT SWIFT DAM, NEAR DUPUYER, MONT.

LOCATION.—At Swift dam, about 20 miles west of Dupuyer and about 35 miles west of Valier.

DRAINAGE AREA.—About 120 square miles.

RECORDS AVAILABLE.—March 26, 1913, to September 30, 1914.

GAGE.—Vertical staff gage on right bank, about one-fourth mile below dam.

DISCHARGE MEASUREMENTS.—Made from a foot log above the gage at high stages and by wading during normal periods. See Miscellaneous measurements, p. 213.

CHANNEL AND CONTROL.—Gravelly and shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.93 feet at 6 p. m. May 17 (discharge, 545 second-feet); minimum discharge estimated at 1 second-foot September 30.

1913–1914: Maximum stage recorded, 2.85 feet May 28–30, 1913 (discharge, 1,210 second-feet); minimum discharge estimated at 1 second-foot September 30, 1914. See "Regulation."

WINTER FLOW.—Discharge relation probably affected by ice at times; channel open during the winter of 1913–14.

DIVERSIONS.—Two small diversions.

REGULATION.—Flow regulated by operation of Swift dam.

COOPERATION.—Gage-height record and results of discharge measurements furnished by engineers of the Valier-Montana Land & Water Co.

ACCURACY.—Accuracy rating reduced because of the shifting of channel.

Discharge measurements of Birch Creek at Swift dam, near Dupuyer, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 18	W. S. Merrill	0.70	99	May 21	L. B. Crossan	1.39	356
Dec. 4	do	.55	71	June 27	R. O. Crawford	.94	151
Jan. 3	do	.44	56	July 9	do	.75	114
Mar. 5	L. B. Crossan	.30	36	22	do	.58	86
Apr. 2	do	.31	44	Aug. 5	do	.50	73
May 4	Templeton and Crossan	1.12	211	22	L. B. Crossan	.42	64
9	L. B. Crossan	1.28	281	Sept. 17	R. O. Crawford	.36	53

Daily discharge, in second-feet, of Birch Creek at Swift dam, near Dupuyer, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	70	105	70	60	49	39	50	222	320	170	70	59
2	70	112	77	60	49	39	50	344	320	165	69	57
3	70	101	77	56	49	40	50	364	297	178	72	62
4	74	101	74	57	49	38	50	236	297	158	70	57
5	75	103	67	63	48	38	60	222	293	130	70	63
6	84	99	67	60	49	40	74	258	312	142	68	57
7	83	95	67	61	49	41	64	320	290	132	66	60
8	77	95	67	58	51	42	64	364	272	142	64	62
9	75	95	67	51	49	42	55	290	286	123	62	63
10	77	99	64	56	49	41	60	290	286	126	64	57
11	96	97	64	54	47	42	64	312	282	108	66	55
12	170	97	64	54	47	40	81	293	282	102	64	57
13	188	95	64	54	48	42	112	316	356	106	70	62
14	158	93	63	53	46	44	135	336	420	104	64	63
15	123	86	61	54	46	40	180	320	393	96	64	63
16	114	88	61	51	43	44	236	340	393	92	64	60
17	103	91	61	51	43	45	178	545	328	100	72	60
18	99	88	60	49	42	48	194	525	290	94	72	63
19	95	82	58	49	42	49	152	506	268	100	66	59
20	95	84	50	50	41	45	170	420	249	90	63	60
21	101	80	48	50	41	46	180	380	249	88	66	59
22	103	80	50	54	41	45	222	360	230	86	64	60
23	116	80	63	51	41	51	222	340	246	81	63	62
24	163	80	64	49	40	50	194	376	214	79	57	62
25	148	80	61	51	40	46	236	356	228	81	55	63
26	134	77	61	57	39	50	208	372	197	79	57	60
27	134	74	61	58	39	57	172	393	180	74	62	42
28	116	72	61	50	40	50	170	348	208	72	60	162
29	116	75	57	57	.....	48	162	308	170	77	57	79
30	112	70	58	57	.....	49	180	304	168	74	55	1
31	107	.....	61	49	.....	50	.....	304	.....	72	57	.....

NOTE.—Daily discharge computed as follows: Oct. 1 to Oct. 11, Mar. 26 to May 5, and July 7 to Sept. 30, from well-defined rating curve; Oct. 16 to Mar. 15, from well-defined rating curve; Oct. 12 to 15, by indirect method for shifting channels. Discharge interpolated Aug. 6 to 8. Headgates closed 8 hours Sept. 27; estimate of discharge therefore reduced one-third.

Monthly discharge of Birch Creek at Swift dam, near Dupuyer, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	188	70	108	6,640	A.
November	112	70	89.1	5,300	A.
December	77	48	62.8	3,860	B.
January	63	49	54.3	3,340	B.
February	51	39	44.9	2,490	B.
March	57	38	44.6	2,740	B.
April	236	50	134	7,970	B.
May	545	222	344	21,200	B.
June	420	168	277	16,500	B.
July	178	72	107	6,580	B.
August	72	55	64.3	3,950	A.
September	162	1	61.6	3,670	A.
The year	545	1	116	84,200	

BIRCH CREEK NEAR DUPUYER, MONT.

LOCATION.—In sec. 28, T. 29 N., R. 8 W., at Kepple's ranch (formerly Shield's), about one-half mile above the head of "B" canal of the Valier-Montana Land and Water Co., 12 miles northwest of Dupuyer, and about 25 miles above the junction of Birch Creek with Two Medicine River.

DRAINAGE AREA.—About 155 square miles. (Figure published in Water-Supply Paper 356 in error.)

RECORDS AVAILABLE.—July 25, 1907, to September 30, 1914.

GAGE.—A sloping staff gage on the right bank just above the cable. A Bristol water-stage recorder was installed April 1, 1911, at the same section, but the staff is still read daily. A temporary staff gage was put in July 23, 1908, about 200 feet below the site of the original gage, which had been washed out by the high water of June, 1908. The temporary gage was used until October 1, 1908, when a permanent chain gage was installed at a point about one-fourth mile farther upstream. A Bristol automatic gage was installed April 1, 1911, but the chain gage was read daily until December 31, 1913, when it was abandoned. Present staff gage installed January 1, 1914. Observers, L. G. Kepple and R. O. Crawford.

DISCHARGE MEASUREMENTS.—Made from cable 200 feet below gage; low-stage measurements made by wading just below the cable section.

CHANNEL AND CONTROL.—Shifts at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year: 4.22 feet at 5.30 p. m. May 17 (discharge, 445 second-feet); minimum stage recorded, 3.13 feet at 3 p. m. March 25 (discharge, 52 second-feet). Open-season records only; mean flow for February estimated at 50 second-feet, and on some days the flow was undoubtedly less than this.

1907–1914: Maximum stage recorded, 9.3 feet July 28, 1909 (discharge, 1,680 second-feet); minimum stage recorded, 3.13 feet March 25, 1914 (discharge, 52 second-feet). Open-season records only; mean flow for February, 1911, estimated at 35 second-feet.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—A number of small ditches divert water for irrigation.

REGULATION.—The discharge is largely controlled by the Swift dam.

COOPERATION.—Gage-height record and results of discharge measurements furnished by the engineers of the Valier-Montana Land & Water Co.

ACCURACY.—Results considered good.

Discharge measurements of Birch Creek near Dupuyer, Mont., during the year ending Sept. 30, 1914.

Date.	[a] Made by—	Gage height.	Discharge.	Date.	[a] Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 15	W. S. Merrill	[b] 5.00	170	June 17	R. O. Crawford	3.90	296
Dec. 4	do	[b] 4.83	[c] 76	July 6	do	3.50	154
11	Templeton and Merrill	[b] 4.60	[c] 92	15	do	3.40	118
Jan. 1	W. S. Merrill	3.85	[c] 103	18	do	3.37	111
May 1	Templeton and Larson	3.64	211	31	do	3.30	87
8	R. M. Templeton	3.76	252	Aug. 28	do	3.21	70
22	L. B. Crossan	4.01	379	Sept. 22	do	3.17	55
June 9	R. O. Crawford	3.69	220				

[a] Engineers of the Valier-Montana Land & Water Co.
[b] Read on old chain gage abandoned Dec. 31, 1913.
[c] Ice present.

Daily discharge, in second-feet, of Birch Creek near Dupuyer, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	90	143	112	.....	56	204	332	175	86	64
2	90	143	.....	.....	56	280	378	171	83	64
3	90	132	.....	.....	56	378	355	164	83	64
4	112	132	.....	.....	56	332	378	160	81	64
5	101	132	.....	.....	64	293	355	157	81	64
6	101	143	.....	.....	86	259	301	153	78	64
7	101	132	.....	.....	81	255	271	150	76	64
8	101	122	.....	.....	76	251	247	146	74	64
9	90	122	.....	.....	76	310	223	136	74	64
10	90	122	.....	.....	76	355	223	136	74	64
11	101	122	.....	.....	76	310	216	133	74	62
12	122	132	.....	.....	88	310	216	133	71	62
13	188	122	.....	.....	122	306	219	143	71	64
14	200	122	.....	.....	139	332	445	129	71	64
15	165	122	.....	.....	171	378	355	119	71	64
16	165	122	.....	56	208	445	332	116	69	64
17	143	122	.....	62	171	445	310	113	88	64
18	132	122	.....	66	153	445	314	110	81	64
19	132	122	.....	61	171	422	301	107	76	64
20	132	112	.....	56	239	400	263	104	71	61
21	143	112	.....	59	223	355	259	100	69	61
22	143	112	.....	56	208	355	219	97	69	59
23	143	112	.....	56	212	355	223	97	69	59
24	165	101	.....	56	247	400	212	94	76	59
25	188	101	.....	52	239	378	219	91	74	59
26	188	101	.....	53	235	342	212	91	71	59
27	176	101	.....	55	227	310	185	91	69	59
28	165	101	.....	57	216	288	182	88	66	64
29	154	112	.....	58	200	288	185	88	64	61
30	154	112	.....	59	200	288	178	88	64	64
31	143	.....	.....	56	.....	280	.....	88	64	.....

NOTE.—Daily discharge computed as follows: Oct. 1 to Dec. 1, from a fairly well defined rating curve; Mar. 16 to 25 and Mar. 29 to Sept. 30, from a well-defined rating curve. Discharge relation affected by ice Dec. 2 to Mar. 15 and Mar. 26 to 29. Mean discharge estimated as follows: Dec. 1 to 31, 95 second-feet; Jan. 1 to 31, 65 second-feet; Feb. 1 to 28, 50 second-feet; Mar. 1 to 15, 55 second-feet; Mar. 26 to 29, discharge estimated.

Monthly discharge of Birch Creek near Dupuyer, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	200	90	136	8,360	B.
November	143	101	120	7,140	B.
December	.....	.....	[a] 95	5,840	C.
January	.....	.....	[a] 65	4,000	C.
February	.....	.....	[a] 50	2,780	C.
March	.....	.....	[b] 56.2	3,460	C.
April	247	56	148	8,810	A.
May	445	204	334	20,500	A.
June	445	178	270	16,100	A.
July	175	88	122	7,500	A.
August	88	64	73.8	4,540	A.
September	64	59	62.6	3,720	A.
The year	445	.....	128	92,800	

[a] Estimated. See footnote to table of daily discharge.
[b] Mar. 1–15 and 26 to 29 estimated.

BIRCH CREEK AT NELSON'S RANCH, NEAR DUPUYER, MONT.

LOCATION.—In the NW. ¼ sec. 27, T. 29 N., R. 8 W., below the headworks of the "B" canal of the Valier Project, at Nelson's ranch, about 11 miles northwest of Dupuyer.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 8 to September 30, 1914.

GAGE.—Inclined wooden staff on the right bank, a short distance above the ranch buildings. Observers, John Ryan and R. O. Crawford.

DISCHARGE MEASUREMENTS.—Made by wading at tag wire about 100 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages. Bed composed of cobblestones and gravel, with a small amount of algæ if the water remains at low stages for a considerable period during the summer. Both banks of medium height; right is steep; left slopes gently; neither overflows owing to the regulation above.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.55 feet at 6.30, 6, and 5 p. m. May 17–19, inclusive (discharge, 385 second-feet); minimum stage recorded, 1.73 feet at 5.35 p. m. September 27 (discharge, 1.6 second-feet). See Regulation.

WINTER FLOW.—Discharge relation affected by ice.

REGULATION.—The discharge is controlled by the Swift dam and the head gates of the "B" canal.

DIVERSIONS.—The greater part of the flow of Birch Creek is diverted above this station.

ACCURACY.—Results good.

COOPERATION.—Gage-height record and results of discharge measurements were furnished by the Valier-Montana Land & Water Co.

Discharge measurements of Birch Creek at Nelson's ranch, near Dupuyer, Mont., during the year ending Sept. 30, 1914.

[Made by R. O. Crawford.[a]]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
June 10	1.83	4.51	June 26	2.28	41	Aug. 28	1.87	6.34
20	2.00	15.9	July 8	2.04	18.3			

[a] An engineer of the Valier-Montana Land & Water Co.

Daily discharge, in second-feet, of Birch Creek at Nelson's ranch, near Dupuyer, Mont., for the year ending Sept. 30, 1914.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	233	22	18	7.2	16	24	33	18	8.8	5.6
2	.....	250	12	18	7.2	17	385	35	13	20	5.6
3	.....	29	8.8	16	6.4	18	385	20	14	15	5.6
4	.....	33	44	17	5.6	19	385	17	10	11	5.6
5	.....	30	42	17	6.0	20	364	16	8.8	9.6	5.2
6	.....	22	40	16	6.4	21	344	14	9.6	8.0	4.4
7	.....	16	24	16	6.8	22	324	10	8.0	7.6	4.0
8	8	10	19	15	7.2	23	324	51	8.8	7.2	3.6
9	14	5.2	25	14	6.8	24	344	54	11	14	2.6
10	18	5.2	23	14	6.4	25	324	46	17	12	2.2
11	16	128	22	13	4.8	26	286	42	14	8.0	1.9
12	12	66	18	11	6.0	27	233	33	13	7.2	1.6
13	13	56	22	11	6.4	28	200	22	14	6.8	7.2
14	16	76	23	10	6.4	29	184	23	21	6.8	7.2
15	20	125	19	9.6	6.4	30	178	22	19	7.2	17
						31	170	.....	18	7.2	.....

NOTE.—Daily discharge computed from a rating curve well defined below 250 second-feet.

Monthly discharge of Birch Creek at Nelson's ranch, near Dupuyer, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 8–31	385	8.0	190	9,040	B.
June	250	5.2	50.7	3,020	A.
July	44	8.0	18.7	1,150	A.
August	20	6.8	12.0	738	A.
September	17	1.6	5.84	348	A.
The period				14,300	

BIRCH CREEK AT HALL'S RANCH, NEAR DUPUYER, MONT., 1914.

LOCATION.—At Hall's ranch, about 4 miles below the headworks of the "B" canal of the Valier Carey project.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 16, 1913, to September 30, 1914.

GAGE.—Vertical staff on left bank. Observers, John Hall, John Ryan, and R. O. Crawford.

DISCHARGE MEASUREMENTS.—Made by wading at different sections.

CHANNEL AND CONTROL.—Shifting. Bed is of gravel and cobblestones. Right bank is a high rock cliff; the left bank is of medium height, wooded, and will not overflow because of regulation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.20 feet at 3.30 p. m. May 18, 1914 (discharge, 410 second-feet); minimum stage recorded, 0.10 foot at 2.20 p. m. May 3 (discharge, 1.0 second-foot).

1913–1914: Maximum stage recorded, 3.3 feet May 28, 1913 (discharge, 910 second-feet); minimum stage recorded, 0.10 foot May 3, 1914 (discharge, 1.0 second-foot). Records only for part of year when discharge relation is not affected by ice.

WINTER FLOW.—Discharge relation seriously affected by ice; records discontinued during part of the winter months.

REGULATION.—Discharge controlled by operation of the gates of the Swift dam and the headworks of the "B" canal.

DIVERSIONS.—The greater part of the flow of Birch Creek is diverted above this station.

ACCURACY.—Results considered good.

COOPERATION.—Gage-height record and results of discharge measurements furnished by the Valier-Montana Land & Water Co.

Discharge measurements of Birch Creek at Hall's ranch, near Dupuyer, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct 15	W. S. Merrill[a]	[b] 1.48	154	June 11	R. O. Crawford[a]	1.20	103
Dec. 3	do	[b] 1.20	103	26	do	.79	38
Jan. 1	do	1.35	65	July 3	do	.45	11.4
Mar. 4	Crossan and Larson[a]	[c] 1.30	[c] 40	7	do	.68	26
May 1	Templeton and Larson[a]	.34	10.1	Aug. 29	do	.45	11.2
22	L. B. Crossan[a]	1.91	302				

[a] Engineers of the Valier-Montana Land & Water Co.
[b] Discharge relation affected by backwater from small diversion dam.
[c] Ice jam formed during measurement.

Daily discharge, in second-feet, of Birch Creek, at Hall's ranch, near Dupuyer, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10	140	100	.....	26	17	220	22	17	11
2	15	134	92	.....	28	13	205	15	18	10
3	17	130	85	.....	28	1.0	38	11	17	10
4	24	126	92	.....	28	4.0	32	44	16	10
5	22	122	97	.....	23	7.2	26	46	16	9.0
6	20	120	100	.....	15	7.6	22	43	16	9.0
7	20	120	97	.....	18	8.0	18	26	14	9.0
8	85	118	92	.....	21	8.0	13	19	12	9.0
9	86	118	88	.....	23	8.0	10	26	12	9.0
10	86	118	85	.....	23	6.0	10	26	12	7.5
11	140	120	85	.....	23	6.8	102	26	12	6.5
12	144	120	84	.....	23	7.2	58	22	12	7.0
13	160	110	82	.....	23	7.6	92	25	12	8.5
14	180	104	82	.....	23	6.8	92	26	11	7.5
15	156	100	94	15	15	3.4	109	21	11	7.5
16	136	100	112	23	8	8.0	37	18	11	6.5
17	122	100	130	23	17	390	42	16	11	6.5
18	118	100	130	20	19	410	24	16	20	6.0
19	114	100	130	21	19	390	24	14	16	6.0
20	114	98	132	19	15	390	22	12	13	6.5
21	114	98	132	15	13	330	13	12	12	6.5
22	114	100	.....	20	12	302	11	12	11	6.0
23	114	104	.....	19	10	302	57	11	12	6.0
24	134	102	.....	19	8.0	320	58	14	15	6.0
25	160	100	.....	18	9.4	320	57	16	13	6.0
26	150	106	.....	17	8.0	268	37	14	12	6.0
27	140	110	.....	15	10	252	30	13	12	5.5
28	136	114	.....	15	12	220	23	14	12	9.0
29	134	118	.....	15	14	220	24	18	11	11
30	136	118	.....	19	15	190	22	18	11	14
31	138	.....	.....	23	.....	190	.....	18	11	.....

NOTE.—Daily discharge computed as follows: Oct. 1 to 2, estimated; Oct. 3 to Dec. 21, from a fairly well defined rating curve; Mar. 15 to May 21, from a well-defined rating curve; May 22 to Sept. 30, from a well-defined rating curve; discharge relation affected by ice Dec. 22 to Mar. 14. Mean discharge Dec. 22 to 31 estimated at 90 second-feet.

Monthly discharge of Birch Creek at Hall's ranch, near Dupuyer, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	180	10	104	6,400	B.
November	140	98	112	6,660	B.
December	.....	.....	97.5	6,000	C.
March 15–31	23	15	18.6	627	B.
April	28	8	17.6	1,050	B.
May	410	1.0	149	9,160	B.
June	220	10	50.9	3,030	A.
July	46	11	20.5	1,260	A.
August	20	11	13.3	818	A.
September	14	5.5	7.93	472	B.

BIRCH CREEK AT ROBARE, MONT.

LOCATION.—In the N. ½ sec. 31, T. 30 N., R. 7 W., about one-half mile downstream from the former post office of Robare, about 10 miles north of Dupuyer, and about 14 miles west of Valier.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 4 to September 30, 1914.

GAGE.—Inclined staff on right bank. Observer, R. O. Crawford.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—The bed is of cobblestones and gravel, both banks are medium high and wooded, and will probably not overflow. The control is a riffle about 100 feet below the gage, and is liable to shift.

EXTREMES OF DISCHARGE.—Maximum discharge during year, June 1, estimated from flow of Birch Creek at Nelson's ranch at 215 second-feet (no gage height); minimum stage recorded, 1.52 feet at various hours, July 22, 24–28, August 7–17, 20–23, 28 and 29 (discharge, 0.5 second-foot). See "Regulation" and "Accuracy."

WINTER FLOW.—Discharge relation affected by ice; observations discontinued during winter months.

REGULATION.—Discharge controlled by operation of the gates at the Swift dam, the "B" canal headworks, and several smaller ditches.

DIVERSIONS.—Most of the water is diverted above the station.

ACCURACY.—Accuracy rating omitted from table of monthly discharge because of the large part of the discharge in June which is estimated and because of the small discharge in the other months. In view of the facts that the quantities are small, that the discharge of the lowest measurement is estimated, and that the measuring section is wide at low stages the records are believed to be good.

COOPERATION.—Results of discharge measurements and record of gage readings furnished by the Valier-Montana Land & Water Co.

Discharge measurements of Birch Creek at Robare, Mont., during the year ending Sept. 30, 1914.

[Made by R. O. Crawford.[a]]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 15	2.57	78
July 3	1.55	[b] 1.0
6	1.98	15.3

[a] An engineer of the Valier-Montana Land & Water Co.
[b] Discharge estimated.

Daily discharge, in second-feet, of Birch Creek at Robare, Mont., for the year ending Sept. 30, 1914.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	[a] 215	7.1	0.7	0.7	16	28	0.8	0.5	0.8
2	[a] 210	2.5	.7	.7	17	29	.8	.5	.8
3	[a] 38	1.0	.7	.7	18	15	.8	.8	1.0
4	29	23	.7	.7	19	11	.8	.7	1.0
5	25	17	.7	.7	20	7.8	.7	.5	.7
6	22	16	.7	.7	21	6.8	.7	.5	.7
7	15	9.0	.5	.7	22	2.8	.5	.5	.8
8	9.0	5.2	.5	.7	23	28	.7	.5	.7
9	7.8	1.8	.5	.7	24	25	.5	1.2	.8
10	5.2	1.2	.5	.7	25	31	.5	1.0	.8
11	59	1.2	.5	.7	26	17	.5	.8	.7
12	32	1.0	.5	.7	27	13	.5	.7	.7
13	52	.8	.5	.7	28	9.0	.5	.5	.8
14	69	1.2	.5	.7	29	8.2	.8	.5	.8
15	78	.8	.5	.8	30	7.4	.8	.7	1.0
					31		.7	.7	

[a] June 1–3, discharge estimated from flow at Nelson's ranch.

NOTE.—Discharge computed from a fairly well defined rating curve. See "Accuracy."

Monthly discharge of Birch Creek at Robare, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
June	.....	2.8	36.8	2,190
July	23	.5	3.21	197
August	1.2	.5	.62	38.1
September	1.0	.7	.76	45.2
The period	.....	.....	.....	2,470.

NOTE.—See "Accuracy" in station description and footnote to table of daily discharge.

DUPUYER CREEK NEAR VALIER, MONT.

LOCATION.—In the NE. ¼ NW. ¼ sec. 33, T. 29 N., R. 6 W., about 1,000 feet above a large diversion dam at the head of the canal from Dupuyer Creek to Lake Francis reservoir, and about 11 miles northwest of Valier. The Birch Creek canal discharges into Dupuyer Creek below the gaging station and above the diversion dam.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 17, 1912, to September 30, 1914.

GAGE.—A staff gage installed May 15, 1913, and a Bristol water-stage recorder at the same section; Bristol recorder not used; chain gage at same site read prior to installation of present gage; all published gage heights referred to same datum. Observers, C. E. Crocker and E. D. Perkins.

DISCHARGE MEASUREMENTS.—Made from a cable at high and by wading at medium and low stages.

CHANNEL AND CONTROL.—Shift slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.85 feet at 8 a. m. May 24 (discharge, 351 second-feet); minimum stage recorded, 2.22 feet at 8.45 a. m. August 9 (discharge, 4.4 second-feet).

1912–1914: Maximum stage recorded, 3.85 feet May 24, 1914 (discharge, 351 second-feet); minimum stage recorded, 2.22 feet August 9, 1914 (discharge, 4.4 second-feet).

Open-season records; estimates of mean monthly flow only available for winter months.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Numerous small diversions for irrigation.

ACCURACY.—Conditions favor accuracy of records. Estimates for period in which discharge relation is affected by ice considered fair.

COOPERATION.—Gage-height record and results of discharge measurements furnished by the Valier-Montana Land & Water Co.

Discharge measurements of Dupuyer Creek near Valier, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 1	W. S. Merrill[a]	2.47	13.8	May 8	L. B. Crossan[a]	2.96	65.
Dec. 16	....do	*b* 2.72	28.	May 22	....do	3.12	93.
Jan. 9	....do	*b* 2.80	32.	June 16	....do	3.25	120.
Mar. 6	Crossan and Larson[a]	*b* 3.02	24.	July 15	....do	2.55	18.2
Apr. 4	Templeton and Crossan.	2.72	33.				

a Engineers of the Valier-Montana Land & Water Co.
b Discharge relation affected by ice.

Daily discharge, in second-feet, of Dupuyer Creek near Valier, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.
1	13	49	32	48	75	47	9.6
2	13	48	31	48	71	43	7.2
3	13	46	36	48	71	41	5.2
4	a24	61	33	55	71	41	5.0
5	34	54	48	71	80	40	5.0
6	27	54	58	68	86	38	5.0
7	23	61	42	71	79	38	5.2
8	26	48	48	65	71	30	4.8
9	28	38	45	68	68	27	4.4
10	a38	43	51	80	63	26	5.0
11	49	a40	48	125	55	26	9.6
12	67	38	63	90	52	24	6.0
13	78	55	58	88	71	22	6.8
14	71	42	55	90	140	18	8.0
15	58	48	52	94	149	18	8.0
16	51	37	48	94	121	19	7.6
17	48	33	48	100	100	19	8.0
18	43	31	47	110	90	18	15
19	41	34	42	106	71	15	15
20	44	31	45	102	69	14	14
21	a41	a34	55	96	63	13	13
22	38	36	47	90	55	12	12
23	48	28	45	92	58	17	12
24	47	38	45	351	63	15	18
25	43	47	46	132	69	12	18
26	46	34	42	112	63	12	18
27	48	30	42	94	57	11	15
28	46	30	52	92	55	11	14
29	48	30	54	94	50	12	14
30	49	30	54	106	47	12	14
31	46	.....	.....	79	.....	11	14

a Discharge interpolated.

NOTE.—Daily discharge determined as follows: Oct. 1 to Nov. 30, from a well-defined rating curve; Apr. 1 to Aug. 30, from a rating curve well defined below 200 second-feet. Gage not read Aug. 31 to Sept. 30; mean discharge Sept. 1–30 estimated 15 second-feet from gage readings Aug. 30 and Oct. 8, 1914.

Discharge relation affected by ice and mean discharge estimated as follows: Dec. 1–31, 30 second-feet; Jan. 1–31, 32 second-feet; Feb. 1–28, 28 second-feet; Mar. 1–31, 25 second-feet.

Monthly discharge of Dupuyer Creek near Valier, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	78	13	41.6	2,560	A.
November	61	28	40.9	2,430	B.
December	.....	.....	a30	1,840	D.
January	.....	.....	a32	1,970	D.
February	.....	.....	a28	1,560	D.
March	.....	.....	a25	1,540	D.
April	63	31	47.1	2,800	A.
May	351	48	95.5	5,870	A.
June	149	47	74.4	4,430	A.
July	47	11	22.6	1,390	A.
August	18	4.4	10.2	627	A.
September	.....	.....	a15	893	D.
The year	351	.....	38.6	27,900	

a Estimated.

DRY FORK OF MARIAS RIVER NEAR VALIER, MONT.

LOCATION.—In the SW. ¼ sec. 36, T. 29 N., R. 5 W., about 5 miles south of the dam of the Lake Francis reservoir, 9 miles southeast of Valier.

DRAINAGE AREA.—About 120 square miles.

RECORDS AVAILABLE.—March 19, 1911, to September 30, 1914.

GAGES.—Bristol water-stage recorder and staff gage on the left bank; Bristol recorder has a range of 8 feet.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Shifting; bed of stream composed of sand and gravel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.45 feet at 1 a. m. October 14 (discharge, 40 second-feet); channel reported dry from September 1 to October 4 and July 15 to August 8.

1911–1914: Maximum stage recorded, 5.2 feet May 21, 1912 (discharge, 600 second-feet); channel reported dry during June, July, August, and September, 1911; August 11–15 and August 25 to October 4, 1913; July 15 to August 8, 1914.

WINTER FLOW.—Discharge relation seriously affected by ice; part of flow estimated from engineer's notes.

DIVERSIONS.—Numerous small diversions for irrigation.

ACCURACY.—Because of the small flow, the missing gage heights, and the shifting channel, a large percentage of error is possible.

COOPERATION.—Bristol charts and results of discharge measurements were furnished by the engineers of the Valier-Montana Land & Water Co.

Discharge measurements of Dry Fork of Marias River near Valier, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	W. S. Merrill *a*	1.78	1.0	Apr. 20	L. B. Crossan *a*	2.00	3.5
Jan. 7	.....do	2.35	*b* .11	May 12	.....do	2.28	22.3
Mar. 21	L. B. Crossan *a*	2.30	18.0				

a Engineers of Valier-Montana Land & Water Co.
b Jan. 7, discharge relation affected by ice. Result represents only part of flow. Total mean discharge estimated not more than 1 second-foot.

Daily discharge, in second-feet, of Dry Fork of Marias River near Valier, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.
1	0.0	1.2	.....	21	8.0	0.6	0.2	0.0
2	.0	1.2	.....	15.0	8.0	.4	.2	.0
3	.0	1.4	.....	11.5	5.3	.6	.2	.0
4	.0	1.5	.....	9.4	4.4	.6	.2	.0
5	.3	1.5	.....	10.1	4.4	.8	.2	.0
6	.6	2.0	.....	13.6	4.4	.9	.2	.0
7	.8	2.0	.....	17.7	10.1	.8	.2	.0
8	1.0	2.3	.....	20	10.1	1.4	.2	.0
9	1.1	2.2	.....	23	10.1	.9	.2	.....
10	1.4	2.0	.....	26	7.1	1.2	.2	.....
11	1.2	2.0	.....	23	14.6	.9	.2	.....
12	5.2	1.8	.....	23	22	1.4	.2	.....
13	18.0	2.0	.....	23	10.8	1.4	.2	.....
14	32	2.2	.....	23	7.6	1.4	.2	.....
15	19.5	2.8	.....	23	5.8	1.4	.0	.....
16	11.8	2.8	.....	3.5	4.4	1.7	.0	.....
17	8.2	2.2	.....	3.5	3.5	1.7	.0	.....
18	4.6	1.4	.....	3.5	2.8	1.7	.0	.....
19	2.8	1.2	.....	3.5	2.6	1.4	.0	.....
20	4.0	1.5	.....	3.5	1.8	.9	.0	.....
21	4.3	1.4	18.0	3.3	1.4	.8	.0	.....
22	2.8	1.5	10.1	3.2	1.4	.6	.0	.....
23	2.2	1.2	7.6	1.8	1.5	.4	.0	.....
24	1.8	1.2	7.6	2.2	1.8	.3	.0	.....
25	1.4	1.2	12.2	2.6	2.6	.4	.0	.....
26	1.5	1.2	12.9	2.6	3.0	.6	.0	.....
27	1.2	1.4	12.2	2.6	1.4	.5	.0	.....
28	1.4	1.2	10.1	2.1	.9	.4	.0	.....
29	1.2	1.2	9.4	3.0	.8	.3	.0	.....
30	1.2	1.2	10.1	5.8	.9	.2	.0	.....
31	1.1	.....	12.9	.....	.8	.....	.0	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Nov. 27 from a rating curve well defined between 3 and 310 second feet and fairly well defined at other stages; Mar. 21 to Apr. 19 by indirect method for shifting channels; Apr. 20 to Aug. 8 from a well-defined rating curve. Discharge relation affected by ice Nov. 28, 1913, to Mar. 20, 1914; mean discharge Dec. 1 to Feb. 28 estimated as follows: Dec. 1–31, 1.5 second feet; Jan. 1–31, 0.5 second-foot; Feb. 1–28, 1.0 second-foot. Mean discharge Mar. 1–20 not estimated because of lack of information; gage readings during this period as follows:

	Feet.		Feet.		Feet.		Feet.
Mar. 1	3.45	Mar. 6	3.15	Mar. 11	3.1	Mar. 16	2.57
2	3.45	7	3.15	12	2.99	17	2.44
3	3.4	8	3.25	13	2.96	18	2.32
4	3.3	9	3.25	14	2.86	19	2.28
5	3.2	10	3.15	15	2.68	20	2.28

Gage not read Oct. 8, Jan. 1–6, Jan 8–18, Jan. 20 to Feb. 27, Apr. 13–17, Apr. 24, May 5–8, May 11, June 13–17, July 21–24, and Aug. 9 to Sept. 30; discharge for these days interpolated except when estimated as noted above.

Monthly discharge of Dry Fork of Marias River near Valier, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	32	0.0	4.28	263	B.
November	2.8	1.2	1.66	99	B.
December	.....	.....	[a] 1.5	[b] 92	.....
January	.....	.....	[a] .5	[b] 31	.....
February	.....	.....	[a] 1.0	[b] 56	.....
March 21–31	.....	.....	11.2	244	D.
April	26	1.8	11.0	654	D.
May	22	0.8	5.30	326	D.
June	1.7	.2	.886	52.7	D.
July	.2	.0	.090	[b] 5.5	.....
August 1–8	.0	.0	.0	0	.....

[a] Estimated.
[b] Results approximate. A statement of probable accuracy in percentage for such low discharges might be misleading.

NOTE.—See footnotes to table of daily discharge.

TETON RIVER AT STRABANE, MONT.

LOCATION.—In the SE. ¼ NE. ¼ sec. 35, T. 25 N., R. 7 W., on the highway bridge half a mile north of Peeble's ranch, at Strabane post office, 16 miles above Chouteau.

DRAINAGE AREA.—140 square miles.

RECORDS AVAILABLE.—November 26, 1904, to December 31, 1906; January 16, 1908, to September 30, 1914.

GAGE.—Standard chain gage fastened to upstream side of bridge near center of river, installed March 23, 1911; prior to that date several different gages and datums were used. Observer, James Peebles, jr.

DISCHARGE MEASUREMENTS.—At flood stages made from the bridge at the gage; at low stages by wading at various sections.

CHANNEL AND CONTROL.—Shifts at high stages; current swift. There are several channels at both low and high stages. The results show the total flow of all the channels.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.76 feet at 4 p. m. June 4 (discharge, 415 second-feet); minimum stage recorded, 3.2 feet at 4 p. m. March 31 (discharge 23 second-feet).

1908–1914: Maximum stage recorded, 8.95 feet June 10, 1908 (discharge, 1,680 second-feet); minimum stage recorded, 2.55 feet January 19–23, 1913 (discharge, 17 second-feet). See Gage.

WINTER FLOW.—Discharge relation not affected by ice.

DIVERSIONS AND STORAGE.—Most of the normal flow is appropriated and used for irrigation. See Miscellaneous measurements, pages 213 and 215.

ACCURACY.—Accurate determination of discharge during high stages difficult because of shifting channel. Results good.

Discharge measurements of Teton River at Strabane, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 23	C. S. Heidel	3.73	78	June 26	C. S. Heidel	4.20	189
May 5	do	4.13	172	Aug. 13	W. A. Lamb	3.63	69

Daily discharge, in second-feet, of Teton River at Strabane, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	74	89	81	51	30	32	30	97	356	162	80	61
2	74	89	81	51	29	34	32	105	356	162	78	58
3	81	89	81	51	28	34	32	138	380	150	74	57
4	81	89	81	52	28	34	34	176	410	150	72	56
5	81	89	81	53	30	36	35	176	380	150	69	54
6	81	89	81	53	30	38	35	162	312	150	72	53
7	81	89	81	53	30	41	35	162	312	150	74	53
8	81	89	81	53	32	41	37	176	312	162	75	54
9	81	89	81	53	32	40	38	176	273	150	78	54
10	81	89	81	52	36	44	39	176	254	129	76	56
11	81	89	74	52	36	44	39	162	237	125	75	56
12	89	89	74	49	35	44	40	176	220	116	72	56
13	97	89	74	48	39	46	41	176	254	108	69	54
14	97	89	74	46	39	46	42	189	333	105	69	54
15	97	89	74	46	40	46	42	220	380	101	68	53
16	97	89	74	46	41	44	48	312	380	101	72	53
17	97	89	74	45	42	44	50	380	356	99	72	52
18	97	81	74	45	40	44	51	380	292	99	72	53
19	97	81	67	45	40	41	52	356	273	97	72	53
20	89	81	67	45	38	39	56	356	273	97	69	54
21	81	81	67	46	35	36	56	333	254	108	69	53
22	81	81	55	49	31	35	61	292	237	99	68	53
23	81	81	55	44	28	32	61	273	220	99	66	53
24	81	81	54	42	28	31	63	292	204	92	66	53
25	81	81	53	40	28	30	03	312	189	89	68	53
26	89	81	53	34	28	29	72	312	176	87	69	53
27	89	81	53	34	31	28	78	312	162	84	66	53
28	89	81	53	34	31	28	81	312	162	83	66	53
29	89	81	53	34	.....	28	84	312	162	83	63	53
30	89	81	55	30	.....	30	84	312	162	81	63	53
31	89	.....	55	30	.....	25	.....	333	.....	81	61	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Dec. 31, from a fairly well defined rating curve; Jan. 1 to Sept. 30, from a rating curve well defined below 200 second-feet. Discharge relation possibly affected by ice during January, February, and March; accuracy of results for those months reduced.

Monthly discharge of Teton River at Strabane, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	97	74	86.2	5,300	B.
November	89	81	85.5	5,090	B.
December	81	53	69.1	4,250	B.
January	53	30	45.4	2,790	B.
February	42	28	33.4	1,850	B.
March	46	25	36.9	2,270	B.
April	84	30	50.4	3,000	B.
May	380	97	247	15,200	B.
June	410	162	276	16,400	B.
July	162	81	114	7,010	A.
August	80	61	70.4	4,330	A.
September	61	52	54.1	3,210	A.
The year	410	25	97.7	70,700	

NOTE.—See footnote to table of daily discharge.

DEEP CREEK NEAR CHOUTEAU, MONT.

LOCATION.—In the SW. ¼ NW. ¼ sec. 15, T. 23 N., R. 5 W., at Hugh Robinson's ranch, 5 miles southwest of Chouteau.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 24, 1911, to September 30, 1914.

GAGE.—Overhanging chain gage on right bank. Observer, Hugh Robinson.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Clean and fairly permanent; bed composed of gravel; gravel bar about 50 feet below the gage forms the controlling section.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.5 feet at 7 a. m. May 25 (discharge, 212 second-feet); minimum stage recorded, 5.27 feet at 7 a. m. September 6 (discharge, 11 second-feet).

1911–1914: Maximum stage recorded, 8.4 feet May 21, 1912 (discharge, 1,090 second-feet); minimum stage recorded, 5.28 feet September 25, 1913, and 5.27 feet September 6, 1914 (discharge, 11 second-feet).

Open season records only: Flow may have been lower at times during the winter months.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—A few small ditches divert water from creek above station.

ACCURACY.—Records considered excellent.

Discharge measurements of Deep Creek near Chouteau, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 7	W. A. Lamb	5.71	48	June 9	W. A. Lamb	6.07	112
May 12	B. E. Jones	6.07	113	Aug. 13	....do	5.37	15.0

NOTE.—Measurements made by wading.

Daily discharge, in second-feet, of Deep Creek near Chouteau, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	14	41	.....	51	86	130	51	14	20
2	14	41	.....	38	96	155	44	17	20
3	14	41	.....	44	107	155	28	14	17
4	14	36	.....	33	142	168	24	17	20
5	23	36	.....	38	107	155	22	14	14
6	42	36	.....	67	96	168	24	14	11
7	31	36	.....	76	96	168	26	17	13
8	36	33	.....	67	82	130	22	14	12
9	27	33	.....	58	86	118	24	17	14
10	31	33	.....	58	86	107	22	14	12
11	42	33	.....	58	130	86	22	14	12
12	125	38	.....	44	130	107	33	17	14
13	125	33	.....	58	107	96	28	14	12
14	103	28	.....	51	118	182	28	17	17
15	63	24	.....	51	96	168	24	14	14
16	47	33	.....	58	142	130	22	14	14
17	41	44	44	51	196	118	26	16	17
18	35	33	51	58	182	96	22	14	14
19	41	28	44	51	196	107	24	17	17
20	47	28	44	51	155	86	20	14	14
21	47	33	58	55	155	86	19	14	14
22	47	33	44	48	155	86	20	17	17
23	47	28	44	44	130	76	17	14	12
24	41	28	33	41	196	76	20	20	14
25	48	28	44	44	212	67	16	20	12
26	41	28	51	51	182	67	16	20	12
27	48	38	44	38	168	76	20	24	14
28	48	29	44	51	142	58	14	17	12
29	48	34	38	86	155	67	18	20	14
30	41	34	33	86	130	58	14	17	12
31	41	.....	44	.....	130	.....	14	17	.....

NOTE.—Discharge computed from a well-defined rating curve.

Monthly discharge of Deep Creek near Chouteau, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	125	14	45.5	2,800	A.
November	44	24	33.4	1,990	A.
March 17–31	58	33	44.0	1,310	A.
April	86	33	53.5	3,180	A.
May	212	82	135	8,300	A.
June	182	58	112	6,660	A.
July	51	14	23.4	1,440	A.
August	24	14	16.2	996	A.
September	20	11	14.4	857	A.

WILLOW CREEK NEAR CHOUTEAU, MONT.

LOCATION.—In sec. 14, T. 23 N., R. 6 W., at McPhee's ranch, 12 miles southwest of Chouteau.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 2, 1912, to September 30, 1914.

GAGE.—Staff gage on left bank. Low-water section reads to 5.00 feet; high-water section reads 5.00 to 9.00 feet. Observer S. A. McPhee.

DISCHARGE MEASUREMENTS.—Made by wading at gage except in extremely high water, when they may be made from a bridge half a mile below the gage.

CHANNEL AND CONTROL.—Fairly permanent.

EXTREMES OF DISCHARGE. Maximum stage recorded during year: 2.3 feet at 9.20 a. m. May 24 (discharge, 70 second-feet); channel reported dry July 20 to September 30. 1912–1914: Maximum stage recorded, 5.8 feet May 21, 1912 (discharge, 735 second-feet); channel reported dry July 20 to September 30, 1914.

WINTER FLOW.—Discharge relation affected by ice; probably little flow.

DIVERSIONS.—Several diversions above the station; water used mostly to irrigate hay lands.

ACCURACY.—Conditions for obtaining accurate discharge data are good.

Discharge measurements of Willow Creek near Chouteau, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 12	B. E. Jones	2.10	50	June 9	W. A. Lamb	1.72	18.4

Daily discharge, in second-feet, of Willow Creek near Chouteau, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.
1	3.0	15	8.2	39	48	17	6.0
2	4.2	15	9	48	48	19	7.5
3	5	14	10	20	53	17	4.5
4	5	13	10	11	48	18	3.6
5	a5	13	10	20	48	24	5.1
6	a7	12	9	39	39	37	3.6
7	7	12	.....	39	37	31	4.5
8	8	12	.....	35	31	24	3.0
9	9	13	.....	31	31	17	2.6
10	10	14	.....	37	44	19	3.0
11	13	15	.....	31	53	12	1.4
12	13	14	.....	37	51	15	2.0
13	17	14	.....	35	41	33	.6
14	17	13	.....	31	37	64	.6
15	24	13	.....	33	37	53	.8
16	26	13	.....	28	44	33	.3
17	20	14	.....	31	44	33	.6
18	20	14	.....	24	35	24	.3
19	21	14	.....	24	33	17	.2
20	24	14	.....	26	35	17	.0
21	26	14	.....	23	31	14	.....
22	17	14	.....	24	33	17	.....
23	17	14	.....	20	30	12	.....
24	15	14	.....	20	70	12	.....
25	15	13	.....	22	51	14	.....
26	17	12	.....	a21	39	11	.....
27	17	12	.....	20	39	13	.....
28	19	10	.....	35	31	8.5	.....
29	19	9	.....	39	25	8.5	.....
30	17	8.2	.....	58	28	9.5	.....
31	15	.....	.....	.....	23	.....	.....

a Gage not read; discharge interpolated.

NOTE.—Daily discharge computed as follows: Oct. 1 to Dec. 6, from a rating curve fairly well defined between 1 second-foot and 283 second-feet and poorly defined at other stages; Apr. 1 to July 19, from a fairly well defined rating curve. Stream practically dry July 20 to Sept. 30.

Monthly discharge of Willow Creek near Chouteau, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	26	3.0	14.6	898	B.
November	15	8.2	13.0	774	B.
December 1-6	10	8.2	9.37	112	B.
April	58	11	30.0	1,790	B.
May	70	23	39.9	2,450	B.
June	64	8.5	21.4	1,270	B.
July	7.5	0	1.62	99.6	C.

NOTE.—See footnote to table of daily discharge.

MUDDY CREEK NEAR BYNUM, MONT.

LOCATION.—In the NW. ¼ SE. ¼ sec. 22, T. 26 N., R. 6 W., just above the mouth of Blackleaf Creek and about 2 miles above Bynum.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 24, 1912, to September 30, 1914.

GAGE.—Overhanging chain gage on left bank.

DISCHARGE MEASUREMENTS.—Made by wading near the gage.

CHANNEL AND CONTROL.—Shifting at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.3 feet at 10 a. m. June 14 (discharge, 12 second-feet); minimum stage recorded, 1.8 feet at 9 a. m. August 1 (discharge, 0.1 second-foot).

1912–1914: Maximum stage recorded, 3.2 feet June 27, 1913 (discharge, 320 second-feet); creek reported dry August 18, 23, 24, 31; September 1–3, 10, 29, October 7, 1912.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—The summer flow is appropriated and used and the flood waters have been filed on by the Teton Cooperative Reservoir Co.

ACCURACY.—Frequent discharge measurements are necessary to insure good results. See footnote to table of daily discharge.

Discharge measurements of Muddy Creek near Bynum, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 23	C. S. Heidel	2.00	[a]0.73	Oct. 13	C. S. Heidel	2.18	4.2
May 5	do	2.24	7.1	June 26	do	2.08	1.6
11	B. E. Jones	2.22	6.5	Aug. 14	W. A. Lamb	2.00	[a].40

[a] Estimated.

Daily gage height, in feet, of Muddy Creek near Bynum, Mont., for the year ending Sept. 30, 1914.

[H. Fligger and A. Baudendistel, observers.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.0	2.0	2.0	1.95	1.95	2.0	1.9	.....	2.05	2.05	1.8	.....
2	2.0	2.0	2.0	2.0	1.95	.....	1.95	.....	2.0	2.05	1.85	1.95
3	2.0	2.05	2.0	1.95	1.95	2.0	1.9	.....	2.0	2.05	1.95	.....
4	2.0	2.05	2.0	2.0	2.0	2.0	1.95	.....	.....	2.0	1.95	2.0
5	.....	2.0	2.0	1.95	2.0	2.0	1.95	.....	2.1	2.0	1.95	2.0
6	2.05	2.0	2.0	1.95	1.95	.....	.....	.....	2.15	1.95	.....	.....
7	2.1	2.0	2.0	2.0	1.95	2.0	2.1	.....	2.1	.....	1.95	2.0
8	2.05	2.0	2.0	1.95	2.0	1.95	2.1	.....	.....	1.95	1.95	.....
9	2.05	2.0	2.0	2.0	2.0	1.95	2.05	.....	2.1	1.95	.....	2.0
10	2.05	2.0	2.0	1.95	2.0	1.95	.....	.....	2.1	1.95	1.95	.....
11	2.05	2.0	2.0	1.95	1.95	.....	2.05	.....	.....	2.0	1.95	2.0
12	2.05	2.05	2.0	2.0	1.95	2.0	2.15	.....	2.1	.....	.....	2.0
13	2.05	2.05	2.0	1.95	2.05	1.95	.....	.....	2.15	2.0	.....	.....
14	2.05	2.05	2.0	2.0	2.0	1.95	2.15	.....	2.3	1.95	1.95	2.0
15	2.0	2.05	2.0	1.95	1.95	1.95	2.1	.....	2.15	1.95	1.95	.....
16	2.0	2.05	2.0	1.95	1.95	1.95	2.15	2.15	.....	1.95	.....	2.0
17	2.0	2.0	2.0	2.0	1.95	1.95	2.15	2.15	2.15	.....	1.95	.....
18	2.0	2.0	2.0	1.95	1.95	1.95	2.1	2.15	2.15	1.95	.....	2.0
19	2.0	2.0	2.0	2.0	2.0	1.95	.....	2.15	2.25	1.95	1.95	2.0
20	2.0	2.0	2.0	1.95	1.95	2.0	2.05	.....	2.2	1.95	1.95	.....
21	2.0	2.0	2.0	1.95	1.95	1.95	2.05	2.1	2.15	1.95	.....	2.0
22	2.0	2.0	2.0	1.95	1.95	1.9	.....	.....	.....	.....	1.95	.....
23	.....	2.0	2.0	1.95	1.95	1.95	2.0	2.15	2.15	1.9	.....	2.0
24	2.0	2.0	2.0	2.0	2.0	.....	2.05	2.15	2.1	1.9	1.95	2.0
25	2.0	2.0	2.0	2.0	2.0	1.95	2.05	.....	.....	1.9	.....	.....
26	2.0	2.0	2.0	1.95	1.95	1.9	2.0	2.15	2.05	.....	1.9	2.0
27	2.0	2.05	2.0	1.95	1.95	1.9	2.0	2.15	2.05	1.9	1.9	.....
28	2.0	2.05	2.0	2.0	1.95	1.95	2.0	2.15	2.0	.....	.....	2.0
29	2.0	2.05	2.0	2.0	.....	.....	1.95	2.1	.....	1.85	1.9	.....
30	2.0	2.0	2.0	1.95	.....	1.95	1.95	2.1	2.0	1.85	.....	2.0
31	2.0	.....	2.0	1.95	.....	1.95	.....	2.05	.....	.....	1.95	.....

NOTE.—Discharge relation affected by ice Jan. 1 to Mar. 31.

Daily discharge, in second-feet, of Muddy Creek near Bynum, Mont., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.2	1.0	1.2	1.2	0.1	0.4	16	3.6	3.6	3.6	0.4	0.4	0.5
2	.4	2.0	.5	1.2	.2	.4	17	3.6	3.6	3.6	.4	.4	.5
3	.2	3.0	.5	1.2	.4	.4	18	1.9	3.6	3.6	.4	.4	.5
4	.4	5.0	1.2	.5	.4	.5	19	1.6	3.6	8.4	.4	.4	.5
5	.4	7.1	1.9	.5	.4	.5	20	1.2	2.8	5.2	.4	.4	.5
6	1.2	6.0	3.6	.4	.4	.5	21	1.2	1.9	3.6	.4	.4	.5
7	1.9	5.0	1.9	.4	.4	.5	22	.8	2.8	3.6	.3	.4	.5
8	1.9	4.0	1.9	.4	.4	.5	23	.5	3.6	3.6	.2	.4	.5
9	1.2	4.0	1.9	.4	.4	.5	24	1.2	3.6	1.9	.2	.4	.5
10	1.2	5.0	1.9	.4	.4	.5	25	1.2	3.6	1.6	.2	.3	.5
11	1.2	6.5	1.9	.5	.4	.5	26	.5	3.6	1.2	.2	.2	.5
12	3.6	5.0	1.9	.5	.4	.5	27	.5	3.6	1.2	.2	.2	.5
13	3.6	4.2	3.6	.5	.4	.5	28	.5	3.6	.5	.2	.2	.5
14	3.6	4.0	12	.4	.4	.5	29	.4	1.9	.5	.2	.2	.5
15	1.9	3.5	3.6	.4	.4	.5	30	.4	1.9	.5	.2	.3	.5
							31	.....	1.2	.....	.2	.4	.....

NOTE.—Daily discharge not computed October, November, and December because of the small discharge and shifting channel. See table of daily gage heights. Discharge Apr. 1–30 and May 15 to Sept. 30, determined from a rating curve well defined between 0.5 and 11.5 second-feet. Discharge May 1–15 estimated from current-meter measurements made May 5, 11, and 13. Discharge interpolated for days on which gage was not read.

Monthly discharge of Muddy Creek near Bynum, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	.....	.....	[a]1.0	61	[b]
November	.....	.....	[a]1.0	60	[b]
December	.....	.....	[a].7	43	[b]
April	3.6	0.2	1.40	83.3	C.
May	.....	.....	3.67	226	C.
June	12	.5	2.74	163	C.
July	1.2	.2	.43	26.4	[b]
August	.4	.1	.35	21.5	[b]
September	.5	.4	.49	29.2	[b]

[a] Estimated.
[b] Results approximate; quantities involved too small to warrant rating accuracy in percentage.

NOTE.—See footnote to table of daily discharge.

BLACKLEAF CREEK NEAR BYNUM, MONT.

LOCATION.—In the NW. ¼ SE. ¼ sec. 22, T. 26 N., R. 6 W., about 200 feet above the mouth of the creek, and 2 miles above Bynum.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 24, 1912, to September 30, 1914.

GAGE.—Overhanging chain gage on left bank. Observer, H. Fligger.

DISCHARGE MEASUREMENTS.—Made by wading near the gage.

CHANNEL AND CONTROL.—Shifting at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.7 feet at 11 a. m. October 13 (discharge, 40 second-feet); creek dry July 21 to September 30.

1912–1914: Maximum stage recorded, 3.15 feet June 27, 1913 (discharge, 90 second-feet); creek dry July 21 to September 30, 1914.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—All the summer flow is used and flood waters have been filed on by the Teton Cooperative Reservoir Co.

ACCURACY.—Frequent discharge measurements are necessary to insure good results. See footnote to table of daily discharge.

Discharge measurements of Blackleaf Creek near Bynum, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 23	C. S. Heidel	1.90	2.0	May 13	C. S. Heidel	2.20	11.9
May 5	do	2.25	13.1	June 26	do	1.84	1.2
11	B. E. Jones	2.51	28.6	Aug. 14	W. A. Lamb	[a] 1.68	(a)

[a] Stream dry; gage height is point of zero flow.

Daily discharge, in second-feet, of Blackleaf Creek near Bynum, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.
1	0.6	1.3	1.3	11	5	1.4	1.4
2	.6	2.0	1.3	11	6	1.4	1.4
3	.6	3.0	1.3	7.2	8	1.4	1.4
4	.6	3.0	1.3	7.2	10	2.4	.5
5	1.3	3.0	1.3	7.2	13	3.4	4.5
6	2.0	2.0	1.3	11	13	5.8	3.4
7	4.0	2.0	2.0	11	13	4.5	2.8
8	5.2	2.0	3.0	13	15	4.5	2.3
9	4.0	2.0	3.0	11	20	4.5	1.4
10	4.0	2.0	3.0	11	25	4.5	.5
11	4.0	2.0	3.0	11	29	4.5	.5
12	25	2.0	3.0	11	20	4.5	.5
13	40	2.0	3.0	11	12	5.8	.5
14	19	2.0	3.0	11	10	22	.5
15	5.2	2.0	3.0	9.1	8	13	.5
16	4.0	2.0	3.0	9.1	7.2	12	.5
17	3.0	2.0	3.0	9.1	7.2	11	.5
18	3.0	2.0	3.0	9.1	7.2	11	.5
19	3.0	2.0	3.0	8.2	7.2	9.1	.5
20	3.0	3.0	3.0	7.2	7.2	7.2	.2
21	3.0	3.0	3.0	7.2	7.2	7.2	.0
22	2.0	3.0	3.0	6.5	6.5	7.2	.0
23	2.0	3.0	3.0	5.8	5.8	7.2	.0
24	2.0	2.0	3.0	5.8	5.8	4.5	.0
25	2.0	2.0	3.0	4.5	5.8	3.0	.0
26	2.0	2.0	3.0	4.5	5.8	1.4	.0
27	2.0	2.0	3.0	4.5	5.8	1.4	.0
28	1.3	2.0	3.0	4.5	3.4	.5	.0
29	1.3	2.0	3.0	4.5	3.4	.5	.0
30	1.3	1.3	3.0	4.5	2.3	.5	.0
31	1.3	.....	3.0	.....	2.3	.....	.0

NOTE.—Daily discharge determined as follows: Oct. 1 to Dec. 31, from a rating curve fairly well defined above 3 second-feet; Apr. 1–30 and May 16 to July 20, from a well-defined rating curve. Discharge estimated May 1–15 from measurements made May 5, 11, and 13. Creek dry July 21 to Sept. 30. Discharge relation affected by ice about Jan. 1 to Mar. 31; data insufficient for estimates of discharge. Gage readings for the entire year are available, but those from April to September are somewhat uncertain, and estimates of daily discharge Apr. 1 to July 20 should be used with caution.

Monthly discharge of Blackleaf Creek near Bynum, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	40	.6	4.91	302	B.
November	3.0	1.3	2.19	130	C.
December	3.0	1.3	2.64	162	C.
April	13	4.5	8.29	493	C.
May	29	2.3	9.58	589	C.
June	22	.5	5.58	332	C.
July	4.5	.0	.78	48	
August				0.0	
September				0.0	

NOTE.—See footnote to table of daily discharge.

NORTH FORK OF MUSSELSHELL RIVER NEAR MARTINSDALE, MONT.

LOCATION.—In sec. 6, T. 8 N., R. 12 E., half a mile above the junction of the North and South forks, at the ranch of Martin J. Settle, 4 miles north of Martinsdale.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 10, 1907, to September 30, 1914, when the station was discontinued.

GAGE.—Chain on left bank just above observer's private wagon bridge; datum unchanged. Observer, A. H. Settle.

DISCHARGE MEASUREMENTS.—Made from the private wagon bridge or by wading.

CHANNEL AND CONTROL.—Composed of gravel; may shift somewhat during high water as current is swift.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.8 feet at 7 a. m. June 6 (discharge, 448 second-feet); minimum stage recorded, 3.1 feet at 7 a. m. August 8, 12, 14, 16, and 18 (discharge, 7 second-feet).

1907–1914: Maximum stage recorded, 6.4 feet May 22, 1912 (discharge, 572 second-feet); minimum stage recorded, 2.75 feet August 4, 5, 27, and 28, 1910 (discharge, 0.5 second-foot).

WINTER FLOW—Discharge relation affected by ice.

DIVERSIONS.—A number of diversions are made for irrigation.

ACCURACY.—Open-season records apparently good.

Discharge measurements of North Fork of Musselshell River near Martinsdale, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 7	3.52	35	June 19	4.25	140
Apr. 27	4.01	98	Aug. 7	3.18	10.7

Daily discharge, in second-feet, of North Fork of Musselshell River near Martinsdale, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	25	34	.....	100	117	100	25	22
2	25	34	.....	84	117	84	18	25
3	25	34	.....	117	117	84	25	22
4	34	34	.....	134	117	70	12	22
5	34	34	100	134	151	70	18	18
6	34	34	243	134	448	57	12	22
7	34	34	100	100	426	34	18	22
8	34	34	57	117	426	34	7	25
9	34	34	57	117	426	34	12	22
10	34	34	45	134	426	34	10	18
11	45	34	84	282	262	45	12	22
12	57	34	57	282	224	34	7	25
13	45	25	100	224	302	34	12	25
14	34	45	117	224	302	25	7	25
15	34	57	205	224	262	25	12	22
16	34	34	205	205	243	25	7	30
17	34	34	117	262	224	25	12	30
18	34	25	100	243	187	25	7	30
19	34	25	100	262	151	25	15	30
20	34	25	100	262	134	18	15	34
21	34	34	117	243	134	25	18	40
22	34	34	100	224	134	18	12	34
23	34	.....	100	224	117	25	18	30
24	34	.....	117	224	117	18	12	30
25	34	.....	100	224	100	12	18	25
26	34	.....	117	224	117	18	12	30
27	34	.....	100	169	100	12	18	30
28	34	.....	117	169	117	18	12	30
29	34	.....	117	151	100	25	18	30
30	34	.....	84	151	100	18	12	25
31	34	.....	.....	134	.....	25	18	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve. Mean discharge Nov. 23 to 30 estimated at 25 second-feet and Apr. 1 to 4 at 100 second-feet. Gage not read Nov. 23 to Apr. 4.

Monthly discharge of North Fork of Musselshell River near Martinsdale, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	57	25	34.6	2,130	B.
November	57	.....	[a]31.5	1,870	C.
April	243	45	[a]109	6,490	B.
May	282	84	186	11,400	B.
June	448	100	207	12,300	B.
July	100	12	35.4	2,180	B.
August	25	7	13.9	855	B.
September	40	18	26.5	1,580	B.

[a] Partly estimated; see footnote to table of daily discharge.

MUSSELSHELL RIVER AT HARLOWTON, MONT.

LOCATION.—In sec. 26, T. 8 N., R. 15 E., at the highway bridge 1 mile south of Harlowton.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 11, 1907, to September 30, 1914. A station was maintained at Shawmut from August 12, 1902, to June 30, 1907.

GAGES.—Standard chain gage on the upstream side of the public highway bridge, installed May 24, 1909, at a datum 0.52 foot higher than that previously used. All gage heights for 1909 were corrected to the new datum.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed of stream composed of sand and gravel; will probably shift in flood.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.1 feet at 7 a. m. June 7 (discharge, 1,490 second-feet); minimum stage recorded, 0.12 foot at 7 a. m. and 6 p. m. September 17 (discharge, 1.0 second-foot).

1907–1914: Maximum stage recorded, 4.85 feet May 30–31, 1908 (discharge, 2,940 second-feet); river dry August 4–11, 1910.

DIVERSIONS.—A large part of the valley is irrigated and many small ditches take water from the Musselshell; practically the entire flow of the stream is appropriated.

ACCURACY.—Growth of aquatic plants in channel affects the discharge relation, particularly during periods of low water. See footnote to the table of daily discharge.

Discharge measurements of Musselshell River at Harlowton, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 7	0.84	106	June 17	2.18	730
Apr. 30	1.38	268	Aug. 7	.26	5.4

Daily discharge in second-feet, of Musselshell River at Harlowton, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	56	108	133	258	631	360	16	6
2	59	108	136	247	665	317	14	6
3	68	108	149	297	619	285	11	7
4	68	108	163	360	772	247	9	8
5	73	106	181	406	891	226	8	9
6	73	102	190	406	1,290	200	7	10
7	73	102	203	338	1,380	194	6	10
8	81	102	206	317	1,110	262	6	10
9	95	102	203	360	1,110	203	6	10
10	108	102	190	568	932	152	6	10
11	108	106	178	891	850	160	2.8	10
12	115	108	200	891	772	160	1.8	10
13	118	108	223	772	891	149	3.0	10
14	130	108	247	736	850	130	1.8	11
15	136	108	313	699	850	115	1.8	12
16	146	108	338	736	811	102	1.8	13
17	136	106	301	811	772	89	1.0	15
18	130	102	273	932	699	72	1.8	17
19	130	99	244	932	568	64	3.0	19
20	115	97	247	975	568	61	3.0	24
21	118	93	273	975	539	54	3.8	35
22	123	93	293	975	456	48	6	35
23	125	95	297	975	431	40	2.8	33
24	120	111	297	975	431	36	3.0	33
25	120	.....	301	975	406	31	2.8	31
26	120	.....	309	975	699	28	4.6	30
27	115	.....	317	932	510	26	5	30
28	115	.....	338	932	510	24	5	30
29	111	.....	297	891	431	20	6	30
30	108	.....	273	772	406	18	5	30
31	108	.....	.....	699	.....	17	5	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to July 17, from a fairly well defined rating curve. July 18 to Aug. 6, by indirect method for shifting channels; Aug. 7 to Sept. 30, from a poorly defined rating curve. Discharge Nov. 25–30 estimated at 100 second-feet. See "Accuracy."

Monthly discharge of Musselshell River at Harlowton, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	146	56	106	6,520	B.
November	111	.....	[a] 103	6,130	B.
April	338	133	244	14,500	B.
May	975	247	710	43,700	B.
June	1,390	406	731	43,500	B.
July	360	17	125	7,690	C.
August	16	1	5.19	319	C.
September	35	6	18.1	1,080	C.

[a] Partly estimated; see footnote to table of daily discharge.

CHECKERBOARD CREEK NEAR DELPINE, MONT.

LOCATION.—In the SW. ¼ SW. ¼ sec. 4, T. 9 N., R. 9 E., 2½ miles above the junction of Checkerboard Creek with Musselshell River, 8 miles from Delpine post office, and 21 miles from Martinsdale.

DRAINAGE AREA.—23 square miles.

RECORDS AVAILABLE.—May 26, 1909, to December 31, 1911; May 21, 1913, to September 30, 1914.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made from foot bridge or by wading.

CHANNEL AND CONTROL.—Gravel; slightly shifting because of high velocity of current.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.3 feet at 4 p. m. May 10 (discharge, 53 second-feet); minimum stage recorded, 2.25 feet at 5.30 p. m. September 20, 23, 25, 27, and 30 (discharge, 7 second-feet).

1909–1911 and 1913–1914: Maximum stage recorded, 2.0 feet May 4, 1909 (discharge, 146 second-feet); minimum stage recorded, 0.37 foot Sept. 28, 1910 (discharge 2.7 second-feet).

Open-season records only; flow may have been lower at times during the winter months.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—None.

ACCURACY.—Results fair.

Discharge measurements of Checkerboard Creek near Delpine, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 8	2.17	3.6	June 20	2.85	26
Apr. 29	2.46	12.9	Aug. 8	2.34	9.8

Daily discharge, in second-feet, of Checkerboard Creek near Delpine, Mont., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	18	31	a17	11	8	16	34	47	a40	a11	a8	8
2	.....	22	31	a17	a11	a8	17	24	47	a37	11	8	8
3	.....	24	39	a16	a11	8	18	14	47	a35	a11	a8	a8
4	.....	20	36	a16	a10	a8	19	12	50	a33	11	a8	a7
5	.....	20	34	16	10	8	20	11	50	31	a11	8	7
6	.....	18	31	a16	a10	a8	21	10	47	a31	a11	a8	a7
7	.....	22	28	a14	a10	a8	22	10	47	31	11	a8	a7
8	.....	22	28	14	10	8	23	11	47	a30	a11	8	7
9	.....	24	26	a14	a10	a8	24	12	47	28	a11	8	a7
10	.....	53	26	a12	a10	a8	25	14	42	a25	a11	a8	7
11	.....	44	28	12	10	8	26	16	36	22	11	8	a7
12	8	42	28	a12	10	a8	27	14	36	a20	a11	a8	7
13	10	42	31	a12	a10	a8	28	a13	36	18	a11	a8	a7
14	11	44	36	a12	a8	8	29	12	36	a18	a11	8	a7
15	36	47	42	12	8	a8	30	a15	34	a18	11	a8	7
							31	.....	31	.....	a11	8	.....

a Gage not read; discharge interpolated.

NOTE.—Daily discharge determined from a fairly well defined rating curve.

Monthly discharge of Checkerboard Creek near Delpine, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April 12-30	36	8	15.1	569	B.
May	53	18	36.8	2,260	B.
June	42	18	29.7	1,770	B.
July	17	11	12.5	769	B.
August	11	8	8.9	547	B.
September	8	7	7.6	452	B.
The period	.....	.....	.....	6,370	

SOUTH FORK OF MUSSELSHELL RIVER NEAR MARTINSDALE, MONT.

LOCATION.—In the S. ½ sec. 12, T. 8 N., R. 11 E., near the public highway, 1¼ miles northeast of Martinsdale, near the blacksmith shop of the Martinsdale Sheep Co., at a point about 1½ miles above original site, which was near the ranch of M. J. Settle.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 28, 1908, to September 30, 1914; June 19, 1907, to April 28, 1908, at old station 1½ miles downstream.

GAGE.—Staff nailed to tree on the right bank. The datum of this gage bears no determined relation to the datum of the gage at the original station.

DISCHARGE MEASUREMENTS.—Made by wading near the gage or from a bridge 150 feet below.

CHANNEL AND CONTROL.—Bed of stream composed chiefly gravel; clean and nonshifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.0 feet at 4 p. m. June 6 (discharge, 693 second-feet); minimum stage recorded, 0.83 foot at 10.30 a. m. August 10 (discharge 0.9 second-foot).

1907–1914: Maximum stage recorded, 5.8 feet June 2–4, 1911 (discharge, 1,260 second-feet); river dry August 7, 9, 11, 13–15, and September 13, 1908.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Many small ditches take water from the creek.

ACCURACY.—Open-season records good.

Discharge measurements of South Fork of Musselshell River near Martinsdale, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 7	1.69	27	June 19	3.30	211
Apr. 28	2.95	142	Aug. 7	.82	[a] 1.0

[a] Discharge estimated; point of zero flow about gage height 0.6 foot.

Daily discharge, in second-feet, of South Fork of Musselshell River near Martinsdale, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8 0	40	.....	46	134	423	121	2.2	3.2
2	5.5	43	.....	58	155	423	104	2.2	2.8
3	5.5	36	.....	88	185	369	87	2.2	2.6
4	5.5	33	.....	118	261	423	77	1.1	3.2
5	11	30	.....	148	234	486	77	1.1	3.2
6	19	43	.....	201	201	647	67	1.1	3.2
7	24	30	.....	109	193	522	58	1.0	2.8
8	24	30	.....	104	177	369	46	1.0	3.2
9	27	36	.....	82	185	369	43	1.0	2.8
10	27	36	.....	72	322	369	36	.9	2.8
11	33	36	.....	62	486	369	35	1.1	2.6
12	58	33	.....	104	423	322	43	2.2	3.2
13	67	30	.....	121	369	300	43	2.2	3.7
14	67	30	.....	185	322	300	46	2.6	4.4
15	58	30	43	193	322	300	31	3.2	7.2
16	50	33	40	243	369	280	24	2.2	8.9
17	50	33	40	155	486	261	19	2.6	11
18	40	.....	43	148	561	252	17	2.2	12
19	36	.....	49	155	561	218	15	3.2	12
20	36	.....	58	201	603	209	8	3.2	11
21	40	.....	54	185	561	209	10	3.2	16
22	36	.....	33	148	561	201	8	3.2	26
23	36	.....	27	148	561	170	10	3.2	24
24	36	.....	24	155	561	162	8	3.2	24
25	40	.....	30	193	603	162	8	3.2	22
26	36	.....	36	185	561	141	8	3.9	20
27	40	.....	35	185	561	148	6.8	3.2	20
28	43	.....	35	162	561	155	4.4	5.5	20
29	43	.....	24	148	486	141	4.4	4.4	20
30	43	.....	23	134	423	134	4.4	4.4	20
31	40	.....	27	.....	423	.....	2.2	3.7	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve. Discharge relation affected by ice Nov. 18–20; mean discharge Nov. 18–30 estimated at 25 second-feet. Gage not read Nov. 21 to Mar. 14 nor Apr. 3 and 4; discharge interpolated Apr. 3 and 4.

Monthly discharge of South Fork of Musselshell River near Martinsdale, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	67	5.5	35.0	2,150	B.
November	43	.....	[a] 30.2	1,800	C.
March 15–31	58	23	36.5	1,230	B.
April	243	46	141	8,390	B.
May	603	134	400	24,600	B.
June	647	134	294	17,500	B.
July	121	2.2	34.6	2,130	B.
August	5.5	.9	2.57	158	B.
September	26	2.6	10.6	631	B.

[a] Partly estimated; see footnote to table of daily discharge.

FLATWILLOW CREEK NEAR FLATWILLOW, MONT.

LOCATION.—In sec. 23, T. 12 N., R. 25 E., at Flatwillow Ranch Co.'s ranch, 8 miles above Flatwillow and 30 miles north of Roundup.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 3, 1911, to September 30, 1914.

GAGE.—Staff gage, marked to tenths of feet, nailed to a timber driven into bed of stream and braced to the banks; below the wagon bridge near the ranch buildings.

DISCHARGE MEASUREMENTS.—Made from a footbridge or by wading.

CHANNEL AND CONTROL.—Likely to shift; current very sluggish.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.0 feet at 5 p. m. April 17 (discharge, 221 second-feet); minimum stage recorded, 2.0 feet at 11 a. m. and 6 p. m. August 6, 8, 10, 12, 14 and 16 (discharge, 8 second-feet).

1911–1914: Maximum stage recorded, 7.6 feet June 13, 1913 (discharge, 307 second-feet); minimum stage recorded, 2.1 feet, September 3–4, 1912 (discharge, 1.0 second-foot).

Open-season records only; flow may have been lower at times during the winter months.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Much water is diverted above the gage during the irrigation season. A canal to divert water into the storage reservoir of the Flatwillow–Carey project heads about a mile above the station.

ACCURACY.—Results considered fair.

Discharge measurements of Flatwillow Creek near Flatwillow, Mont., during the year ending Sept. 30, 1914.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 6	2.92	37	June 18	3.15	50
May 1	3.95	93	Aug. 6	2.05	8.9

Daily discharge, in second-feet, of Flatwillow Creek near Flatwillow, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	22	44	32	.....	149	106	136	83	13	32
2	22	44	36	.....	136	100	124	72	12	28
3	22	40	40	.....	142	95	130	72	11	28
4	25	40	36	.....	136	89	130	67	10	20
5	28	36	36	.....	155	89	149	67	9	24
6	32	36	36	.....	162	83	142	62	8	20
7	28	36	36	.....	194	83	112	62	10	24
8	28	36	40	.....	214	78	89	57	8	20
9	32	36	32	.....	194	95	72	62	10	24
10	32	36	40	.....	124	100	57	53	8	20
11	28	36	40	.....	95	130	53	53	10	24
12	28	36	40	.....	118	142	40	44	8	20
13	32	32	40	.....	155	168	44	44	10	24
14	32	32	36	.....	181	162	83	40	8	20
15	32	32	36	.....	201	175	83	40	10	28
16	28	36	36	.....	214	168	67	32	8	24
17	28	36	36	.....	221	175	62	36	10	28
18	28	36	36	.....	188	168	67	28	13	28
19	32	36	36	.....	181	168	72	28	16	32
20	32	40	36	.....	162	162	62	24	16	32
21	32	40	40	.....	155	175	67	28	20	36
22	32	40	40	.....	136	168	72	24	20	32
23	32	36	40	.....	142	181	83	24	28	32
24	32	32	40	.....	142	162	78	20	24	24
25	32	36	40	.....	142	168	78	24	28	28
26	36	40	40	78	136	155	78	16	28	20
27	36	40	40	83	136	155	89	20	32	24
28	40	36	40	78	124	142	89	13	28	20
29	40	40	44	95	124	142	95	16	32	24
30	40	36	48	124	112	130	83	13	24	16
31	44	.....	48	142	.....	136	.....	13	28	.....

NOTE.—Daily discharge determined from two fairly well defined rating curves applicable Oct. 1 to Dec. 31 and Mar. 26 to Sept. 30. Gage not read Aug. 2–5; discharge interpolated. Discharge relation affected by ice about Jan. 1 to Mar. 25; data insufficient to estimate discharge.

Monthly discharge of Flatwillow Creek near Flatwillow, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	44	22	31.2	1,920	B.
November	44	32	37.1	2,210	B.
December	48	32	38.6	2,370	B.
March 26–31	142	78	100	1,190	B.
April	221	95	156	9,280	B.
May	181	78	137	8,420	B.
June	149	40	86.2	5,130	C.
July	83	13	39.9	2,450	B.
August	32	8	16.1	990	B.
September	36	16	25.2	1,500	B.

NOTE.—See footnote to table of daily discharge.

SOUTH FORK OF MILK RIVER NEAR BROWNING, MONT.

LOCATION.—In the SW. ¼ sec. 29, T. 37 N., R. 9 W., at Richard Croff's ranch, just above Kennedy Coulee, about 30 miles northeast of Browning, and about 6 miles south of the international boundary line.

DRAINAGE AREA.—288 square miles.

RECORDS AVAILABLE.—April 28, 1905, to September 30, 1914.

GAGE.—In 1913 and 1914 a Stevens water-stage recorder set at the same location and datum as the chain gage formerly used.

DISCHARGE MEASUREMENTS.—Made from a cable about 200 feet above the gage or by wading.

CHANNEL AND CONTROL.—Practically permanent. Growth of aquatic plants in channel affects the discharge relation at low stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.8 feet at 6 p. m. April 12 (discharge, 588 second-feet); minimum stage recorded, 2.25 feet August 6–8 (discharge, 4 second-feet).

1905–1914: Maximum stage recorded, 15.4 feet June 6, 1908 (determined from high-water marks; flood width, 850 feet; flood cross-section, about 2,600 square feet); minimum stage recorded, 2.9 feet August 18–20, 1906 (discharge, 1 second-foot). Datum unchanged; difference in discharge relation due to shifting channel.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—No diversion or storage above station.

ACCURACY.—Records considered excellent except during winter months.

COOPERATION.—Station maintained in cooperation with the Irrigation Office, Department of the Interior, Canada, during 1914.

Discharge measurements of South Fork of Milk River near Browning, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 12	L. Danielson[a]	2.90	73	June 21	W. A. Lamb	2.72	37.8
Nov. 18	do	2.80	39.9	26	O. H. Hoover[a]	3.08	98
Dec. 20	W. A. Lamb	2.45	[b]11.9	July 18	do	2.50	16.6
Mar. 15	do	3.01	70	22	W. A. Lamb	2.41	10.0
Apr. 10	O. H. Hoover[a]	3.99	280	Aug. 13	O. H. Hoover[a]	2.43	10.8
23	do	3.28	130	Sept. 4	do	2.44	12.4
May 16	do	3.15	117	10	W. A. Lamb	2.51	15.8
June 5	do	2.98	83	19	O. H. Hoover[a]	2.57	22.6

[a] Engineer of the Irrigation Office, Department of the Interior, Canada.
[b] Ice at gage.

Daily discharge in second-feet, of South Fork of Milk River near Browning, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	22	.....	34	.....	116	.....	63	37	7.0	14
2	22	.....	27	.....	a 128	.....	63	30	6.6	15
3	24	.....	29	.....	a 140	.....	66	27	6.2	11
4	36	.....	28	.....	153	.....	68	24	4.6	13
5	39	.....	30	.....	381	.....	74	28	4.6	14
6	38	.....	35	.....	429	.....	85	35	4.4	13
7	43	.....	30	.....	266	.....	83	33	4.4	13
8	46	.....	27	.....	222	.....	66	24	4.4	15
9	61	.....	27	.....	283	.....	58	21	6.6	19
10	45	.....	23	.....	280	.....	52	20	9.7	17
11	49	.....	.....	.....	283	.....	52	20	12	17
12	64	.....	.....	.....	488	.....	47	20	12	20
13	131	.....	.....	.....	470	.....	64	18	9.0	25
14	112	.....	.....	.....	307	.....	124	16	8.2	24
15	72	.....	.....	83	245	.....	112	16	6.2	24
16	50	.....	.....	74	255	110	85	15	4.8	25
17	50	.....	.....	81	214	110	66	16	12	23
18	27	44	.....	83	157	105	55	16	37	24
19	38	50	.....	78	130	101	46	15	47	22
20	64	20	.....	83	188	109	42	13	24	20
21	104	27	.....	73	204	130	39	11	17	19
22	123	32	.....	69	153	116	35	10	13	17
23	90	39	.....	88	135	99	37	9.0	14	15
24	51	46	.....	103	166	88	39	8.6	25	15
25	35	51	.....	92	172	85	60	9.0	35	14
26	38	49	.....	94	.....	81	92	8.2	28	13
27	38	43	.....	94	.....	80	76	7.4	22	10
28	31	36	.....	96	.....	74	55	6.6	18	10
29	25	35	.....	94	.....	71	49	7.0	15	9.7
30	.....	38	.....	90	.....	68	43	7.0	15	9.0
31	.....	.....	.....	81	.....	64	.....	7.0	15	.....

a Discharge interpolated Apr. 2–3.

NOTE.—Gage not read Oct. 30 to Nov. 17, Dec. 21 to Mar. 14, Apr. 2, Apr. 3, and Apr. 26 to May 15. Mean discharge Oct. 30 to Nov. 17 estimated at 25 second-feet. Mean discharge Dec. 11–31 estimated, because discharge relation was affected by ice, at 15 second-feet. Discharge Apr. 26 to May 15 estimated from flow at Mackey's ranch about 15 miles north of the Canadian boundary; Mean discharge Apr. 26–30 estimated at 130 second-feet; May 1–15, at 148 second-feet. Discharge for other period determined from well-defined rating curve.

Monthly discharge of South Fork of Milk River near Browning, Mont., for the year ending Sept. 30, 1914.

[Drainage area, 288 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	131	22	52.2	0.181	0.21	3,210	B.
November	51	20	31.2	.108	.12	1,860	C.
December	34	15	19.5	.068	.08	1,200	C.
March 15–31	103	69	85.6	.297	.19	2,890	C.
April	488	116	220	.764	.85	13,100	B.
May	.....	64	120	.417	.48	7,380	B.
June	124	35	63.2	.219	.24	3,760	A.
July	37	6.6	17.3	.060	.07	1,060	A.
August	47	4.4	14.4	.050	.06	885	A.
September	25	9.0	16.7	.058	.06	994	A.

NOTE.—See footnotes to table of daily discharge.

MILK RIVER AT INTERNATIONAL BOUNDARY.

LOCATION.—In the SE. ¼ sec. 1, T. 1, R. 5 W., fourth meridian, Canadian Land Survey, or the NE. ¼ sec. 6, T. 37 N., R. 9 E., Montana principal meridian, at international boundary line, 30 miles north of Rudyard, Mont., the nearest railroad station, and 7 miles northwest of Goldstone, Mont., the nearest post office.

DRAINAGE AREA.—2,514 square miles,[1] as determined by Canadian Commission of Irrigation.

RECORDS AVAILABLE.—August 7, 1909, to September 30, 1914. Station maintained by Canadian Department of Interior, 1909 to 1912.

GAGE.—Gurley water-stage recorder on left bank. Prior to July, 1913, a staff gage on right bank about one-half mile above site of present gage.

DISCHARGE MEASUREMENTS.—Made from a cable about one-half mile above the gage; low-water measurements are made by wading at the gage.

CHANNEL AND CONTROL.—Shifting at low stages but fairly permanent at medium and high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.23 feet (new staff gage) April 9 (discharge, 1,065 second-feet); river reported dry August 3–17, 22, 23.

1909–1914: Maximum stage recorded, 4.63 feet (old staff gage) April 6, 1912 (discharge, 2,008 second-feet); river reported dry August 3–17, 22, 23, 1914. See "Gage."

WINTER FLOW.—Discharge relation affected by ice.

ACCURACY.—Records good.

COOPERATION.—Station maintained in cooperation with the Irrigation Office, Department of the Interior, Canada, during 1914. Records computed in accordance with Canadian rules.

Discharge measurements of Milk River at international boundary during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	J. E. Degnan [a]	2.80	55	May 29	B. E. Jones	3.27	112
24	do [a]	3.05	74	June 16	J. E. Degnan [a]	3.16	85
Nov. 7	do [a]	2.97	55	24	B. E. Jones	2.94	57
9	W. A. Lamb	3.14	85	July 8	J. E. Degnan [a]	2.83	40
Dec. 24	do	2.95	14.7	14	B. E. Jones	2.92	40
Mar. 21	do	3.30	78	14	do	2.91	40
22	J. E. Degnan [a]	3.25	113	28	J. E. Degnan [a]	2.31	2
23	do [a]	3.64	203	Aug. 13	do	.....	[b]
Apr. 23	do	3.56	185	Sept. 1	F. R. Steinberger [a]	2.60	15.6
May 1	B. E. Jones	3.53	153	4	W. A. Lamb	2.57	17.5
27	J. E. Degnan [a]	3.35	120	23	J. E. Degnan [a]	2.64	18.3

[a] Engineer of the Irrigation Office, Department of the Interior, Canada.
[b] River dry.

[1] Revised since publication of report issued in 1915.

Daily discharge, in second-feet, of Milk River at international boundary for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	51	65	.....	639	148	90	61	1.0	17.8
2	49	70	.....	729	140	92	69	.4	20.0
3	46	64	.....	818	140	94	62	.....	20.0
4	46	63	.....	908	148	85	49	.....	16.3
5	52	66	.....	1,003	161	83	42	.....	13.5
6	60	65	.....	925	171	171	40	.....	12.1
7	61	63	.....	869	184	138	38	.....	10.0
8	56	71	.....	1,009	208	108	38	.....	8.5
9	58	85	.....	1,065	220	87	35	.....	7.5
10	62	89	.....	1,009	205	77	33	.....	6.7
11	61	82	.....	449	254	80	30	.....	6.3
12	59	80	.....	366	254	124	27	.....	10.0
13	61	72	.....	371	224	151	41	.....	122
14	61	59	.....	376	177	191	74	.....	83
15	62	95	.....	510	167	131	25	.....	41
16	61	86	.....	583	153	87	21	.....	29
17	68	108	.....	471	148	83	15.6	.....	27
18	98	96	.....	355	140	82	13.5	26	27
19	97	94	.....	282	145	87	12.1	3.9	21
20	90	89	.....	325	148	108	12.1	.9	19.4
21	84	71	78	291	143	85	11.4	.4	20.0
22	77	112	104	224	140	72	11.4	.....	19.4
23	74	82	254	187	143	65	10.0	.....	20.0
24	74	83	277	171	138	55	9.5	44	20.0
25	71	84	335	250	133	74	8.0	24	18.6
26	70	85	404	184	128	300	6.7	25	18.6
27	67	86	340	156	124	98	3.2	25	16.3
28	67	86	566	156	114	65	2.6	23	15.6
29	66	87	371	184	108	63	2.0	20.0	14.2
30	67	89	460	167	102	59	1.4	17.0	12.1
31	56	.....	550	.....	98	.....	.9	16.3	.....

NOTE.—Discharge computed by indirect method for shifting channels Apr. 24 to May 26 and July 13–27; river reported dry Aug. 3–17, 22, and 23; discharge for other periods determined from fairly well defined rating curve.

Gage readings Nov. 7 to Mar. 13 and May 14–27 obtained from a staff gage set to datum of water-stage recorder. No record of daily gage heights Dec. 24, Dec. 26 to Jan. 4, Feb. 4–28, Mar. 14–20, and Aug. 4–16. Discharge relation affected by ice about Dec. 1 to Mar. 20; data insufficient to warrant publication of estimates of discharge in this period. River reported frozen to bottom Jan. 1–4 and Feb. 4–28.

Monthly discharge of Milk River at international boundary for the year ending Sept. 30, 1914.

[Drainage area, 2,514 square miles.[a]]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October	98	46	66	0.026	0.030	4,027
November	112	59	81	.032	.036	4,814
March 21–31	566	78.0	340	.135	.055	7,416
April	1,065	156.0	501	.199	.222	29,812
May	254	98.0	158	.063	.073	9,715
June	300	55.0	103	.041	.046	6,129
July	74	.9	26	.010	.012	1,599
August	44	.0	7.3	.003	.003	449
September	122	6.3	23.0	.009	.010	1,369

[a] Revised since publication of report issued in 1915.

NOTE.—See footnotes to the table of daily discharge.

MILK RIVER AT HAVRE, MONT.

LOCATION.—In the SE. ¼ SE. ¼ sec. 5, T. 32 N., R. 16 E., at the highway bridge in Havre.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 15, 1898, to September 30, 1914.

GAGE.—Chain fastened to bridge rail on downstream side.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.0 feet March 14 (discharge, 1,080 second-feet); channel reported dry July 29 to August 22.

1898–1914: Maximum stage recorded, 16.5 feet June 9, 1908 (discharge not computed); mean for day was 14.80 feet (discharge, 9,600 second-feet). Channel reported dry as follows: July 16–18, 1898; August 16–20, 1904; July 25, August 18–26, 1905; November 16 to December 31, 1906; July 28 to September 14, 1910; July 29 to August 22, 1914.

WINTER FLOW.—River at Havre frozen over from last part of November to first part of April and in parts of the cross sections it is usually frozen to the bottom.

DIVERSIONS.—None above station; entire flow is appropriated and diverted for irrigation below Havre.

ACCURACY.—Frequent discharge measurements are necessary to properly define the rating curve, and even with these the estimates are subject to considerable error. In years of low precipitation the flow ceases and the water stands in pools for several months.

COOPERATION.—Gage-height record furnished by United States Weather Bureau.

Discharge measurements of Milk River at Havre, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	W. A. Lamb	5.70	61	May 30	B. E. Jones	5.91	95
Mar. 20	do	6.32	174	June 23	do	5.81	84
Apr. 30	B. E. Jones	6.41	174	July 13	do	5.18	15
May 28	do	5.90	[a] 106				

[a] Results questionable because of strong downstream wind.

Daily discharge, in second-feet, of Milk River at Havre, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	20	58	58	.....	945	159	83	97	.....	1.0
2	20	58	58	.....	620	159	83	70	.....	1.0
3	31	58	70	.....	555	182	97	57	.....	1.0
4	31	58	70	.....	375	159	57	57	.....	1.0
5	31	70	70	.....	325	182	57	57	.....	1.0
6	31	70	70	.....	620	182	126	57	.....	1.0
7	58	70	70	.....	375	159	281	45	.....	1.0
8	58	70	70	750	431	210	243	45	.....	1.0
9	58	70	70	685	375	210	141	45	.....	1.0
10	58	70	.....	555	685	159	141	34	.....	1.0
11	58	70	.....	375	620	210	126	34	.....	1.0
12	58	70	.....	492	431	210	97	24	.....	1.5
13	47	58	.....	945	555	243	111	16	.....	1.5
14	47	58	.....	1,080	375	182	111	16	.....	10
15	47	58	.....	1,010	431	182	111	16	.....	10
16	58	58	.....	685	431	182	159	10	.....	83
17	58	58	.....	685	620	159	126	57	.....	83
18	47	58	.....	555	685	141	141	24	.....	70
19	58	58	.....	375	431	126	83	24	.....	70
20	58	58	.....	159	431	126	83	10	.....	70
21	58	58	.....	126	431	111	83	10	.....	16
22	123	70	.....	126	325	111	70	3.5	.....	7
23	123	70	.....	555	375	126	83	3.5	0.2	7
24	123	70	.....	375	281	126	70	1.5	1.5	7
25	86	70	.....	318	281	126	57	1.0	2.5	7
26	86	70	.....	261	281	97	.97	1.5	7.0	7
27	86	70	.....	203	281	97	126	1.5	7.0	7
28	70	58	.....	145	210	111	243	1.5	7.0	7
29	70	58	.....	97	159	97	159	.....	7.0	7
30	58	58	.....	97	159	83	111	.....	7.0	5
31	58	.....	.....	159	.....	83	.....	.....	7.0	.....

NOTE.—Discharge computed from two fairly well defined rating curves applicable Oct. 1 to Dec. 9 and Mar. 8 to Sept. 30. Channel dry July 29 to Aug. 22. Discharge interpolated Mar. 25–28, during which time river was reported "frozen." No gage readings available Dec. 10 to Mar. 7, Mar. 25–28, and July 29 to Aug. 22.

Monthly discharge of Milk River at Havre, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	123	20	60.4	3,710	A.
November	70	58	63.6	3,780	A.
December 1–9	70	58	67.3	1,200	A.
March 8–31	1,080	97	451	21,500	B.
April	945	159	437	26,000	B.
May	243	83	151	9,280	B.
June	281	57	119	7,080	B.
July	97	0	26.4	1,620	B.
August	7	0	1.49	91.6	C.
September	83	1	16.2	964	B.

FORT BELKNAP CANAL NEAR CHINOOK, MONT.

LOCATION.—In the SE. ¼ sec. 20, T. 33 N., R. 18 E., at the highway bridge, about one-half mile below the headgates of the canal, on Milk River 8 miles west of Chinook.

RECORDS AVAILABLE.—June 21, 1903, to September 30, 1914.

GAGE.—The high water of June, 1908, washed out both the bridge and the gage; a new gage was installed June 27, 1908, at a different datum within a few feet of the site of the old gage; a new bridge was built about one-fourth mile upstream from the site of the old one.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Soil, easily eroded. Silt is deposited and weeds and moss are present. At low stages the water is uniformly sluggish.

DIVERSIONS.—In order to divert water into the laterals checks are erected in the main canal, and these checks often back the water for long distances above. Checks are put up under a great variety of conditions, and as a result velocities differ widely at the same gage height during the season.

ACCURACY.—In order to establish the correct discharge relation it is necessary to make several rating curves for the station. Frequent discharge measurements are necessary to obtain reliable results. Results are good for May, June, and July, and fair for April and August.

Discharge measurements of Fort Belknap canal near Chinook, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 28	B. E. Jones	2.72	75	June 20	B. E. Jones	1.60	5
May 4	do	2.55	70	29	do	2.75	27
9	do	3.00	97	July 1	W. Arthurs	2.60	22
16	do	2.72	72	8	do	2.40	17.6
25	do	2.83	68	11	do	2.50	20
June 2	do	2.95	63	18	do	2.80	27
9	do	2.98	50	22	do	2.20	7.3
9	do	2.98	46	24	do	1.90	4.3

Daily discharge in second-feet of Fort Belknap canal near Chinook, Mont., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1		83	62	18	0.5	16		76	6.6	20	.0
2		80	60	18	.4	17		75	6.2	20	.0
3		80	58	18	.4	18		74	5.8	25	.0
4		70	60	18	.4	19	43	75	5.4	20	.0
5		70	58	18	.4	20	43	77	7.0	14	.0
6		80	55	18	.4	21	50	70	18	6.4	.0
7		80	52	18	.3	22	80	69	18	5.9	.0
8		86	63	18	.3	23	80	68	16	3.3	.0
9		90	47	16	.3	24	76	67	17	2.6	.2
10		90	42	16	.3	25	76	69	18	2.3	.7
11		96	41	18	.2	26	83	65	18	1.5	.5
12		89	41	19	.2	27	76	64	20	1.0	.4
13		80	38	19	.1	28	80	60	25	.8	.4
14		79	7.5	19	.0	29	83	55	22	.7	.3
15		77	7.0	17	.0	30	83	65	22	.6	.2
						31		60		.5	.0

NOTE.—Daily discharge determined as follows: Mean discharge estimated April 6 to 18, at 15 second-feet; Apr. 19 to May 10, from a fairly well defined rating curve; May 11 to June 19, by indirect method for shifting channels; June 20 to July 18, from a well-defined rating curve; July 19 to 21, by indirect method for shifting channels; July 22 to Aug. 31, from a fairly well defined rating curve. Work was begun on the headgates Apr. 6, but there was not much flow until Apr. 19. June 20, head gate was raised in afternoon; the discharge computed from observer's reading and the current-meter measurement. No gage readings available Oct. 1 to Apr. 18, Aug. 17 to 23, and Aug. 31 to Sept. 30.

Monthly discharge of Fort Belknap canal near Chinook, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April 7-30	83	.....	43.0	2,050	C.
May	96	55	74.8	4,600	B.
June	63	5.4	30.6	1,820	B.
July	25	.5	12.7	781	B.
August	.7	.0	.22	13.5	(a)
The period	.....	.....	.....	9,260	

[a] Result fair considering low discharge.

NOTE.—See footnote to table of daily discharge.

PARADISE CANAL NEAR CHINOOK, MONT.

LOCATION.—Near the headgate on Milk River at Rudolph Friede's ranch.

RECORDS AVAILABLE.—June, 1903, to September 30, 1914.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—See Fort Belknap Canal near Chinook (p. 84).

ACCURACY.—Discharge relation affected by changes in slope of water surface between the gage and a pond below, as it takes from one to two days for the water level in the pond to adjust itself to changes in discharge. In order to establish the correct discharge relation it is necessary to make several rating curves for the station. Frequent discharge measurements are necessary to obtain reliable results. Results are good, April to June, and fair for July.

Discharge measurements of Paradise canal near Chinook, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 29	B. E. Jones	1.51	11.6	June 2	B. E. Jones	1.38	[a] 5.6
May 4	.....do	1.70	15.6	June 8	.....do	1.43	5.3
9	.....do	1.62	13.7	8	.....do	1.83	11.3
16	.....do	1.28	6.0	9	.....do	1.62	7.6
25	.....do	1.67	9.4	22	.....do	[b] 1.31	2.5
27	.....do	1.74	10.8	30	.....do	1.07	1.5

[a] Mean of two measurements at different sections.
[b] Probably backwater at gage.

NOTE.—On July 7 W. Arthurs estimated that zero flow would occur at about gage height 0.58 foot.

Daily discharge in second-feet of Paradise canal near Chinook, Mont., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	.....	18	5.5	1.8	16	24	5.8	5.4	.....
2	.....	20	5.6	.6	17	22	5.7	5.1	.....
3	.....	18	8.0	.5	18	18	6.1	5.0	.....
4	.....	17	9.8	.2	19	16	10	4.4	.....
5	.....	15	9.5	.1	20	16	7.5	6.0	.....
6	.....	15	2.1	.1	21	16	9.7	6.8	.....
7	.....	12	3.1	.0	22	17	9.1	3.8	.....
8	.....	11	9.2	.6	23	14	8.5	1.2	.....
9	.....	14	7.2	3.2	24	14	11	2.8	.....
10	.5	16	7.6	3.0	25	5.5	9.1	5.0	.....
11	.3	7.7	7.7	1.3	26	11	9.9	3.1	.....
12	16	7.2	4.0	.0	27	11	11	.8	.....
13	13	6.8	1.0	.....	28	12	11	1.2	.....
14	9.5	7.2	.0	.....	29	12	9.4	2.0	.....
15	23	6.3	1.7	.....	30	11	7.2	2.1	.....
					31	.....	5.8	.....	.....

NOTE.—Discharge determined as follows: Apr. 10 to May 10, from a rating curve well defined between 9.5 and 18 second-feet, and poorly defined at other stages; May 11–24, by indirect method for shifting channels; May 25 to June 2, from a rating curve well defined between 4.7 and 12 second-feet, and poorly defined at other stages; June 3–7, by the indirect method for shifting channels; after June 7, from a well-defined rating curve; Apr. 10 the canal ran one-half day. After July 11 the canal was practically dry. No gage records available Oct. 1 to Apr. 9 and July 13–Sept. 30.

Monthly discharge of Paradise canal near Chinook, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April 10–30	24	0.3	13.4	558	B.
May	20	5.7	10.6	652	B.
June	9.8	0	4.56	271	B.
July 1–12	3.2	0	0.95	22.6	C.
The period	.....	.....	.....	1,500	

NOTE.—See footnote to table of daily discharge.

HARLEM CANAL NEAR ZURICH, MONT.

LOCATION.—In the SW. ¼ sec. 33, T. 33 N., R. 21 E., about 500 feet below the headgates of the canal on Milk River, 1½ miles southeast of the Great Northern Railway section house at Zurich.

RECORDS AVAILABLE.—June, 1903, to September 30, 1914.

GAGE.—Staff, 300 feet below headgates. Observer, Howsan Kirby.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—See Fort Belknap Canal near Chinook (p. 84).

ACCURACY.—In order to determine the correct discharge relation it is necessary to make frequent discharge measurements. Several rating curves used during the period. Results good for May, June, and July, and fair for April.

Discharge measurements of Harlem canal near Zurich, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 29	B. E. Jones	3.57	57	June 2	B. E. Jones	2.03	8.1
May 4	....do	3.65	65	8	....do	2.84	23
9	....do	3.37	54	20	....do	3.48	39
16	....do	3.83	63	30	....do	2.96	22
25	....do	2.65	26	July 7	W. Arthurs	1.55	[a].3

[a] Estimated.

Daily discharge, in second-feet, of Harlem canal near Zurich, Mont., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	8	55	11	21	16	48	62	47	.....
2	46	63	6.8	22	17	46	64	43	.....
3	44	67	3.8	16	18	49	62	39	.....
4	40	66	2.7	8.5	19	46	61	38	.....
5	43	45	1.8	4.5	20	53	53	35	.....
6	36	69	2.8	1.5	21	44	47	36	.....
7	41	66	6.1	.4	22	40	40	27	.....
8	43	59	20	.0	23	40	29	14	.....
9	33	52	39	.0	24	55	27	7.6	.....
10	37	51	50	.0	25	60	26	7.2	.....
11	36	60	47	.....	26	53	21	9.2	.....
12	42	63	48	.....	27	65	19	9.2	.....
13	45	61	46	.....	28	55	20	12	.....
14	38	64	46	.....	29	64	21	18	.....
15	38	60	49	.....	30	61	18	21	.....
					31	.....	14	.....	.....

NOTE.—Daily discharge determined as follows: Apr. 1–29, from a poorly defined rating curve; Apr. 30 to May 3, by the indirect method for shifting channels; May 4–10 and May 25 to June 3, from a fairly well defined rating curve; May 11–24 and June 4–19, by the indirect method for shifting channels; June 20 to July 10, from a fairly well defined rating curve. Head gates raised Mar. 29. Canal dry after July 7. No gage records available Oct. 1 to Mar. 31 and July 11 to Sept. 30.

Monthly discharge of Harlem canal near Zurich, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April	65	8	45.0	2,680	C.
May	69	14	47.9	2,950	B.
June	50	1.8	24.8	1,480	B.
July 1–10	22	0	7.39	147	B.
The period	.....	.....	.....	7,260	

NOTE.—See footnote to table of daily discharge.

AGENCY DITCH NEAR HARLEM, MONT.

LOCATION.—In the SW. ¼ sec. 33, T. 32 N., R. 25 E., at the waste gate, about one-half mile below the head gate of the ditch on Milk River, at Fort Belknap agency.

RECORDS AVAILABLE.—July 14, 1905, to September 30, 1914.

GAGE.—Staff. Observer, L. W. Teter.

DISCHARGE MEASUREMENTS.—Made from highway bridge, about 1,000 feet above the gage.

CHANNEL AND CONTROL.—See Fort Belknap canal near Chinook (p. 84).

DIVERSIONS.—See Fort Belknap canal near Chinook (p. 84).

ACCURACY.—In order to obtain reliable results frequent discharge measurements are necessary. Twelve rating curves were used during the period. Results are good.

Discharge measurements of Agency ditch near Harlem, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 10	L. W. Teter	4.00	64	May 31	L. W. Teter	4.10	27
12	do	4.75	88	June 5	do	3.25	38
16	do	4.55	68	11	B. E. Jones	3.63	72
20	do	4.65	85	11	L. W. Teter	3.60	69
24	do	4.20	62	15	do	4.00	85
28	do	3.45	37	19	do	4.10	63
29	B. E. Jones	3.81	52	26	do	4.30	44
May 1	L. W. Teter	4.00	63	July 3	do	3.15	52
7	B. E. Jones	3.83	53	6	B. E. Jones	3.28	54
8	L. W. Teter	3.80	52	7	do	2.95	43
14	do	3.45	38	8	do	2.38	26
21	do	4.30	28	8	do	1.92	14.1

Daily discharge, in second-feet, of Agency ditch near Harlem, Mont., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	.....	63	27	42	16	70	28	49	28
2	.....	60	35	38	17	74	27	56	25
3	.....	57	43	42	18	91	27	35	23
4	.....	54	43	52	19	98	27	49	21
5	.....	53	41	54	20	86	28	33	18
6	.....	52	42	55	21	78	28	32	17
7	.....	53	39	42	22	74	27	44	15
8	26	52	29	24	23	70	27	37	14
9	53	51	35	19	24	64	27	40	14
10	58	44	51	21	25	66	27	43	.....
11	98	34	69	31	26	60	28	44	.....
12	90	24	68	34	27	42	27	42	.....
13	93	23	72	34	28	40	28	40	.....
14	86	30	74	34	29	48	27	36	.....
15	68	27	71	34	30	66	25	38	.....
					31	.....	27	.....	.....

NOTE.—Daily discharge determined from 12 fairly well defined rating curves applicable as follows: Apr. 8–11, 12–14, 15–18, 19–27, Apr. 28 to May 18, May 19–30, May 31 to June 3, June 4–8, 9–17, 18–22, June 23–27, and June 28 to July 24, when head gate was closed; changes due to changes in the gates; water in ditch half day Apr. 8.

Monthly discharge of Agency ditch near Harlem, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April 8–30	98	26	69.5	3,170	B
May	63	23	35.9	2,210	B.
June	74	27	45.2	2,690	B.
July 1–24	55	14	30.5	1,450	B.
The period	.....	.....	.....	9,520	

NOTE.—See footnote to table of daily discharge.

MILK RIVER AT MALTA, MONT.

LOCATION.—In the NW. ¼ sec. 17, T. 30 N., R. 30 E., at the old highway bridge at Malta.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 31, 1902, to September 30, 1914.

GAGE.—Chain fastened to hand rail on downstream side of bridge.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Slightly shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.75 feet at 9 a. m. March 24 (discharge, 1,100 second-feet); minimum stage recorded, 0.8 foot at 9 a. m. and 4 p. m. September 11 and 12 (discharge, 8 second-feet).

1902–1914: Maximum stage recorded, 19.75 feet April 10, 1907 (discharge, 11,200 second-feet); river reported dry August 13 to November 10, 1904; April 24 to May 8, August 30 to end of year, 1905; April 10, 27–29, May 1, 4–23, 1906; July 16 to December 8, 1910. Open-water records only.

WINTER FLOW.—Discharge relation affected more or less by ice during winter.

DIVERSIONS.—The entire run-off from the drainage area above does not pass the station; between Havre and Malta 7 canals, which irrigate about 25,000 acres, divert water from Milk River and its tributaries. Diversions are also made by the Reclamation Service at Dodson dam.

ACCURACY.—Results considered good.

Discharge measurements of Milk River at Malta, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 13	W. A. Lamb	1.89	152	June 3	B. E. Jones	0.91	10
May 5	B. E. Jones	1.16	32	18	do	1.39	49

Daily discharge, in second-feet, of Milk River at Malta, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	31	281			360	38	11	281	21	12
1	31	152			360	43	12	211	22	12
3	31	152			382	30	13	155	21	12
4	31	127			382	29	13	132	19	14
5	31	127			688	25	14	125	18	12
6	41	127			688	21	18	116	17	11
7	41	152			814	21	18	78	16	10
8	41	152			688	21	15	42	15	9
9	41	152			630	21	16	29	15	9
10	41	152			574	21	14	35	14	9
11	41	152	85		601	21	16	33	13	8
12	41	152			688	17	18	28	11	8
13	53	152	68		688	16	180	33	12	21
14	53	152			630	16	506	29	14	16
15	60	152			547	14	344	28	12	16
16	76	152	68		426	13	140	27	12	16
17	105	152			340	16	76	25	11	12
18	85	152			228	14	46	22	11	12
19	85	152			76	16	37	21	16	11
20	85	152			496	14	34	24	29	11
21	85	152			688	11	32	22	26	12
22	85	152			574	10	32	22	22	11
23	85	152		847	448	11	31	22	16	11
24	105	127		988	382	12	33	22	16	11
25	105	127		574	281	13	35	21	12	11
26	105	127		630	263	14	53	21	12	12
27	105	105		574	245	13	125	21	14	12
28	127	105		448	158	12	166	21	13	13
29	152	85		382	47	14	448	21	14	15
30	211	85		426	36	13	360	21	14	16
31	360			382		12		21	14	

NOTE.—Discharge determined from a fairly well defined rating curve. No gage-height records available Dec. 1–10, 12, 14, 15, and Dec. 17 to Mar. 4. During periods for which gage-height records are available discharge relation was affected by ice about Mar. 5–22 and possibly to Mar. 31, and estimates of discharge Mar. 23–31 should therefore be used with caution. Mean discharge Apr. 19 (76 second-feet) is correct, although it appears discordant.

Monthly discharge of Milk River at Malta, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	360	31	82.9	5,100	B.
November	281	85	144	8,570	B.
March 23–31	988	382	583	10,400	D.
April	814	36	447	26,600	B.
May	43	10	18.1	1,110	B.
June	506	11	95.2	5,660	B.
July	281	21	55.1	3,390	B.
August	29	11	15.9	978	B.
September	21	8	12.2	726	B.

NOTE.—See footnote to table of daily discharge.

MILK RIVER AT HINSDALE, MONT.

LOCATION.—In the NE. ¼ SW. ¼ sec. 33, T. 31 N., R. 36 E., at the highway bridge over Milk River, about 1 mile from Hinsdale, a point 46 miles above the junction of Milk River with the Missouri.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 13, 1908, to September 30, 1914.

GAGE.—Chain fastened to upstream side of highway bridge; datum unchanged.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.0 feet at 6 p. m. June 14 (discharge, 3,630 second-feet); minimum stage recorded, 0.95 foot at 7 p. m. August 8, 10, and 17 (discharge, 12 second-feet).

1908–1914: Maximum stage recorded, April 6, 1912, discharge estimated at 24,200 second-feet; river reported dry August 9–13, 1910. Open-season records only.

WINTER FLOW.—Stream frozen entirely across and to a considerable depth from late in November until the first of April.

DIVERSIONS.—No water is diverted between the station at Hinsdale and that at Malta. The flow of the stream has, however, been appropriated by the United States Reclamation Service in connection with the Milk River project and will be diverted at a point 9 miles east of Hinsdale to irrigate land in lower Milk River valley.

ACCURACY.—Results considered good.

Discharge measurements of Milk River at Hinsdale, Mont., during the year ending Sept. 30, 1914.

[Made by B. E. Jones.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
May 6	1.91	147	June 17	4.26	1,210
June 4	1.26	35	July 4	2.60	354

Daily discharge, in second-feet, of Milk River near Hinsdale, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	40	.....	.....	288	40	337	20	48
2	40	.....	.....	227	40	328	24	48
3	35	.....	.....	186	34	320	20	48
4	40	.....	1,690	173	34	354	20	40
5	40	.....	1,390	138	34	304	17	28
6	40	.....	1,030	161	34	304	17	24
7	40	140	1,210	138	34	288	17	24
8	40	120	1,270	118	40	242	12	24
9	40	120	1,150	109	28	213	14	28
10	50	120	942	109	34	161	12	20
11	50	120	888	109	24	149	13	19
12	50	120	915	100	28	503	14	18
13	50	105	1,090	91	722	272	12	17
14	60	105	1,270	91	3,630	199	14	20
15	75	.....	1,210	91	2,010	138	24	186
16	75	.....	1,150	91	778	100	24	118
17	60	.....	1,030	91	1,090	91	28	173
18	50	.....	970	91	1,390	82	24	109
19	50	.....	1,030	91	1,330	82	34	91
20	60	.....	832	82	1,210	64	100	82
21	60	.....	590	82	860	48	48	64
22	75	.....	915	82	590	40	970	56
23	90	.....	778	64	463	40	213	40
24	90	.....	750	73	368	40	1,150	40
25	.....	.....	524	56	272	28	2,790	34
26	.....	.....	463	56	257	24	483	34
27	.....	.....	435	48	425	28	304	34
28	.....	.....	407	34	483	20	138	34
29	.....	.....	389	40	425	24	110	34
30	.....	.....	337	40	389	20	82	34
31	.....	.....	.....	40	.....	20	64	.....

NOTE.—Daily discharge determined from two well-defined rating curves applicable Oct. 1 to Nov. 14 and Apr. 4 to Sept. 30. Apr. 1-3, mean discharge estimated at 1,100 second-feet. Discharge interpolated for other days for which gage readings are not available. No gage-height records available Oct. 25 to Nov. 6, Nov. 15 to Apr. 3, Apr. 13, 27, May 10, 15, May 30 to June 6, June 24, July 2, 17, 23, Aug. 11, 29, Sept. 2, 7, 11, 12, and 27.

Monthly discharge of Milk River near Hinsdale, Mont., for the year ending Sept. 30, 1914

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean		
October 1-24	90	35	54.2	2,580	B.
April	1,690	337	932	55,500	B.
May	288	34	103	6,330	B.
June	3,630	24	570	33,900	B.
July	503	20	157	9,650	B.
August	2,790	12	220	13,500	B.
September	186	17	52.3	3,110	B.

NORTH FORK OF MILK RIVER NEAR KIMBALL, ALBERTA.

LOCATION.—In the NE. ¼ sec. 11, T. 1, R. 23 W., fourth meridian, at the Peters ranch, 18 miles east of Kimball, Alberta, and about 2 miles north of the international boundary.

DRAINAGE AREA.—101 square miles.

RECORDS AVAILABLE.—January 1, 1913, to September 30, 1914. A station was maintained by the Irrigation Office, Department of the Interior, Canada, in the NE. ¼ sec. 13, T. 1, R. 23 W., fourth meridian, about 2 miles downstream, July 21, 1909, to December 21, 1912. Another was maintained at Alexander Dubray's ranch 2 miles south of the international boundary May 8, 1911, to December 31, 1912.

GAGE.—Stevens water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—At low water made by wading at convenient sections near gage; at high water from a cable 2 miles below gage.

CHANNEL AND CONTROL.—Slightly shifting.

WINTER FLOW.—Discharge relation affected by ice.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.48 feet (staff gage) April 5 (discharge, 517 second-feet); minimum stage recorded, 1.53 feet (water-stage recorder) August 7–8 (discharge, 11.1 second-feet); constant stage.

1909–1914: Maximum stage recorded, 3.9 feet July 27–28, 1909 (discharge, 591 second-feet); minimum stage recorded, 2.11 feet January 11, 1913 (discharge estimated at 8.9 second-feet, as discharge relation was affected by ice).

ACCURACY.—Results good.

COOPERATION.—Station maintained during 1914 in cooperation with Irrigation Office, Department of the Interior, Canada.

Discharge measurements of North Fork of Milk River near Kimball, Alberta, during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 25	W. A. Lamb	1.84	23	June 5	O. H. Hoover [a]	1.72	23.0
Nov. 25	J. E. Degnan [a]	1.81	27.3	21	W. A. Lamb	1.64	15.6
Dec. 6	do	1.76	20.2	24	O. H. Hoover [a]	1.63	16.5
17	do	1.69	14.6	25	do	1.84	31.0
31	do	[b] 2.12	14.1	25	do	1.71	23.0
Jan. 13	do	[b] 2.00	16.5	July 17	do	1.58	13.6
24	do	[b] 2.55	12.3	21	do	1.56	12.0
Feb. 10	do	[b] 3.42	13.5	22	W. A. Lamb	1.54	11.4
27	do	[b] 2.93	16.2	Aug. 12	O. H. Hoover [a]	1.57	13.5
Mar. 14	W. A. Burton [a]	[b] 2.25	43.0	Sept. 3	do	1.59	14.1
27	O. H. Hoover [a]	[b] 1.97	24.0	7	G. H. Whyte [a] and O. H. Hoover [a]	1.58	13.8
Apr. 8	do	1.96	43.0				
22	do	1.77	25.0	10	W. A. Lamb	1.60	13.2
May 15	do	1.75	25.0	18	O. H. Hoover [a]	1.61	14.9
24	W. A. Lamb	1.75	24.0				

[a] Engineer of the Irrigation Office, Department of the Interior, Canada. [b] Ice present.

Daily discharge, in second-feet, of North Fork of Milk River near Kimball, Alberta, for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	30	26	19.5	14.0	13.3	16.8	34.0	26.0	16.0	14.9	13.8	14.9
2	29	27	18.8	13.4	12.7	17.3	33.0	26.0	16.6	13.8	13.8	14.3
3	29	33	23.0	13.8	12.0	18.3	35.0	26.0	17.2	14.3	12.8	14.3
4	30	38	20.0	14.2	11.5	19.4	197.0	34.0	18.5	13.3	11.9	13.8
5	30	26	18.8	15.2	11.2	21.0	517.0	35.0	22.0	17.9	12.4	13.8
6	30	25	21.0	18.0	11.8	22.0	282.0	52.0	23.0	18.5	11.5	13.3
7	30	24	17.9	17.8	12.3	22.0	48.0	44.0	20.0	17.2	11.1	13.8
8	31	24	18.8	16.9	13.1	22.0	43.0	37.0	19.8	15.5	11.1	15.5
9	32	24	22.0	16.2	13.6	21.0	42.0	34.0	18.5	14.9	11.9	14.9
10	33	23	23.0	15.3	13.5	20.0	41.0	30.0	17.2	14.9	12.8	13.3
11	35	24	19.5	15.3	13.3	42.0	40.0	27.0	17.2	15.5	12.4	12.4
12	71	22	20.0	16.2	12.7	42.0	39.0	25.0	17.2	16.0	12.4	16.0
13	53	33	22.0	16.5	13.0	42.0	38.0	26.0	24.0	16.0	13.8	17.9
14	41	44	21.0	16.4	13.5	43.0	37.0	25.0	26.0	16.0	12.4	14.9
15	33	33	18.8	16.4	14.0	42.0	35.0	25.0	20.0	15.5	11.9	13.3
16	31	22	18.8	16.2	14.0	43.0	29.0	23.0	18.5	16.6	11.9	13.8
17	32	21	19.5	16.2	13.9	43.0	24.0	22.0	18.5	15.5	24.0	14.3
18	31	21	14.6	15.8	13.8	40.0	19.8	21.0	16.0	13.3	31.0	14.9
19	27	47	14.5	15.3	13.7	37.0	25.0	21.0	14.3	13.3	19.2	14.9
20	27	37	14.5	14.7	13.4	37.0	32.0	26.0	14.9	13.3	16.0	14.9
21	24	27	14.5	14.2	13.2	35.0	24.0	28.0	15.5	13.3	14.9	14.9
22	25	29	14.5	13.7	13.0	38.0	15.5	23.0	15.5	12.8	14.3	15.5
23	23	26	14.4	13.0	13.7	38.0	26.0	23.0	15.5	13.8	16.0	16.0
24	24	24	14.4	12.3	15.0	32.0	26.0	23.0	16.0	14.3	25.0	16.0
25	23	23	14.3	12.4	16.0	24.0	26.0	22.0	24.0	14.3	19.8	16.6
26	22	27	14.3	13.1	16.2	24.0	25.0	19.2	26.0	13.8	17.9	15.5
27	21	26	14.3	14.0	16.2	24.0	25.0	17.9	17.2	14.3	16.0	14.9
28	24	26	14.3	12.7	16.4	25.0	26.0	17.2	15.5	13.8	14.9	14.3
29	24	24	14.2	13.2	.....	27.0	29.0	16.0	14.3	14.3	14.3	14.9
30	24	23	14.2	14.0	.....	31.0	28.0	16.0	15.5	14.3	14.9	14.9
31	41	.....	14.1	13.7	.....	34.0	.....	16.0	.....	14.3	14.3	.....

NOTE.—Discharge determined as follows: Oct. 1 to Dec. 17, from a well-defined rating curve; Dec. 18 to Apr. 3, estimated, because of ice, from gage heights, temperature records, and discharge measurements; Dec. 18–22, readings taken on staff gage; no gage readings Feb. 12, 13, 24 (discharge interpolated) and Apr. 6–13, 16, 17 (discharge estimated). Apr. 4, discharge estimated by hydrographer; Apr. 5, estimated from a slope measurement; Apr. 18 to Sept. 30, determined from a rating curve well defined between 10 and 140 second-feet.

Estimates of discharge made by Irrigation Office, Department of the Interior, Canada; checked by U. S. Geological Survey.

Monthly discharge of North Fork of Milk River near Kimball, Alberta, for the year ending Sept. 30, 1914.

[Drainage area, 101 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October	71	21	31.0	0.307	0.35	1,906
November	47	21	27.6	.273	.30	1,642
December	23	14.1	17.5	.173	.20	1,076
January	18	12.3	14.8	.147	.17	910
February	16.4	11.2	13.6	.135	.14	755
March	43.0	16.8	30.4	.301	.35	1,869
April	517	15.5	61.4	.608	.68	3,654
May	52	16	26.0	.257	.30	1,599
June	26	14.3	18.3	.181	.20	1,089
July	18.5	12.8	14.8	.147	.17	910
August	31	11.1	15.2	.150	.17	935
September	17.9	12.4	14.8	.147	.16	881
The year	517	11.1	23.8	.236	3.19	17,200

NOTE.—See footnote to table of daily discharge.

BATTLE CREEK[1] NEAR CHINOOK, MONT.

LOCATION.—In sec. 3, T. 33 N., R. 19 E., at a point about 4½ miles north of Chinook, about 7 miles above junction of Battle Creek with Milk River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 22, 1905, to September 30, 1914.

GAGE.—Chain on left bank near the house of the observer.

DISCHARGE MEASUREMENTS.—Made by wading or at the cable near the gage.

CHANNEL AND CONTROL.—Sandy and shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.05 feet at 5 p. m. April 17 (discharge, 650 second-feet); creek reported dry July 14 to September 30.

1905–1914: Maximum stage recorded, 12.60 feet June 8, 1906 (discharge, 4,600 second-feet); creek reported dry September 3 to October 22, 1905; July 8 to November 20, 1908; June 21 to end of year, 1910; July 22 to September 3, 1911; September 7–23, 1913; July 14 to September 30, 1914.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Several canals divert water above the station in Canada and in the United States. The Matheson and Cook canals divert water below the station for irrigation in Milk River Valley near the mouth of Battle Creek; aggregate appropriation, 78 second-feet.

ACCURACY.—Rating curve fair; results apparently reliable.

Greater part of run-off occurs during floods caused by heavy rains in the spring and early summer. In the fall the channel is often dry.

Discharge measurements of Battle Creek near Chinook, Mont., during the year ending Sept. 30, 1914.

[Made by B. E. Jones.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 28	1.42	79.0	June 6	.35	4.6
May 16	1.11	53.0	29	.14	.48

[1] Decision of U. S. Geographic Board; known locally as North Fork of Milk River; data prior to 1913 published under that name.

Daily discharge in second-feet of Battle Creek near Chinook, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.
1	0.8	5.6	16	.....	54	67	3.0	0.3
2	.8	5.6	.....	.....	270	61	2.8	.2
3	.6	5.6	.....	.....	207	55	2.4	.2
4	.8	5.9	.....	.....	163	68	4.5	.2
5	.8	6.9	.....	.....	163	112	4.5	.2
6	1.0	8.4	.....	.....	105	65	4.5	.2
7	1.3	11	.....	.....	92	49	3.9	.1
8	1.5	11	.....	.....	86	38	2.4	.1
9	4.9	11	.....	.....	85	36	2.0	.1
10	5.1	13	.....	.....	81	38	1.6	.1
11	5.6	13	.....	.....	75	40	1.6	.1
12	6.1	15	.....	.....	112	33	3.9	.1
13	4.7	16	.....	.....	140	31	4.5	.1
14	4.2	16	.....	.....	125	31	6.0	.....
15	4.2	16	.....	207	140	30	26	.....
16	3.7	14	.....	478	258	49	13	.....
17	3.7	14	.....	418	650	38	5.1	.....
18	3.7	16	.....	216	478	36	3.3	.....
19	3.7	16	.....	132	332	36	2.8	.....
20	4.2	16	.....	118	226	34	2.0	.....
21	5.1	14	.....	140	172	27	1.8	.....
22	5.6	16	.....	92	132	22	1.2	.....
23	5.9	15	.....	86	118	22	.6	.....
24	5.6	14	.....	98	112	20	1.1	.....
25	5.1	15	.....	98	98	18	1.6	.....
26	4.9	17	.....	98	86	11	2.0	.....
27	4.9	22	.....	98	84	8.7	1.5	.....
28	4.9	24	.....	98	81	7.2	1.0	.....
29	4.7	25	.....	92	73	6.3	.4	.....
30	4.7	25	.....	86	69	4.2	.4	.....
31	5.4	.....	.....	68	.....	3.3	.....	.....

NOTE.—Daily discharge determined from two fairly well defined rating curves applicable Oct. 1 to Dec. 1 and Mar. 15 to Sept. 30. Stream dry July 14 to Sept. 30. No gage height records available Dec. 2 to Mar. 14, June 24, 27, 28, and July 14 to Sept. 30.

Monthly discharge of Battle Creek near Chinook, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	6.1	0.6	3.81	234	B
November	25	5.6	14.1	839	B.
March 15–31	478	68	154	5,190	B.
April	650	54	162	9,640	B.
May	112	3.3	35.4	2,180	B.
June	26	0.4	3.71	221	B.
July	.3	.0	.064	3.9	C.

NOTE.—See footnote to table of daily discharge.

COOK CANAL NEAR CHINOOK, MONT.

LOCATION.—In the N. ½ sec. 30, T. 33 N., R. 20 E., about half a mile above a small wooden highway bridge on the road running parallel to the Great Northern Railway, about 3 miles east of Chinook.

RECORDS AVAILABLE.—April 10, 1905, to September 30, 1914.

GAGE.—Staff.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading.

ACCURACY.—Results good for May, June, and July; fair for April.

Discharge measurements of Cook canal near Chinook, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 29	B. E. Jones	3.21	37	June 2	B. E. Jones	1.66	3.2
May 4	do	3.11	35	8	do	1.78	3.9
9	do	2.90	26	19	do	2.32	8.9
16	do	3.45	37	22	do	1.61	2.5
25	do	2.64	14.1	30	do	1.78	1.6
27	do	2.22	9.0	July 7	W. Arthurs	1.95	2.1

Daily discharge in second-feet of Cook canal near Chinook, Mont., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1		37	3.3	1.8	16	60	37	32	
2		36	2.8	1.8	17	71	37	19	
3		35	2.5	2.0	18	56	29	11	
4		33	3.1	3.5	19	45	29	8.9	
5		39	3.6	3.5	20	26	24	5.5	
6		48	3.8	3.9	21	28	23	3.8	
7		45	4.0	2.5	22	31	14	2.5	
8		27	4.4	1.5	23	35	14	1.0	
9		26	3.6	1.2	24	41	16	.6	
10		21	3.1	.5	25	46	15	1.5	
11		28	3.6	.2	26	45	10	3.9	
12	37	26	4.7	.2	27	43	8.5	1.1	
13	41	24	5.3	.1	28	41	7.3	.5	
14	35	21	6.7	.0	29	41	6.0	.2	
15	48	26	39	.0	30	41	4.9	1.5	
					31		4.2		

NOTE.—Discharge determined as follows: Prior to May 15, and June 27 to July 13, from a fairly well defined rating curve; May 15 and June 25–26, by indirect method for shifting channels, May 16 to June 24, from a well-defined rating curve; Apr. 1–11, estimated at 25 second-feet. Water turned into canal about Apr. 1,; after July 13 canal was dry. Higher gage reading May 16 caused partly by beaver dams in canal below gage. No gage-height records available Oct. 1 to Apr. 11 and July 15 to Sept. 30.

Monthly discharge of Cook canal near Chinook, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April	71		36.2	2,150	C.
May	48	4.2	24.2	1,490	B.
June	39	.2	6.22	370	B.
July 1–15	3.9	.0	1.51	44.9	B.
The period				4,050	

NOTE.—See footnote to table of daily discharge.

MATHESON CANAL NEAR CHINOOK, MONT.

LOCATION.—In the NW. ¼ sec. 29, T. 33 N., R. 20 E., at the headgate of the canal near the main road, 3½ miles east of Chinook.

RECORDS AVAILABLE.—April 10, 1905, to September 30, 1914.

GAGE.—Staff.

DISCHARGE MEASUREMENTS.—Made by wading.

ACCURACY.—Results good for May, June, and July; fair for April.

Discharge measurements of Matheson canal near Chinook, Mont., during the year ending Sept. 30, 1914.

[Made by B. E. Jones.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 29	3.99	9.4	May 25	3.26	2.3	June 8	2.71	*a*.01
May 4	3.62	5.8	27	3.18	1.6	22	2.76	*a*.02
9	3.47	4.9	June 2	2.85	.12	30	3.06	.75
16	3.64	5.6						

a Estimated.

Daily discharge, in second-feet, of Matheson canal near Chinook, Mont., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	.....	7.5	0.3	0.4	16	17	5.8	5.6	.....
2	.....	6.6	.14	.3	17	24	5.7	3.5	.....
3	.....	6.3	.10	.2	18	22	5.3	1.0	.....
4	.....	5.2	.12	.12	19	21	4.4	.6	.....
5	.....	14	.06	.10	20	19	3.8	.4	.....
6	.....	9.9	.09	.10	21	17	3.8	.12	.....
7	.....	6.7	.06	.03	22	14	2.8	.05	.....
8	.....	5.1	.03	.01	23	12	2.6	.02	.....
9	.....	4.9	.01	.00	24	9.5	2.6	.01	.....
10	.....	4.4	.00	.....	25	11	2.4	.5	.....
11	.....	4.7	.01	.....	26	11	2.2	1.0	.....
12	7.1	4.8	.04	.....	27	9.5	1.9	1.0	.....
13	15	4.8	.03	.....	28	9.0	1.4	1.1	.....
14	14	4.5	.06	.....	29	8.6	.8	1.2	.....
15	15	4.5	2.8	.....	30	8.4	.4	.8	.....
					31	.....	.3	.....	.....

NOTE.—Discharge determined from rating curves as follows: Well defined between 0.1 and 6.3 second-feet, fairly well defined at higher stages, and applicable Apr. 12 to May 4 and May 16 to July 8. May 5–15, discharge estimated by indirect method for shifting channels. Mean discharge Apr. 1–11 estimated at 4 second-feet. Water turned into ditch about Apr. 1; ditch dry after July 8. No gage-height records available Oct. 1 to Apr. 11 and July 10 to Sept. 30.

Monthly discharge of Matheson canal near Chinook, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April	24	.....	10.3	613	C.
May	14	0.3	4.52	278	B.
June	5.6	0	.71	42.2	(*a*)
July 1–9	.4	0	.14	2.5	(*a*)
The period	.....	.....	.....	936	

a Record good, considering low discharge.

NOTE.—See footnote to table of daily discharge.

ROCK CREEK NEAR HINSDALE, MONT.

LOCATION.—In sec. 10, T. 31 N., R. 36 E., at Ottenstror's ranch, about 2 miles below the headgates of Rock Creek canal and 6 miles northeast of Hinsdale.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 19, 1912, to September 30, 1914. July 5, 1905, to December 31, 1907, data were obtained at a station 2 miles upstream, just below the diversion dam of the Rock Creek canal. Flow at the two points is practically the same.

GAGE.—Overhanging chain gage on the left bank.

DISCHARGE MEASUREMENTS.—Made by wading one-fourth mile below gage at low and medium stages and from a bridge 2 miles below at high stages.

CHANNEL AND CONTROL.—Slightly shifting at high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.5 feet at 8.30 a. m. August 22 (discharge, 2,460 second-feet); minimum stage recorded, 5.35 feet at 5 p. m. June 5 (discharge 0.2 second-foot).

1906–7 and 1912–13: Maximum stage recorded, 18.35 feet about June 9, 1906, determined by leveling from flood marks (approximate discharge, computed from extension of rating curve, 18,000 second-feet); creek reported dry April 14 to May 2, 9-24, after July 12, 1906, after September 28, 1907, April 23–25, 27, 28, 30, May 1, 2, and 4, 1913.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Water is not stored but the normal summer flow is appropriated and used during the irrigation season.

ACCURACY.—Records good.

Discharge measurements of Rock Creek near Hinsdale, Mont., during the year ending Sept. 30, 1914.

[Made by B. E. Jones.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 6	5.66	6.4
June 4	5.39	.43
17	6.05	41

Daily discharge, in second-feet, of Rock Creek near Hinsdale, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	8	540	4	0.4	27	27	27
2	8	705	6	1.2	14	27	27
3	10	815	4	.4	8	8	18
4	15	1,100	6	.4	4	1.2	14
5	15	450	4	.2	2	2	11
6	18	670	6	.4	2	1.2	11
7	15	570	8	14	3	2	14
8	10	162	6	50	1.2	1.2	11
9	10	133	2	8	2	1.2	14
10	10	69	4	4	1.2	.4	11
11	10	76	4	3	510	.4	11
12	10	50	6	2	300	1.2	14
13	10	27	4	855	50	.4	11
14	10	27	6	1,360	56	1.2	22
15	10	11	4	264	50	.4	27
16	10	27	4	62	27	.4	44
17	15	50	2	44	14	1.2	38
18	15	27	1.2	18	8	.4	22
19	15	32	2	11	8	1,750	22
20	15	18	1.2	4	4	228	11
21	15	14	1.2	3	3	50	6
22	15	27	2	4	2	2,460	8
23	12	22	1.2	2	1.2	124	6
24	12	27	2	3	2	1,850	8
25	15	22	1.2	1.2	1.2	2,170	6
26	18	8	1.2	1.2	1.2	300	6
27	18	8	2	194	2	252	8
28	15	4	1.2	133	1.2	184	6
29	15	6	2	98	2	205	8
30	15	4	1.2	69	1.2	133	6
31	15	.....	1.2	.....	1.2	80	.....

NOTE.—Discharge determined from two rating curves fairly well defined below 1,200 second-feet and poorly defined at higher stages, applicable Oct. 1–28 and Apr. 1 to Sept. 30. Discharge estimated Oct. 29–31 and interpolated Aug. 31. No gage-height record available Oct. 29 to Mar. 31 and Aug. 31.

Monthly discharge of Rock Creek near Hinsdale, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	18	8	13.0	799	B.
April	1,100	4	190	11,300	B.
May	8	1.2	3.25	200	B.
June	1,360	.2	107	6,370	B.
July	510	1.2	35.8	2,200	B.
August	2,460	.4	318	19,600	C.
September	44	6.0	14.9	887	B.

NOTE.—See footnote to table of daily discharge.

PORCUPINE CREEK AT NASHUA, MONT.

LOCATION.—In the NE. ¼ SW. ¼ sec. 31, T. 28 N., R. 42 W,[1] at Nashua, 500 feet above the ford, one-fourth mile above highway bridge

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 11, 1908, to September 30, 1914.

GAGE.—Staff nailed to tree on left bank.

DISCHARGE MEASUREMENTS.—Made by wading near gage or from a bridge about one-fourth mile below.

CHANNEL AND CONTROL.—Slightly shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 14.0 feet at 8 a. m. June 29 (discharge, 477 second-feet); minimum stage recorded, 3.05 feet at 8.30 a. m. June 11–13, July 25, 26, 29, 30, August 8–20, and September 18–21 (discharge, 0.5 second-foot).

1909–1914: Maximum stage recorded, 17.2 feet August 20, 1912 (discharge, 749 second-feet); creek reported dry August 18 to September 4, 1909, May 27 to June 7, July 12–29, 1910, June 21 to September 5, 1911, and August 1–31, 1913.

WINTER FLOW.—Creek is usually dry.

DIVERSIONS AND STORAGE.—Water is neither diverted nor stored.

ACCURACY.—Records good.

Discharge measurements of Porcupine Creek at Nashau, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 10	W. A. Lamb	4.79	58	June 16	B. E. Jones	6.12	123
May 22	B. E. Jones	3.20	1.8	July 3	do	4.38	38

[1] Incorrectly reported in Water Supply Paper 356 as in " center of sec. 36, T. 28 N., R. 41 E."

Daily discharge, in second-feet, of Porcupine Creek at Nashua, Mont., for the year ending Sept. 30, 1914.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	192	1.8	1.3	57	0.8	27
2	.....	300	4.2	.8	55	5.1	23
3	.....	409	3.2	.5	41	10	14
4	.....	429	3.2	.5	39	5.1	12
5	.....	268	2.5	.8	39	1.8	6.2
6	.....	214	3.2	.8	35	.8	4.2
7	.....	142	2.5	.8	13	.8	3.2
8	.....	106	3.2	.8	10	.5	3.2
9	.....	81	3.2	.8	8.6	.5	2.5
10	.....	62	2.5	.8	5.1	.5	2.5
11	.....	57	3.2	.5	86	.5	1.8
12	.....	48	3.2	.5	76	.5	1.8
13	.....	31	4.2	.5	8.6	.5	1.8
14	.....	25	3.2	116	8.6	.5	1.3
15	31	19	1.8	220	5.1	.5	1.3
16	101	18	1.8	142	4.2	.5	1.3
17	101	16	1.3	81	6.2	.5	.8
18	96	14	1.8	57	6.2	.5	.5
19	48	12	1.8	35	5.1	.5	.5
20	35	10	1.3	31	4.2	.5	.5
21	35	10	1.3	31	2.5	.8	.5
22	35	10	.8	19	1.8	.8	.8
23	35	10	.8	19	.8	.8	.8
24	35	10	.8	18	.8	13	1.3
25	33	7.3	.8	16	.5	39	1.3
26	33	6.2	.8	12	.5	220	1.3
27	33	5.1	.8	23	.8	159	1.3
28	33	5.1	.8	101	.8	101	1.3
29	35	4.2	1.3	445	.5	71	1.3
30	37	3.2	1.3	154	.5	35	1.3
31	91	.....	1.3	.....	.8	31	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve. No gage height record available Oct. 1 to Mar. 14. Creek usually dry in late summer and in winter.

Monthly discharge of Porcupine Creek at Nashua, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 15-31	101	31	49.8	1,680	B.
April	429	3.2	84.1	5,000	B.
May	4.2	.8	2.06	127	C.
June	445	.5	51.0	3,030	B
July	86	.5	16.9	1,040	B.
August	220	.5	22.7	1,400	B.
September	27	.5	4.02	239	B.
The period	.....	.....	.....	12,500	

LITTLE PORCUPINE CREEK AT FRAZER, MONT.

LOCATION.—In the NE. ¼ NE. ¼ sec. 28, T. 27 N., R. 44 E., above the intake of the reservoir, about 1½ miles above the site of the station maintained from 1908 to 1910, and about one-half mile north of Frazer.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 13, 1908, to September 30, 1910, at the original station; April 14, 1911, to September 30, 1914, at present site.

GAGE.—Staff on left bank one-half mile above intake of United States Reclamation Service canal, installed May 10, 1913. Original gage was about 1½ miles below present gage. When station was reestablished April 14, 1911, a gage was placed on left bank about one-fourth mile below present gage.

DISCHARGE MEASUREMENTS.—Made by wading or from railroad bridge at Frazer.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year (new gage), 1.95 feet at 7.30 a. m. June 30 (discharge, 450 second-feet); creek reported dry July 23 to August 18, August 20-28, and September 8–30.

1909–1914: Maximum stage recorded, 7.0 feet April 5, 1912, determined by leveling from flood marks (approximate discharge computed from extension of rating curve, 500 second-feet); creek reported dry January 1 to March 20, March 30 to April 2, April 13 to July 7, July 17 to end of season, 1909; January 1 to March 1, May 3, to June 14, and June 18 to end of season, 1910; January 1 to September 5, 1911; June 5 to August 18, 1912; June 8–19 and July 12 to end of season, 1913; July 23 to August 18, August 20–28, and September 8–30, 1914.

ACCURACY.—Results fair.

Discharge measurements of Little Porcupine Creek at Frazer, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 9	W. A. Lamb	1.10	32	June 15	B. E. Jones	1.22	33
May 21	B. E. Jones	.25	[a].2	July 2	.....do	1.13	32

[a] Estimated.

Daily discharge, in second-feet, of Little Porcupine Creek at Frazer, Mont., for the year ending Sept. 30, 1914.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	56	.....	5.5	16	13	5.5	.....	0.0
2	.....	21	.....	6.2	17	13	4.0	.....	.0
3	.....	18	.....	3.0	18	12	2.6	.....	.0
4	.....	16	.....	2.0	19	7.0	2.0	0.8	.....
5	0.0	24	.....	1.0	20	5.0	1.4	.0	.....
6	.....	16	.....	1.0	21	6.2	1.0	.0	.....
7	.....	7.0	.....	.2	22	7.0	.5	.0	.....
8	.....	4.0	.....	.0	23	5.0	.0	.....	.....
9	.....	4.6	.....	.0	24	3.4	.0	.....	.....
10	.....	7.0	.....	.0	25	5.0	.0	.....	.....
11	.....	11	.....	.0	26	91	.0	.....	.....
12	.....	60	.....	.0	27	45	.0	.....	.....
13	.5	20	.....	.0	28	30	.0	.....	.....
14	34	12	.....	.0	29	27	.....	7.5	.....
15	36	8.2	.....	.0	30	102	.....	5.5	.....
					31	.....	.....	5.0	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve. Stream dry June 1–12, July 29 to Aug. 18, Aug. 20–28, and Sept. 8–30. No observer available prior to June 5. No gage-height record available Oct. 1 to June 4, June 6–12, July 23 to Aug. 18, Aug. 23–28, and Sept. 19–30.

Monthly discharge of Little Porcupine Creek at Frazer, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
June	102	0	14.7	875	B.
July	60	0	9.74	599	B.
August	7.5	0	.61	37.5	[a]
September	6.2	0	.63	37.5	[a]
The period	.....	.....	.....	1,550	

[a] Results fair, considering low discharge.

WOLF CREEK NEAR WOLF POINT, MONT.

LOCATION.—In the SE. ¼ SW. ¼ sec. 8, T. 27 N., R. 47 E., at William Smith's ranch, 2½ miles northwest of Wolf Point.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 15, 1908, to July 31, 1914, when station was discontinued.

GAGE.—Staff near the house of the observer, W. H. Smith.

DISCHARGE MEASUREMENTS.—Made by wading near the gage.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.2 feet at 10.30 a. m. June 26 (discharge, 129 second-feet); creek reported dry October 1 to November 8.

1909–1914: Maximum stage recorded, 4.45 feet, March 22 and 23, 1911 (discharge, 154 second-feet); creek reported dry August 3 to October 2, 1909; August 6–19, 1911; after July 19, 1913; and October 1 to November 8, 1914.

DIVERSIONS.—A small irrigation ditch diverts water above the gage.

ACCURACY.—Results fair.

Discharge measurements of Wolf Creek near Wolf Point, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 9	W. A. Lamb	2.33	15.5	July 2	B. E. Jones	2.60	21.2
May 21	B. E. Jones	1.52	.36	Oct. 27	.....do	1.94	2.8
June 15	.....do	2.00	5.7				

Daily discharge, in second-feet, of Wolf Creek near Wolf Point, Mont., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	.....	0.5	0.3	22	16	1.6	0.5	5.6	.....
2	.....	.5	.3	21	17	1.6	.3	6.6	.....
3	.....	.5	.3	11	18	1.6	.3	6.6	.....
4	.....	.5	.5	11	19	.5	.3	6.6	.....
5	55	.3	.5	8.0	20	1.6	.3	6.6	.....
6	35	.5	.5	8.0	21	.5	.4	6.6	.....
7	15	.3	.5	5.8	22	.5	.3	6.6	.....
8	14	.5	.5	5.8	23	.5	.3	6.6	.....
9	12	.5	.5	5.8	24	.3	.3	6.6	.....
10	10	.3	.5	.....	25	.3	.3	20	.....
11	8.7	.5	.5	.....	26	.5	.3	129	.....
12	7	.5	.5	.....	27	.5	.3	56	2.5
13	5	.5	.5	.....	28	.5	.3	6.6	1.6
14	3	.3	1.0	.....	29	.5	.3	32	.7
15	1.6	.5	5.6	.....	30	.3	.3	27	2.4
					31	.....	.3	.....	4.0

NOTE.—Daily discharge determined as follows: Prior to June 7, from a fairly well defined rating curve; June 8 to July 31, by the indirect method for shifting channels; Oct. 1 to Nov. 8, creek practically dry. No gage-height record available Nov. 9 to Mar. 22, Mar. 24, 25, 27, 28, Mar. 30 to Apr. 4, Apr. 6, 8–10, 12–14, June 8–14, 18, 19, 21–25, July 10–26, 28, and 30. Discharge relation probably affected by ice Mar. 23–29. Mean discharge estimated as follows: Apr. 1–4, 15 second-feet; July 10–26, 4 second-feet. Daily discharge estimated June 8–14 and 21–25; interpolated for other days for which gage heights are missing.

Monthly discharge of Wolf Creek near Wolf Point, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October			Dry.	0.0	
November 1–8			Dry.	.0	
April	55	0.3	7.92	471	C.
May	.5	.3	.38	23.4	(a)
June	129	.3	11.4	678	C.
July		.7	5.73	352	C.

[a] Results fair, considering low discharge.

NOTE.—See footnote to table of daily discharge.

POPLAR RIVER NEAR POPLAR, MONT.

LOCATION.—At the United States Reclamation Service camp in the S. ½ sec. 8, T. 28 N., R. 51 E., 5 miles north of Poplar.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 1, 1913, to September 30, 1914, at present site; August 15, 1908, to June 30, 1911, in the S. ½ sec. 5, T. 28 N., R. 51 E., at Obershaw's ranch, 6 miles north of Poplar; May 2, 1911, to October 4, 1913, at the United States Reclamation Service camp in the NE. ¼ sec. 4, T. 29 N., R. 51 E., 18 miles north of Poplar. The flow at all these points is practically the same except during high water.

GAGE.—Chain on left bank set at new datum; read since October 1, 1913.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge at Poplar.

CHANNEL AND CONTROL.—Shifting at flood stage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.35 feet July 11 (discharge, about 3,600 second-feet); minimum stage recorded, 3.75 feet at 6 a. m. October 3 (discharge, 28 second-feet).

1908–1914: Maximum stage recorded, 12 feet April 10, 1912, determined by leveling from flood marks (approximate discharge computed from extension of rating curve, 10,000 second-feet); minimum stage recorded, 2.2 feet July 29 to August 14, 1910 (discharge, 2 second-feet). Open-season records only; flow may have been lower during winter months. See "Records available."

WINTER FLOW.—Discharge relation affected by ice.

DIVERSION.—Poplar River east canal "C" and Poplar River west canal "B" divert water above station for irrigating approximately 10,000 acres. Proposed irrigation plan provides ultimate irrigation of 28,000 acres.

ACCURACY.—Results good.

Discharge measurements of Poplar River near Poplar, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 12	W. A. Lamb	4.2	41	May 21	B. E. Jones	4.62	63
Apr. 8	do	6.79	[a]985	June 16	do	4.86	83

[a] Measurement made from highway bridge at Poplar.

Daily discharge, in second-feet, of Poplar River near Poplar, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	38	.....	586	101	48	158	65	92
2	.....	38	.....	2,920	92	44	158	61	92
3	.....	38	.....	2,760	86	44	132	61	86
4	.....	36	.....	2,800	86	46	132	61	86
5	32	38	.....	2,580	79	61	110	61	79
6	35	38	.....	1,830	79	65	101	61	79
7	35	40	.....	1,350	79	92	86	58	79
8	35	41	.....	959	79	86	79	58	74
9	35	41	.....	800	79	65	79	54	74
10	38	41	.....	675	79	61	79	54	69
11	38	40	.....	586	74	58	1,120	51	69
12	38	41	.....	501	74	58	863	54	69
13	40	30	.....	448	74	65	325	54	69
14	41	41	.....	422	69	188	205	51	69
15	40	41	.....	448	65	101	145	51	65
16	40	41	.....	501	65	86	121	51	65
17	40	42	.....	448	65	86	110	51	65
18	38	42	1,720	348	61	79	101	61	65
19	38	42	1,280	281	61	74	92	74	65
20	38	41	1,580	241	65	74	92	101	65
21	38	42	832	205	61	69	86	79	65
22	38	40	615	188	61	74	79	2,130	65
23	38	42	372	158	61	74	79	737	65
24	38	40	281	145	58	69	79	397	65
25	38	38	281	132	58	69	74	241	65
26	38	41	281	121	58	145	69	188	65
27	38	38	281	110	54	557	69	132	65
28	36	41	281	101	54	260	65	132	65
29	38	41	260	101	54	205	65	132	65
30	38	40	260	101	51	173	65	121	65
31	38	.....	372	.....	51	.....	65	101	.....

NOTE.—Daily discharge determined from a fairly well-defined rating curve. Discharge estimated Nov. 30. Canal head-gates open Oct. 1; closed Oct. 3. No gage-height records available Nov. 30 to Mar. 17.

Monthly discharge of Poplar River near Poplar, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October 5-31	41	32	37.7	2,020	B.
November	42	30	39.8	2,370	B.
March 18-31	1,720	260	621	17,200	B.
April	2,920	101	762	45,300	B.
May	101	51	68.8	4,230	B.
June	557	44	106	6,310	B.
July	1,120	65	164	10,100	B.
August	2,130	51	180	11,100	B.
September	92	65	70.9	4,220	B.

BIG MUDDY CREEK NEAR CULBERTSON, MONT.

LOCATION.—In the NE. ¼ sec. 20, T. 29 N., R. 54 E., 300 feet above ford at Shield's (formerly Sholtz's) ranch, 11 miles above mouth of stream, 15 miles northwest of Culbertson, and 8 miles above site of original station at Boyd's ranch, which was discontinued because gage heights were affected by backwater from the Missouri.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 14, 1908, to July 19, 1909, at original station; July 19, 1909, to September 30, 1914, at present station.

GAGE.—Inclined rod on left bank near residence of observer.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge about 8 miles below gage.

CHANNEL AND CONTROL.—Earth; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.0 feet at 8.45 a. m. April 4 (discharge, 1,010 second-feet); minimum stage recorded, 2.0 feet at 8 a. m. October 1–5 and September 29–30 (discharge, 2.0 second-feet).

1909–1914: Maximum stage recorded, 10.5 feet April 11 and 12, 1912 (discharge, 1,100 second-feet); minimum stage recorded, 1.6 feet September 17–21 and November 6–12, 1909 (discharge, 0.3 second-foot).

WINTER FLOW.—Little if any flow during winter months.

DIVERSIONS.—Some water is diverted by pumping for irrigation.

ACCURACY.—Results fair.

Discharge measurements of Big Muddy Creek near Culbertson, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 11	W. A. Lamb	2.32	10.2	June 15	B. E. Jones	3.31	18
Apr. 7	do	9.48	[a] 908	July 2	do	6.05	82
May 20	B. E. Jones	2.50	20				

[a] Measurement made at highway bridge, 8 miles below gage.

Daily discharge, in second-feet, of Big Muddy Creek near Culbertson, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sep.
1	2	14	60	38	10	47	94	50
2	2	12	243	38	10	86	94	103
3	2	12	911	38	6	98	86	108
4	2	14	1,010	33	6	117	79	195
5	2	16	974	33	6	108	72	112
6	4	14	956	33	6	112	69	98
7	4	14	956	33	6	94	66	82
8	5	14	884	33	8	94	63	72
9	5	12	893	33	8	79	60	66
10	6	12	956	30	6	76	66	60
11	6	10	866	28	8	76	60	58
12	2	10	559	28	6	76	58	50
13	2	10	440	26	6	76	52	36
14	6	10	312	26	16	72	50	28
15	6	10	162	23	21	72	50	23
16	10	10	162	21	23	72	47	14
17	10	10	98	21	28	72	44	14
18	16	10	127	21	30	127	41	10
19	16	10	255	20	26	142	38	10
20	18	10	231	18	28	184	33	10
21	18	10	184	18	30	201	33	10
22	18	10	142	18	28	195	28	8
23	16	.....	112	18	26	178	26	10
24	16	.....	94	18	26	162	18	10
25	14	.....	79	18	26	157	10	8
26	14	.....	66	16	33	152	10	6
27	12	.....	60	14	36	147	8	5
28	12	.....	50	14	33	132	6	4
29	14	.....	50	12	30	127	4	2
30	14	.....	44	12	28	112	4	2
31	14	.....	.....	12	.....	94	23	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Nov. 22, Apr. 1 to May 31, and Aug. 17 to Sept. 30, from fairly well defined rating curves; June 1 to Aug. 16, by indirect method for shifting channels (discharge relation apparently affected by backwater from Missouri River). No gage-height record available Nov. 23 to Mar. 31 and May 19.

Monthly discharge of Big Muddy Creek near Culbertson, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	18	2	9.3	572	C.
November 1–22	16	10	11.5	502	C.
April	1,010	44	398	23,700	B.
May	38	12	24.0	1,480	B.
June	36	6	18.7	1,110	C.
July	201	47	114	7,010	C.
August	94	4	44.9	2,760	C.
September	195	2	42.1	2,510	C.

YELLOWSTONE RIVER AT CANYON SOLDIER STATION, YELLOWSTONE NATIONAL PARK, WYO.

LOCATION.—In secs. 9 and 16 (approximately), T. 13 S., R. 10 E. Montana meridian, about 30 feet east of the stage road from Lake Yellowstone to the Grand Canyon, one-half mile upstream from the Upper Falls and the Canyon soldier station, 1⅛ miles south of the Canyon Hotel, and about 13 miles below outlet of Lake Yellowstone.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 22, 1913, to September 30, 1914.

GAGE.—Vertical staff installed September 13, 1913, on left bank about one-eighth mile upstream from Chittenden bridge; replaced a temporary staff gage previously used; datum of original gage 1.03 feet higher than that of present gage; all readings on original gage reduced to datum of present gage.

DISCHARGE MEASUREMENTS.—Low-stage measurements (less than 1,500 second-feet) may be made by wading at a section about 100 feet below gage; special care is necessary to get reliable results; medium and high-stage measurements made from the fishing bridge about 13 miles upstream from gage, and the measured inflow of tributary streams between this point and the gage added.

CHANNEL AND CONTROL.—Control is rock at head of rapids about 600 feet below gage; channel between the control and the gage and for nearly one-fourth mile above the gage consists of fine gravel interspersed with small bowlders; water deep and rather sluggish; discharge relation during open-water season probably slightly affected by scattered growth of aquatic plants.

EXTREMES OF STAGE.—Maximum stage recorded during year, 4.1 feet June 22–26; minimum stage recorded, 1.0 feet at 12 m. November 18.

1913–1914: Maximum stage recorded, 5.35 feet June 23 and 25, 1913; minimum stage recorded, 1.0 feet November 18, 1913, and November 18, 1914.

WINTER FLOW.—Discharge relation probably not seriously affected by ice as swift water keeps control open; shore ice, however, makes reading of gage impossible during winter months.

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Gage-height record only fair.

COOPERATION.—Gage read by soldiers of Yellowstone Park detachment; station maintained in cooperation with superintendent of the park.

Data insufficient for estimates of discharge.

Discharge measurements of Yellowstone River at Canyon soldier station, Yellowstone National Park, Wyo., during the year ending Sept. 30, 1914.

[Made by C. G. Paulsen.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 7	1.18	[a] 709
Sept. 16	1.35	[b] 1,050

[a] Measurement made by wading at a section approximately 11 miles above gage. Flow of tributary streams between that section and the gage has been added to discharge of main river to give record published here. Gage reading probably dependable only to nearest tenth.

[b] Measurement made from fishing bridge about 13 miles above gage. Flow of tributary streams entering between measuring section and gage has been added to give above result. Gage height not dependable to nearest hundredth because of fluctuations of stage and uncertain time interval for transit from measuring section to gage.

Daily gage height, in feet, of Yellowstone River at Canyon soldier station, Yellowstone National Park, Wyo., for the year ending Sept. 30, 1914.

[Sergt. W. W. Herndon, observer.]

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	1.8	1.4	.....	2.9	3.7	2.9	.....
2	1.8	1.4	.....	3.0	3.9	2.8	.....
3	1.8	1.4	.....	3.2	3.7	2.8	.....
4	1.75	1.4	.....	3.4	3.7	2.8	.....
5	1.7	1.4	.....	3.6	3.8	2.8	.....
6	1.7	1.4	.....	3.7	3.9	2.7	.....
7	1.7	1.35	.....	3.7	3.8	2.7	.....
8	1.7	1.35	.....	3.7	3.8	2.6	.....
9	1.75	1.35	1.55	3.7	3.9	2.6	.....
10	1.75	1.3	1.45	3.7	3.8	2.5	.....
11	1.7	1.3	.....	3.7	3.8	2.5	.....
12	1.7	1.25	.....	3.7	3.8	2.5	.....
13	1.65	1.2	.....	3.6	3.7	2.4	.....
14	1.6	1.15	.....	3.6	3.7	2.4	1.4
15	1.6	1.1	.....	3.6	3.7	2.4	1.4
16	1.6	1.1	1.55	3.7	3.6	2.4	1.4
17	1.6	1.05	1.55	3.6	3.6	2.3	1.4
18	1.55	1.0	1.7	3.6	3.5	2.2	1.35
19	1.55	.....	1.8	3.6	3.5	2.1	1.35
20	1.55	.....	1.8	3.6	3.4	2.1	1.45
21	1.55	.....	1.9	3.9	3.4	2.1	1.55
22	1.5	.....	2.0	4.1	3.4	1.95	1.55
23	1.5	.....	2.1	4.1	3.3	1.85	1.55
24	1.5	.....	2.2	4.1	3.3	1.8	1.55
25	1.5	.....	2.3	4.1	3.2	1.8	1.55
26	1.5	.....	2.4	4.1	3.2	1.75	1.5
27	1.45	.....	2.4	4.0	3.1	1.75	1.5
28	1.45	.....	2.5	3.9	3.0	1.7	1.45
29	1.45	.....	2.6	3.8	3.0	1.7	1.45
30	1.4	.....	2.7	3.7	2.9	1.65	1.45
31	1.4	.....	2.8	.....	2.9	1.65	.....

YELLOWSTONE RIVER AT CORWIN SPRINGS, MONT.

LOCATION.—In the NE. ¼ sec. 30, T. 8 S., R. 8 E., in the canyon at Corwin Springs, 8 miles below Gardiner, the northern entrance to Yellowstone National Park.

DRAINAGE AREA.—2,630 square miles.

RECORDS AVAILABLE.—September 2, 1910, to September 30, 1914.

GAGE.—A chain gage fastened to the floor of the highway bridge on the downstream side near the right bank, prior to October 25, 1911, a staff gage set to same datum and fastened to a pile beside the concrete abutment on the right bank.

DISCHARGE MEASUREMENTS.—Made from the lower side of highway bridge.

CHANNEL AND CONTROL.—Bed of stream rocky; free from vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.9 feet at 10 a. m. June 4 (discharge, 14,900 second-feet); minimum stage recorded, 1.0 foot at 10 a. m., March 22 (discharge, 1,040 second-feet).

1910–1914: Maximum stage recorded, 10.2 feet June 13, 1911 (discharge, 22,800 second-feet); minimum stage recorded, 0.8 foot March 8–15, 1911, and December 19, 1912 (discharge, 950 second-feet). Estimates of daily discharge made for winter of 1911–12 only; estimated mean monthly discharge for January and February, 1911, 900 second-feet.

DIVERSIONS.—None above station.

STORAGE.—Yellowstone Lake furnishes a natural but uncontrolled regulation.

ACCURACY.—Records good.

The following discharge measurement was made by B. E. Jones:

September 2, 1914: Gage height, 2.08 feet; discharge, 2,010 second-feet.

Daily discharge, in second-feet, of Yellowstone River at Corwin Springs, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,910	1,530	1,300	.....	1,160	1,710	12,200	8,760	4,010	1,910
2	1,910	1,530	1,300	.....	1,160	2,370	13,100	7,970	3,840	1,910
3	1,910	1,450	1,230	.....	1,230	2,130	12,800	8,230	4,010	1,810
4	1,910	1,450	1,230	.....	1,230	3,060	14,900	7,970	3,840	1,810
5	1,810	1,450	1,160	.....	1,230	3,210	13,700	7,230	3,680	1,710
6	1,910	1,450	1,160	.....	1,230	2,770	12,500	7,230	3,520	1,810
7	2,020	1,450	1,160	.....	1,300	2,910	11,000	6,990	3,210	1,710
8	2,020	1,450	1,160	.....	1,300	3,520	9,870	6,760	3,360	1,810
9	2,020	1,450	1,160	.....	1,230	4,890	10,200	6,310	3,360	1,710
10	2,020	1,450	1,160	.....	1,230	5,670	9,310	6,990	3,060	1,710
11	1,910	1,450	1,100	.....	1,230	5,270	8,490	7,230	3,060	1,710
12	2,020	1,450	1,100	.....	1,300	4,530	9,030	6,530	2,910	1,810
13	2,020	1,370	1,100	.....	1,300	4,180	9,310	6,310	2,910	1,620
14	2,250	1,370	1,100	.....	1,300	4,350	9,310	6,090	2,770	1,710
15	1,910	1,370	.....	.....	1,370	5,880	9,590	6,310	2,770	1,710
16	1,810	1,450	.....	.....	1,370	6,760	10,400	5,880	2,770	1,910
17	1,810	1,450	.....	.....	1,370	7,230	9,870	5,470	2,630	1,710
18	1,710	1,370	.....	.....	1,370	7,230	11,000	5,470	2,500	2,500
19	1,710	1,370	.....	.....	1,450	9,310	11,300	5,270	2,500	3,520
20	1,620	1,300	.....	.....	1,620	9,870	11,600	5,270	2,500	2,910
21	1,620	1,300	.....	.....	1,810	9,870	12,500	5,080	2,500	3,520
22	1,620	1,300	.....	1,040	1,810	10,200	11,600	4,890	2,250	2,770
23	1,620	1,300	.....	1,160	1,810	11,000	9,590	4,710	2,250	2,370
24	1,620	1,300	.....	1,100	1,910	10,700	9,310	4,530	2,130	2,250
25	1,710	1,230	.....	1,160	1,910	10,200	9,590	4,530	2,130	2,130
26	1,530	1,300	.....	1,100	1,910	9,310	9,870	4,530	2,020	2,130
27	1,530	1,370	.....	1,100	1,910	9,220	8,760	4,180	2,020	2,020
28	1,620	1,340	.....	1,100	1,910	9,130	8,760	4,350	2,020	2,130
29	1,530	1,320	.....	1,160	1,810	9,030	8,230	4,530	2,020	1,910
30	1,530	1,300	.....	1,160	1,620	9,590	9,030	4,350	2,020	1,910
31	1,530	.....	.....	1,160	.....	11,300	.....	4,350	2,020	.....

Monthly discharge of Yellowstone River at Corwin Springs, Mont., for the year ending Sept. 30, 1914.

[Drainage area, 2,630 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	2,250	1,530	1,800	0.684	0.79	111,000	A.
November	1,530	1,230	1,390	.529	.59	82,700	A.
December 1-14	1,300	1,100	1,170	.445	.23	32,500	A.
March 22-31	1,160	1,040	1,120	.426	.16	22,200	A.
April	1,910	1,160	1,480	.563	.63	88,100	A.
May	11,300	1,710	6,660	2.53	2.92	410,000	A.
June	14,900	8,230	10,600	4.03	4.50	631,000	A.
July	8,760	4,180	5,950	2.26	2.61	366,000	A.
August	4,010	2,020	2,790	1.06	1.22	172,000	B.
September	3,520	1,620	2,070	.787	.88	123,000	A.

NOTE.—Daily discharge determined from a well-defined rating curve. No gage records available Nov. 28 and 29 (discharge interpolated); Dec. 15 to Mar. 21; and May 27 and 28 (discharge interpolated).

YELLOWSTONE RIVER AT HUNTLEY, MONT.

LOCATION.—In the SW. ¼ sec. 24, T. 2 N., R. 27 E., at the new steel highway bridge a mile below Huntley, and a mile below Pryor Creek. Station replaces that formerly maintained at Junction, Mont.

DRAINAGE AREA.—12,000 square miles.

RECORDS AVAILABLE.—October 1, 1907, to September 30, 1914; May 10, 1906, to December 31, 1907, at Junction, where flow is practically the same.

GAGE.—Chain fastened to bridge rail.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.4 feet at 10 a. m. June 5 (discharge 37,800 second-feet); minimum stage recorded, 3.6 feet at 2 p. m. September 11 and 12 (discharge, 2,490 second-feet).

1907–1914: Maximum stage recorded, 11.0 feet June 14, 1911 (discharge, 47,900 second-feet); minimum stage recorded, 1.1 feet December 26–28, 1907 (discharge 1,060 second-feet). Open-season records only. Estimates of mean monthly flow only are available for the winter months.

WINTER FLOW.—River frozen over in places during winter, but during the coldest seasons open channels with floating ice are not of uncommon occurrence.

DIVERSIONS.—The Huntley canal, built by the United States Reclamation Service, takes water from the river about 2 miles above the gaging station; its normal capacity is 400 second-feet, and it supplies the water for 29,000 acres of land. Near Laurel are the headgates of the Billings Land & Irrigation Co.'s canal, which carries about 305 second-feet and irrigates 28,000 acres. Many small ditches take water from the tributaries of the Yellowstone, but few from the stream itself, owing to the variation of the stage of the water surface and consequent difficulty of diversion.

ACCURACY.—Conditions for obtaining accurate data at this station are only fair and many discharge measurements are necessary to define a good rating curve.

Discharge measurements of Yellowstone River at Huntley, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	J. M. Ray	3.96	4,170	June 27	W. A. Lamb	7.70	21,100
Apr. 22	W. A. Lamb	3.82	6,100	Aug. 10	do	4.25	4,300

Daily discharge, in second-feet, of Yellowstone River at Huntley, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,100	4,450	3,500	2,820	.....	3,100	5,480	30,200	17,000	4,140	3,000
2	4,100	5,150	3,500	2,700	.....	3,100	5,310	30,800	15,800	4,140	3,000
3	4,450	5,150	3,200	.....	.....	3,100	5,310	34,000	15,300	3,840	3,000
4	4,450	4,800	2,700	.....	.....	3,100	6,390	37,200	14,200	3,840	3,000
5	4,450	4,450	2,700	.....	.....	3,400	7,530	37,800	14,200	3,840	3,000
6	4,800	4,450	2,700	.....	.....	4,010	7,530	37,200	13,100	3,990	2,870
7	4,800	4,450	2,700	.....	.....	4,320	7,530	29,500	12,600	3,990	2,870
8	4,800	4,450	3,200	.....	.....	4,320	7,140	24,100	11,600	4,140	2,740
9	5,150	4,450	4,100	.....	.....	4,010	6,760	21,200	11,600	4,140	2,740
10	5,500	4,100	3,800	.....	.....	4,320	8,760	19,000	11,600	4,140	2,620
11	5,150	4,100	3,800	.....	.....	4,010	14,000	18,000	11,600	4,140	2,490
12	5,150	3,800	3,800	.....	.....	3,700	14,000	15,300	11,100	4,140	2,490
13	5,150	4,100	3,800	.....	4,010	3,700	13,500	18,000	11,100	3,840	2,740
14	5,150	4,100	4,100	.....	3,700	3,860	11,500	18,600	9,740	3,550	2,870
15	4,800	4,100	4,100	.....	4,010	4,320	11,500	18,600	9,740	3,550	3,000
16	5,150	3,800	4,100	.....	3,700	4,160	14,000	20,900	9,290	3,550	3,140
17	4,800	3,800	3,800	.....	4,010	4,480	19,500	22,100	9,290	3,410	3,140
18	4,450	3,800	3,800	.....	3,700	4,640	19,000	24,000	8,400	3,410	3,270
19	4,450	3,800	3,500	.....	3,700	4,320	21,800	25,300	7,960	3,840	3,270
20	4,450	3,800	3,200	.....	3,100	4,640	23,500	26,000	7,110	4,140	3,270
21	4,450	3,800	3,200	.....	2,950	5,310	26,000	26,600	6,700	3,410	5,160
22	4,450	3,800	3,200	.....	2,800	6,020	27,200	29,400	5,910	3,410	7,530
23	4,450	3,800	3,200	.....	3,100	6,020	27,200	25,300	5,530	3,410	7,110
24	4,450	3,500	3,200	.....	2,800	6,020	29,000	22,100	5,160	3,410	6,700
25	4,450	3,500	3,200	.....	3,100	6,580	30,800	18,600	5,160	3,410	5,530
26	4,450	3,500	3,200	.....	2,950	6,020	27,200	21,500	4,460	3,270	5,530
27	4,800	3,500	3,200	.....	3,100	6,020	24,800	20,900	4,800	3,270	5,160
28	4,450	3,500	4,100	.....	2,680	6,020	23,500	19,200	3,840	3,140	4,800
29	4,450	3,500	3,500	.....	3,100	6,020	27,200	17,000	4,140	3,140	4,800
30	4,450	3,500	3,200	.....	2,950	6,020	28,400	17,000	4,140	3,140	4,800
31	4,450	.....	3,200	.....	3,100	.....	29,500	.....	4,140	3,000	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Jan. 2 and Mar. 13 to May 16, from two poorly-defined rating curves; discharge relation affected by ice Jan. 3 to Mar. 12; records of daily gage heights available for this period, but data insufficient for estimates of discharge Jan. 3 to Feb. 28; mean daily discharge Mar. 1–12 estimated at 3,000 second-feet. May 17 to June 10, discharge determined by indirect method for shifting channels; June 11 to Sept. 30, from a rating curve fairly-well defined above 3,500 second-feet. No gage records available (discharge interpolated) Aug. 4–9.

Monthly discharge of Yellowstone River at Huntley, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	5,500	4,100	4,660	287,000	C.
November	5,150	3,500	4,030	240,000	C.
December	4,100	2,700	3,440	212,000	C.
March	4,010	.....	3,180	196,000	C.
April	6,580	3,100	4,620	275,000	C.
May	30,800	5,310	17,100	1,050,000	C.
June	37,800	15,300	24,200	1,440,000	C.
July	17,000	3,840	9,240	568,000	B.
August	4,140	3,000	3,670	226,000	C.
September	7,530	2,490	3,850	229,000	C.

NOTE.—See footnote to table of daily discharge.

YELLOWSTONE RIVER AT INTAKE, MONT.

LOCATION.—In the NW. ¼, sec. 36, T. 18 N., R. 56 E., at the Lower Yellowstone diversion dam at Intake, 18 miles below Glendive.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 1, 1911, to September 30, 1914. Gage-height records obtained by the War Department and the Department of Agriculture at Glendive, 1893 to 1903, and by the United States Geological Survey at Glendive, 1903 to 1910.

GAGE.—Chain gage on north abutment of dam. Gage readings show the depth of the water on the crest of the dam.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.0 feet at 8 a. m. and 6 p. m. June 7 (discharge 78,400 second-feet); minimum stage recorded, 1.4 feet at 8 a. m. and 5 p. m. September 15–21 (discharge, 4,860 second-feet).

1903–1914: Maximum stage recorded, 10.1 feet July 4, 1912 (discharge, 112,000 second-feet); minimum stage recorded, 0.9 foot December 26–28, 1912 (discharge, 2,950 second-feet). Open-season records; estimates of mean monthly flow only are available for winter months.

WINTER FLOW.—Discharge relation affected by ice.

THE DAM.—A rock-filled timber-crib on a pile foundation was completed January 29, 1910. It is 700 feet long, crosses the stream at right angles to the current, and raises the low-water level of the river about 4 feet. The dam is specially designed to resist the effects of ice by having an approach on a slope of 3 to 1, and the downstream face is ogee-shaped and protected by a heavy rock apron.

DIVERSIONS.—Lower Yellowstone canal, which diverts water to irrigate 66,000 acres of land, has its headworks at the north abutment.

ACCURACY.—Results fair. See footnote to daily discharge.

Daily discharge, in second-feet, of Yellowstone River at Intake, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7,260	6,740	5,760	6,000	9,540	13,600	49,400	35,600	10,200	5,530
2	7,260	6,740	5,760	7,260	8,360	12,900	47,900	34,300	10,200	5,300
3	7,260	6,740	5,760	8,940	7,800	12,900	50,800	32,000	10,200	5,300
4	6,740	6,740	5,760	10,200	8,940	12,200	59,800	29,600	10,200	5,300
5	6,740	6,490	5,760	10,800	11,500	11,500	69,100	29,600	10,200	5,300
6	7,530	6,740	5,300	10,200	11,500	11,500	75,300	28,600	11,500	5,300
7	8,940	6,740	5,300	10,200	10,200	10,800	78,400	27,500	10,800	5,300
8	9,540	6,740	5,300	10,200	8,940	14,400	78,400	27,500	10,200	5,300
9	8,940	6,240	5,300	9,540	8,360	14,400	72,200	26,400	10,200	5,300
10	8,940	6,740	5,300	8,940	8,360	14,400	59,800	25,400	9,540	5,300
11	8,940	6,240	5,300	7,000	8,360	13,600	49,400	24,400	9,540	5,300
12	8,940	6,240	5,300	7,260	7,800	16,000	42,200	23,400	9,540	5,300
13	8,940	6,240	5,300	7,800	7,800	19,500	36,800	23,400	9,540	5,300
14	8,650	6,240	5,300	9,240	7,800	23,400	36,800	24,400	8,940	5,080
15	8,360	6,740	5,300	8,080	7,800	23,400	35,600	23,400	8,360	4,860
16	7,800	6,740	5,300	8,360	7,800	21,400	36,800	21,400	8,360	4,860
17	7,800	6,240	5,300	7,800	7,260	21,400	34,300	21,400	8,360	4,860
18	7,260	6,240	5,300	7,800	6,740	23,400	34,300	21,400	8,940	4,860
19	6,740	6,240	5,300	7,800	7,260	24,400	36,800	20,400	10,200	4,860
20	6,740	6,240	5,300	7,800	7,260	27,500	42,200	18,600	10,800	4,860
21	6,740	6,240	5,300	7,800	8,940	32,000	59,800	17,700	11,500	4,860
22	6,740	6,240	5,300	7,530	8,940	39,400	69,100	16,800	8,360	6,240
23	6,740	6,240	5,300	6,240	8,940	45,000	59,800	15,200	8,360	11,500
24	6,740	6,240	5,300	6,240	10,200	52,200	59,800	13,600	8,360	12,200
25	6,740	6,240	5,300	6,240	10,800	53,800	50,800	12,200	7,800	11,500
26	6,240	5,760	5,300	6,240	11,500	59,800	42,200	11,500	7,260	10,200
27	6,740	5,760	5,300	6,240	11,500	62,900	56,800	11,500	6,740	8,940
28	6,740	5,760	5,300	6,490	12,900	62,900	66,000	11,500	6,740	7,800
29	6,740	5,760	5,300	7,000	12,900	53,800	59,800	12,200	6,240	7,260
30	6,740	5,760	5,300	7,530	13,600	53,800	45,000	12,200	6,240	7,260
31	6,240	.....	5,300	8,940	.....	53,800	.....	10,200	5,760	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve based on discharge measurements made at Glendive and a curve showing the relation of gage heights at Glendive to those at Lower Yellowstone dam.

Monthly discharge of Yellowstone River at Intake, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	9,540	6,240	7,500	461,000	B.
November	6,740	5,760	6,340	377,000	B.
December	5,760	5,300	5,370	330,000	B.
March	10,800	6,000	7,990	491,000	B.
April	13,600	6,740	9,320	555,000	B.
May	62,900	10,800	29,400	1,810,000	B.
June	78,400	34,300	53,200	3,170,000	B.
July	35,600	10,200	21,400	1,320,000	B.
August	11,500	5,760	9,010	554,000	B.
September	12,200	4,860	6,370	379,000	B.

BIG TIMBER CREEK NEAR BIG TIMBER, MONT.

LOCATION.—At Webb's ranch about 9 miles northwest of Big Timber.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 13, 1912, to September 30, 1914. Stations were maintained on the North and South forks of Big Timber Creek May 6, 1907, to December 31, 1911.

GAGE.—Chain gage on left bank.

DISCHARGE MEASUREMENTS.—Made by wading at ordinary stages; a bridge about one-half mile below gage may be used at high stages.

CHANNEL AND CONTROL.—Shifting during high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.8 feet at 7 a. m. June 5 (discharge, 937 second-feet); minimum stage recorded, 2.35 feet at 8 a. m. March 25 (discharge, 16 second-feet).

1912–1914: Maximum stage recorded, 4.8 feet June 5, 1914 (discharge, 937 second-feet); minimum stage recorded, 1.7 feet October 15–19, 1912, and 2.35 feet March 25, 1914 (discharge, 16 second-feet), difference in gage height due to shifting channel. Open-season records; flow may have been less during the winter months.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Much water is diverted for irrigation above the station.

ACCURACY.—Conditions fair for obtaining accurate records.

Discharge measurements of Big Timber Creek near Big Timber, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	J. M. Ray	2.45	26	June 15	C. S. Heidel	3.66	269
May 22	C. S. Heidel	3.15	232	Aug. 27	B. E. Jones	2.99	31

Daily discharge, in second-feet, of Big Timber Creek near Big Timber, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	24	36	21	.....	28	68	318	310	44	34
2	24	36	24	.....	28	75	484	262	42	22
3	24	36	21	.....	28	80	399	335	39	22
4	24	36	19	.....	28	122	753	335	36	22
5	28	36	19	.....	28	122	937	360	34	18
6	46	36	19	.....	46	108	900	310	31	18
7	33	36	.....	.....	68	94	600	310	28	18
8	33	36	.....	.....	56	108	400	310	28	18
9	28	36	.....	.....	36	122	350	310	28	18
10	36	36	.....	.....	28	122	320	310	28	18
11	36	36	.....	.....	28	108	300	310	22	18
12	36	33	.....	.....	28	94	290	310	22	55
13	36	33	.....	.....	28	137	280	310	22	22
14	36	33	.....	.....	80	204	270	310	22	22
15	36	33	.....	.....	50	168	262	335	22	28
16	36	28	.....	36	56	168	262	310	18	28
17	33	28	.....	36	46	241	335	262	18	22
18	33	28	.....	36	36	241	360	262	18	28
19	33	28	.....	36	36	260	385	262	18	55
20	33	28	.....	36	56	260	310	180	28	102
21	52	28	.....	28	61	279	310	140	18	85
22	46	28	.....	21	61	204	220	120	18	44
23	46	24	.....	21	61	241	180	120	18	28
24	46	24	.....	21	56	260	180	102	18	28
25	46	24	.....	16	56	260	200	102	22	22
26	40	24	.....	21	56	279	518	102	22	28
27	46	21	.....	28	68	279	262	85	22	44
28	46	21	.....	28	68	338	220	44	22	55
29	46	21	.....	36	68	318	360	44	22	55
30	40	21	.....	28	68	279	335	44	22	44
31	36	.....	.....	28	.....	279	.....	44	34	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to June 5, from a rating curve fairly well defined below 320 second-feet and poorly defined at higher stages; June 15 to Sept. 30, from a rating curve fairly well defined between 35 and 385 second-feet and poorly defined at other stages. No gage records available Dec. 7 to Mar. 15, June 6–14 (discharge estimated), and Aug. 2–6 (discharge interpolated).

Monthly discharge of Big Timber Creek near Big Timber, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	52	24	36.7	2,260	B.
November	36	21	30.1	1,790	B.
December 1–6	24	19	20.5	244	B.
March 16–31	36	16	28.5	904	B.
April	80	28	48.2	2,870	B.
May	338	68	191	11,700	B.
June	937	180	377	22,400	C.
July	360	44	224	13,800	B.
August	44	18	25.4	1,560	C.
September	102	18	34.0	2,020	C.

BOULDER RIVER NEAR CONTACT, MONT.

LOCATION.—In the SE. ¼ sec. 14, T. 3 S., R. 12 E., at the ranch of G. W. Baker, 4 miles from Contact, and about 8 miles above McLeod post office; 2½ miles below Boulder Falls.

DRAINAGE AREA.—234 square miles.

RECORDS AVAILABLE.—May 1, 1910, to September 30, 1914.

GAGE.—Staff fastened to left abutment of private wagon bridge near the ranch buildings. Observer, G. W. Baker.

DISCHARGE MEASUREMENTS.—Made from the bridge or by wading.

CHANNEL AND CONTROL.—Rocky; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.8 feet at 6. a. m. and 6 p. m. June 4 (discharge, 3,080 second-feet); minimum stage recorded, 2.2 feet at 7 a. m. and 7 p. m. March 22–29, 31, September 15 and 16 (discharge, 65 second-feet).

1910–1914: Maximum stage recorded, 8.3 feet June 14, 1911 (discharge, 3,850 second-feet); minimum stage recorded, 2.0 feet December 11–16, 1910 (discharge, 32 second-feet).

Open-season records; flow may have been lower at times during winter months.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSION.—A small ditch diverts water for irrigation above station.

ACCURACY.—Results fair.

Discharge measurements of Boulder River near Contact, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 20	C. S. Heidel	4.65	1,250
Aug. 28	B. E. Jones	2.41	124

Daily discharge, in second-feet, of Boulder River near Contact, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	138	138	.....	78	230	2,810	1,180	368	115
2	138	138	.....	78	230	2,720	1,180	345	90
3	138	138	.....	78	230	2,990	1,180	345	90
4	138	125	.....	78	195	3,080	1,070	345	90
5	138	125	.....	90	195	2,990	1,100	265	90
6	150	112	.....	90	230	2,120	1,100	265	90
7	150	112	.....	90	265	1,640	1,100	265	90
8	165	112	.....	90	412	1,180	1,040	230	102
9	165	112	.....	102	460	1,180	965	230	102
10	165	112	.....	128	510	1,040	1,040	265	128
11	165	100	.....	102	510	895	965	195	102
12	165	100	.....	115	562	1,180	895	195	102
13	165	100	.....	115	618	1,400	895	195	90
14	150	100	.....	115	618	1,960	830	165	90
15	150	100	85	128	645	1,960	765	165	65
16	138	90	85	128	735	2,120	705	165	65
17	138	90	85	140	1,330	2,200	705	165	90
18	138	90	85	140	1,330	2,040	645	140	180
19	138	90	85	165	1,400	2,040	590	140	265
20	165	80	110	195	1,480	2,380	590	165	535
21	165	80	85	165	1,880	2,200	535	140	618
22	165	80	65	165	1,880	2,120	485	140	535
23	138	80	65	165	2,040	1,400	485	115	460
24	138	70	65	195	1,960	1,330	435	115	390
25	138	70	65	195	1,960	1,260	435	115	345
26	138	70	65	195	1,960	1,180	412	115	305
27	165	70	65	195	1,960	1,180	412	115	265
28	165	70	65	230	1,880	1,180	390	115	230
29	165	70	65	230	1,960	1,180	390	115	195
30	165	70	85	265	2,040	1,100	412	140	195
31	150	.....	65	.....	2,420	.....	368	115	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Nov. 30, from a rating curve fairly well defined above and poorly defined below 285 second-feet; Mar. 15 to Sept. 30, from a fairly well defined rating curve; gage not read May 31 (discharge interpolated); no gage records Dec. 1 to Mar. 4.

Monthly discharge of Boulder River near Contact, Mont., for the year ending Sept. 30, 1914.

[Drainage area 234 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	165	138	151	0.645	0.74	9,280	C.
November	138	70	96.5	.412	.46	5,740	C.
March 15–31	110	65	75.9	.324	.20	2,560	B.
April	265	78	142	.607	.68	8,450	B.
May	2,420	195	1,100	4.70	5.42	67,600	B.
June	3,080	895	1,800	7.69	8.58	107,000	B.
July	1,180	368	752	3.21	3.70	46,200	B.
August	368	115	192	.821	.95	11,800	B.
September	618	65	204	.872	.97	12,100	B.

BOULDER RIVER NEAR McLEOD, MONT.

LOCATION.—On the bridge at Loasby's ranch, half a mile below McLeod, and 17 miles southwest of Big Timber.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 17, 1912, to July 11, 1914, when station was discontinued.

GAGE.—Staff spiked to lower side of middle pier of bridge. Observer, S. H. Nicholson.

DISCHARGE MEASUREMENTS.—Made from the bridge at the gage.

CHANNEL AND CONTROL.—Slightly shifting; bed composed of bowlders.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.5 feet at 6 p. m. June 4 (discharge, 4,650 second-feet); minimum stage recorded, 3.3 feet April 1–4 and 6 (discharge, 85 second-feet).

1912–1914: Maximum stage recorded, 8.6 feet June 24, 1912 (discharge, 5,400 second-feet); minimum stage recorded, 3.3 feet April 1–4 and 6, 1914 (discharge, 85 second-feet).

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Water is diverted from the principal tributaries for irrigation.

ACCURACY.—Conditions good for obtaining accurate discharge data.

Discharge measurements of Boulder River near McLeod, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 21	C. S. Heidel	6.32	2,360
Aug. 28	B. E. Jones	3.69	216

Daily discharge, in second feet, of Boulder River near McLeod, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Day.	Oct.	Nov.	Apr.	May.	June.	July.
1	410	370	85	320	2,650	2,000	16	450	330	155	1,410	2,500	.....
2	410	370	85	320	3,160	1,920	17	450	330	155	1,540	2,980	.....
3	410	370	85	320	3,760	1,850	18	450	330	190	1,680	3,350	.....
4	410	370	85	320	4,650	1,780	19	410	330	230	1,800	3,550	.....
5	410	370	120	415	3,980	1,700	20	410	330	275	1,940	3,980	.....
6	410	370	85	365	3,160	1,600	21	410	330	275	2,070	3,980	.....
7	410	370	120	365	2,650	1,600	22	410	330	275	2,210	4,200	.....
8	410	370	120	465	2,070	1,600	23	410	290	230	2,350	3,350	.....
9	410	330	120	690	1,940	1,600	24	410	290	230	2,350	3,160	.....
10	410	330	155	825	1,820	1,500	25	410	290	275	2,650	2,210	.....
11	450	330	120	755	1,820	1,700	26	410	290	275	2,650	2,070	.....
12	450	330	120	885	1,940	.....	27	450	290	275	2,350	1,940	.....
13	450	330	155	1,020	2,650	.....	28	450	290	275	2,350	1,940	.....
14	450	330	155	1,150	2,500	.....	29	410	290	320	2,210	1,940	.....
15	450	330	190	1,280	2,500	.....	30	410	290	365	2,500	2,070	.....
							31	370	.....	.....	2,580	.....	.....

NOTE.—Daily discharge determined from two fairly well defined rating curves applicable Oct. 1 to Nov. 30 and Apr. 1 to Sept. 30. No gage records Oct. 16 (discharge interpolated); Dec. 1 to Mar. 31; May 12–20 (discharge interpolated); and July 1–4 (discharge interpolated).

Monthly discharge of Boulder River near McLeod, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	450	370	422	25,900	B.
November	370	290	330	19,600	B.
April	365	85	187	11,100	B.
May	2,650	320	1,420	87,300	C.
June	4,650	1,820	2,820	168,000	B.
July 1–11	2,000	1,500	1,710	37,300	C.

WEST FORK OF BOULDER RIVER AT McLEOD, MONT.

LOCATION.—In the SE. ¼ sec. 16, T. 2 S., R. 13 E., at Koozer's private bridge, 200 yards upstream from the highway bridge at McLeod post office.

DRAINAGE AREA.—137 square miles.

RECORDS AVAILABLE.—May 4, 1907, to July 11, 1914, when the station was discontinued.

GAGE.—Staff fastened to piling of bridge near right bank. Observer, C. C. Nicholson.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Composed of bowlders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.2 feet at 8 a. m. June 2 (discharge, 1,460 second-feet); minimum stage, 1.2 feet April 1–4 (discharge, 28 second-feet).

1907–1914: Maximum stage recorded, 3.6 feet June 17, 1909 (discharge, 1,990 second-feet); minimum stage, 0.1 foot, April 14, 1909, and 1.05 April 17, 1912 discharge, 22 second-feet).

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Water to irrigate about 800 acres of land is diverted above the station.

ACCURACY.—Open-water records good.

Discharge measurements of West Fork of Boulder River at McLeod, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 20	C. S. Heidel	3.10	585
Aug. 29	B. E. Jones	1.46	44

Daily discharge, in second-feet, of West Boulder River at McLeod, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Day.	Oct.	Nov.	Apr.	May.	June.	July.
1	85	85	28	150	1,050	495	16	105	70	40	490	630	.....
2	85	85	28	150	1,460	475	17	105	70	49	525	695	.....
3	85	85	28	150	1,380	455	18	105	70	49	560	830	.....
4	85	85	28	150	1,290	435	19	85	70	62	595	760	.....
5	85	85	32	175	975	410	20	85	70	62	630	830	.....
6	85	85	32	125	695	365	21	85	70	62	570	900	.....
7	85	85	32	125	570	365	22	85	70	78	630	830	.....
8	85	85	32	175	515	320	23	85	70	78	830	695	.....
9	85	85	32	280	410	320	24	85	70	100	975	630	.....
10	85	85	32	280	410	365	25	85	70	100	760	570	.....
11	105	85	32	320	460	460	26	85	70	125	695	570	.....
12	105	70	40	355	515	.....	27	85	70	150	760	570	.....
13	105	70	40	390	760	.....	28	85	70	150	695	515	.....
14	105	70	40	420	760	.....	29	85	70	150	570	515	.....
15	105	70	40	455	630	.....	30	85	70	150	630	515	.....
							31	85	.....	.....	840	.....	.....

NOTE.—Discharge determined as follows: Oct. 1 to Nov. 30, from a well defined rating curve; Apr. 1 to July 11, from a fairly well defined rating curve. No gage records for periods as follows: Dec. 1 to Mar. 31; May 12–19 (discharge interpolated); July 1–4 (discharge interpolated); and July 12 to Sept. 30.

Monthly discharge of West Boulder River at McLeod, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	105	85	90.2	5,550	B.
November	85	70	75.5	4,490	B.
April	150	28	63.4	3,770	B.
May	975	125	466	28,700	C.
June	1,460	410	731	43,500	B.
July 1–11	.....	320	406	8,860	B.

SWEETGRASS CREEK ABOVE MELVILLE, MONT.

LOCATION.—About the middle of sec. 27, T. 5 N., R. 13 E., on Theo. Lavold's ranch, about 9 miles northwest of Melville.

DRAINAGE AREA.—47 square miles (measured on topographic maps).

RECORDS AVAILABLE.—August 21, 1913, to September 30, 1914. Records available from May 5, 1907, to December 31, 1912, at C. M. Rein's ranch in the SW. ¼ sec. 24, T. 5 N., R. 12 E., about 17 miles northwest of Melville. No diversions or tributaries between the two stations.

GAGE.—Vertical staff on left bank about three-fourths mile above observer's house. Observer, T. S. Lavold.

DISCHARGE MEASUREMENTS.—Made by wading at low stages and from wagon bridge at Lavold's house at high stages. Water flows in two or three channels at the high-water measuring section, and conditions for measuring are only fair.

CHANNEL AND CONTROL.—Bed of clean gravel and small bowlders; slightly shifting in high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.7 feet at 11 a. m. June 4 (discharge, 1,280 second-feet); minimum stage recorded, 0.5 foot at 9 a. m. April 1, 2, 4, 21, 22, 24 (discharge, 13 second-feet).

1907–1914 (except 1913): Maximum stage recorded, 5.15 feet (old station) June 1, 1908 (discharge, 1,490 second-feet); minimum stage recorded, 1.42 feet (old station) April 18, 19, 1911, and April 23–30, 1912 (discharge, 8.6 second-feet). See Records available.

WINTER FLOW.—Discharge relation affected by ice.
DIVERSIONS.—Two small ditches divert a negligible quantity of water above station.
ACCURACY.—Records good.

Discharge measurements of Sweetgrass Creek above Melville, Mont., during the period Apr. 25, 1913, to Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 25	R. R. Randell	[a] 1.43	11.2	Aug. 21	C. S. Heidel	1.15	69
May 27	do	[a] 3.74	757	May 22	do	1.82	294
28	do	[a] 3.70	774	June 16	do	1.87	330
June 24	do	[a] 2.52	294	Aug. 26	B. E. Jones	.87	45

[a] Measurements made at old station. See "Records available."

Daily discharge, in second-feet, of Sweetgrass Creek above Melville, Mont., for the period Aug. 21, 1913, to Sept. 30, 1914.

Day.	Aug.	Sept.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	68	36	47	13	27	860	210	80	37
2	.....	68	36	47	13	27	995	269	90	43
3	.....	68	36	47	16	32	1,210	247	80	37
4	.....	68	36	42	13	19	1,280	247	80	32
5	.....	60	36	42	23	32	928	247	90	37
6	.....	60	36	42	19	37	1,140	194	80	32
7	.....	60	47	42	19	37	320	269	90	32
8	.....	60	47	42	23	56	228	228	80	32
9	.....	60	47	42	19	49	228	210	72	32
10	.....	60	47	42	23	50	228	210	90	23
11	.....	60	47	42	19	100	178	194	80	32
12	.....	60	47	42	19	150	178	194	72	23
13	.....	60	47	42	23	150	164	194	72	27
14	.....	60	47	42	19	150	247	178	80	27
15	.....	60	47	42	23	150	291	194	90	37
16	.....	60	47	42	19	200	291	164	72	27
17	.....	60	47	42	23	300	348	164	80	32
18	.....	60	47	42	27	300	464	136	80	27
19	.....	60	47	42	19	300	510	123	80	27
20	.....	47	47	42	23	400	418	136	90	32
21	68	47	47	42	13	400	320	123	80	27
22	60	47	47	42	13	291	348	136	56	32
23	60	60	47	36	16	464	269	112	49	27
24	68	60	47	36	13	995	247	112	37	27
25	68	60	47	36	16	1,210	269	123	49	32
26	54	60	47	36	27	860	510	100	43	27
27	68	60	47	36	27	615	348	90	43	32
28	68	47	47	36	32	464	348	80	43	27
29	54	47	47	36	27	320	247	90	37	27
30	54	42	47	47	32	464	247	100	43	32
31	54	.....	47	.....	.....	464	.....	80	37	.....

NOTE.—Discharge determined as follows: Aug. 21 to Nov. 30, 1913, from a fairly well defined rating curve; Apr. 1 to Sept. 30, 1914 (except May 10–21, when no gage records were available) from a curve well defined below and poorly defined above 420 second-feet; May 10–21, estimated by comparison of records at this station with those of station below Melville. No gage records available Dec. 1, 1913, to Mar. 31, 1914.

Monthly discharge of Sweetgrass Creek above Melville, Mont., for the period Aug. 21, 1913, to Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1913.					
August 21–31	68	54	61.5	1,340	B.
September	68	42	58.3	3,470	B.
The period				4,810	
1914.					
October	47	36	44.9	2,760	B.
November	47	36	41.3	2,460	B.
April	32	13	20.4	1,210	A.
May	1,210	19	[a] 294	18,100	B.
June	1,280	164	455	27,100	B.
July	269	80	166	10,200	A.
August	90	37	69.2	4,250	A.
September	43	23	30.6	1,820	A.

[a] Partly estimated.

NOTE.—See footnote to table of daily discharge.

SWEETGRASS CREEK BELOW MELVILLE, MONT.

LOCATION.—Near middle of south line of Sec. 27, T. 4 N., R. 15 E., at McAllister's ranch, just above the head of the canal owned by the Glass-Lindsay Land Co., and 6 miles southeast of Melville.

DRAINAGE AREA.—137 square miles (measured from topographic maps).

RECORDS AVAILABLE.—April 1, 1909, to September 30, 1914; May 4, 1907, to April 1, 1909, at Adam's ranch, 2½ miles farther downstream.

GAGE.—Standard chain gage on left bank near observer's house. Observers, Alexander Morgan, Robert Donald, and F. A. Larue.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge one-half mile above gage.

CHANNEL AND CONTROL.—Composed of clean gravel; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.8 feet at 6 p. m. June 4 (discharge, 1,040 second-feet); minimum stage recorded, 1.1 feet at 7 a. m. and 6 p. m. August 5–11 (discharge, 13 second-feet).

1909–1914: Maximum stage recorded, 3.9 feet May 16, 1911 (discharge, 1,560 second-feet); minimum stage recorded, 1.0 foot August 23–25, 29, September 2–4, and 6, 1913 (discharge, 10 second-feet).

Open-season records; lower flow may have occurred during the winter months. See "Records available."

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Many diversions are made from this stream. All the low-water flow is appropriated, 550 second-feet being held by adjudicated rights.

ACCURACY.—Records good.

Discharge measurements of Sweetgrass Creek below Melville, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 21	C. S. Heidel	2.55	361
Aug. 26	B. E. Jones	1.44	48

Daily discharge, in second-feet, of Sweetgrass Creek below Melville, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	62	98	70	.....	34	47	550	229	24	40
2	62	88	70	.....	24	34	550	229	19	34
3	55	88	70	.....	24	34	550	222	19	30
4	70	79	.....	.....	24	40	1,040	229	16	34
5	79	79	.....	.....	24	34	988	187	13	28
6	88	88	.....	.....	70	34	933	222	13	28
7	79	92	.....	.....	40	34	498	187	13	28
8	79	74	.....	.....	24	34	354	161	13	19
9	79	70	.....	.....	34	34	302	161	13	19
10	79	72	.....	.....	40	54	260	109	13	19
11	92	72	.....	.....	40	98	248	133	13	19
12	114	74	.....	.....	40	147	211	133	24	19
13	114	79	.....	.....	34	147	281	133	54	24
14	98	74	.....	.....	40	147	289	128	54	24
15	88	70	.....	.....	47	161	345	92	54	28
16	84	70	.....	.....	34	229	332	109	54	30
17	79	70	.....	.....	34	289	448	92	54	24
18	79	70	.....	.....	34	332	424	88	54	19
19	79	70	.....	.....	34	332	498	79	54	19
20	79	70	.....	.....	34	377	550	74	47	30
21	79	62	.....	.....	34	400	424	70	40	40
22	70	62	.....	19	40	297	345	70	40	30
23	74	70	.....	28	54	424	229	67	38	28
24	79	79	.....	19	40	524	211	47	40	28
25	88	70	.....	28	40	473	248	28	40	28
26	92	70	.....	28	34	377	400	40	40	28
27	92	74	.....	28	34	377	332	28	28	28
28	74	74	.....	28	40	377	323	30	30	28
29	88	74	.....	28	54	323	289	24	38	28
30	114	70	.....	28	47	281	268	28	28	28
31	105	.....	.....	28	.....	332	.....	19	40	.....

NOTE.—Discharge determined from a rating curve fairly well defined below 500 second-feet.

Monthly discharge of Sweetgrass Creek below Melville, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	114	55	83.6	5,140	B.
November	98	62	75.1	4,470	B.
March 22–31	28	19	26.2	520	B.
April	70	24	37.5	2,230	B.
May	524	34	220	13,500	B.
June	1,040	211	424	25,200	B.
July	229	19	111	6,830	B.
August	54	13	32.9	2,020	B.
September	40	19	27.0	1,610	B.

STILLWATER RIVER NEAR ABSAROKEE, MONT.

LOCATION.—In the SE. ¼ SE. ¼ sec. 30, T. 3 S., R. 19 E., on the public highway bridge crossing the stream at the Riverside Road House, about 1 mile northwest of Absarokee, and 13 miles southwest of Columbus, below mouth of Rosebud Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 19, 1910, to September 30, 1914, when station was discontinued.

GAGE.—Staff gage nailed to right abutment of pier on upstream side of bridge. Observer, S. A. Leaverton.

DISCHARGE MEASUREMENTS.—Made from lower side of bridge.

CHANNEL AND CONTROL.—Bed of stream very rough; composed of gravel and bowlders, but likely to shift in high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.5 feet at 6 a. m. June 3 (discharge, 6,080 second-feet); minimum stage recorded, 0.2 foot at 7 a. m. April 6 (discharge, 230 second-feet).

1910–1914: Maximum stage recorded, 6.2 feet June 14, 1911 (discharge, 6,410 second-feet); minimum stage recorded, 0 of gage April 14, 1912 (discharge, 170 second-feet).

Open-season records: Flow may have been lower at times during winter months.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Bordering lands irrigated by water taken from river.

ACCURACY.—Results fair.

Daily discharge, in second-feet, of Stillwater River near Absarokee, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	625	475	.....	550	4,320	2,860	1,400	650
2	625	600	.....	600	5,280	3,140	1,400	700
3	600	575	.....	600	6,080	3,280	1,220	650
4	625	475	.....	820	5,760	3,280	1,310	650
5	730	650	.....	700	5,600	3,140	1,140	600
6	650	625	230	700	4,960	3,280	1,140	600
7	625	625	300	700	4,020	3,140	1,220	650
8	625	600	400	650	3,140	2,860	1,070	600
9	650	625	400	760	2,720	2,860	1,140	650
10	675	575	450	880	2,320	3,000	1,000	600
11	675	550	400	1,220	2,070	3,280	1,000	550
12	700	625	400	1,220	2,190	3,280	1,000	600
13	730	550	400	1,000	2,580	2,580	880	550
14	675	500	300	1,070	2,580	2,580	880	600
15	625	475	300	1,070	2,580	2,860	820	550
16	625	575	260	1,500	3,140	2,580	880	600
17	625	475	300	2,190	3,720	2,450	940	600
18	600	400	260	2,450	4,020	2,070	880	550
19	575	425	260	2,860	4,480	1,830	940	500
20	475	450	300	2,860	4,800	1,830	820	1,000
21	475	425	450	3,280	5,120	1,720	760	1,720
22	500	400	450	3,280	4,800	1,830	820	1,610
23	475	375	450	3,720	3,280	1,500	760	1,310
24	500	400	600	4,800	2,860	1,610	820	1,220
25	600	425	600	4,020	3,280	1,400	760	1,000
26	500	450	550	3,280	3,420	1,220	760	880
27	475	350	450	3,140	3,140	1,400	760	880
28	575	400	625	3,420	2,720	1,220	700	820
29	575	325	550	3,420	2,860	1,310	700	880
30	550	450	600	3,000	3,000	1,400	650	820
31	575	.....	.....	3,570	.....	1,400	650	.....

NOTE.—Discharge determined from a fairly well defined rating curve.
No gage records Dec. 3 to Apr. 5.

Monthly discharge of Stillwater River near Absarokee, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	730	475	598	36,800	B.
November	650	325	495	29,500	B.
April 6–30	625	230	411	20,400	B.
May	4,800	550	2,040	125,000	B.
June	6,080	2,070	3,690	220,000	B.
July	3,280	1,220	2,330	143,000	B.
August	1,400	650	943	58,000	B.
September	1,720	500	786	46,800	B.

ROSEBUD RIVER AT ABSAROKEE, MONT.

LOCATION.—In the SW. ¼ SE. ¼ sec. 36, T. 3 S., R. 18 W., on the highway bridge just west of Absarokee, and 14 miles from Columbus; about 1 mile above junction with Stillwater River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 19, 1910, to September 30, 1914, when the station was discontinued.

GAGE.—Staff on downstream side of left abutment. Observers, Fred Brunckhorst and E. M. Eddy.

DISCHARGE MEASUREMENTS.—Made from the downstream side of the bridge.

CHANNEL AND CONTROL.—Bed of stream is composed of gravel and bowlders; not likely to shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.9 feet at 6 a. m. and 8 p. m. June 3–5 (discharge, 2,150 second-feet); minimum stage recorded, 1.8 feet at 6.15 a. m. April 20 (discharge, 135 second-feet).

1910–1914: Maximum stage recorded, 5.0 feet June 16, 1911 (discharge, 4,500 second-feet); minimum stage recorded, 1.75 feet April 1, 1912 (discharge, 125 second-feet).

Open-season records; flow may have been lower at times during the winter months.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Water for irrigation is diverted above the station.

ACCURACY.—Results good.

The following discharge measurement was made by B. E. Jones:

August 31, 1914: Gage height, 2.40 feet; discharge, 354 second-feet.

Daily discharge, in second-feet, of Rosebud River at Absarokee, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	325	242	242	.....	260	1,180	1,180	820	350
2	300	242	242	.....	300	1,800	1,320	720	410
3	280	242	242	.....	300	2,150	1,470	720	410
4	300	225	225	.....	410	2,150	1,320	630	350
5	280	242	242	.....	300	2,150	1,630	630	410
6	300	242	242	.....	410	1,800	1,470	550	300
7	325	242	.....	.....	300	1,630	1,630	630	350
8	325	242	.....	.....	300	1,630	1,180	630	300
9	325	225	.....	.....	300	1,050	1,470	590	300
10	300	242	.....	.....	480	1,050	1,630	720	350
11	300	242	.....	.....	630	720	1,630	550	260
12	300	242	.....	.....	480	720	1,050	480	350
13	300	280	.....	160	480	630	1,470	550	300
14	280	260	.....	160	480	550	1,050	410	300
15	260	242	.....	208	480	820	1,470	480	410
16	280	242	.....	190	550	720	930	380	300
17	280	242	.....	190	720	1,050	930	410	300
18	280	242	.....	190	930	1,180	1,050	630	300
19	280	225	.....	160	990	1,470	1,050	630	300
20	260	242	.....	135	1,630	1,800	1,180	590	550
21	280	242	.....	260	1,630	1,630	1,050	480	480
22	280	242	.....	260	1,470	1,800	930	480	720
23	260	242	.....	350	1,320	1,470	820	550	720
24	260	225	.....	225	1,630	1,320	720	480	550
25	242	242	.....	260	1,470	1,800	820	550	630
26	260	242	.....	225	1,180	1,050	630	480	480
27	242	242	.....	260	1,180	1,180	630	480	480
28	242	242	.....	410	1,180	1,050	720	410	480
29	242	225	.....	260	1,320	930	720	350	480
30	225	242	.....	280	1,180	1,320	930	480	550
31	242	.....	.....	.....	1,180	.....	720	350	.....

NOTE.—Discharge determined from a well-defined rating curve. No gage records Dec. 7 to Apr. 12.

Monthly discharge of Rosebud River at Absarokee, Mont., for the year ending Sept, 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	325	225	279	17,200	B.
November	280	225	241	14,300	B
December 1-6	242	225	239	2,840	B.
April 13-30	410	135	232	8,280	B.
May	1,630	260	822	50,500	B.
June	2,150	550	1,330	79,100	B.
July	1,630	630	1,125	68,900	B.
August	820	350	543	33,400	B.
September	720	260	416	24,800	B.

PRYOR CREEK AT COBURN, MONT.

LOCATION.—In SE. ¼ sec. 35, T. 1 S., R. 27 E., on the Crow Indian Reservation, at Coburn.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 13, 1911, to September 30, 1914.

GAGE.—Overhanging chain gage on left bank. Observer, Harry Foster.

DISCHARGE MEASUREMENT.—Made by wading above the gage.

CHANNEL AND CONTROL.—Firm gravel and cobblestones; permanent. The bed of the stream at the gage is composed of gravel and sand. At low stages the water is deep and sluggish at the gage and for several hundred feet above and below.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.3 feet at 9 a. m. June 26 (discharge, 595 second-feet); minimum stage recorded, 3.8 feet at 6 a. m. and 7 p. m. August 11, 12, 14, 15, 16, 18, 20, 21, 26, 28, 29, September 3–6, 10, and 11 (discharge, 14 second-feet).

1911–1914: Maximum stage recorded, 9.9 feet May 20, 1912 (discharge, 746 second-feet); minimum stage recorded, 3.6 feet September 1, 1913 (discharge, 6 second-feet).

Open-season records; flow may have been lower during the winter months.

WINTER FLOW.—Channel blocked with ice during winter months.

DIVERSION.—Water sufficient to irrigate approximately 1,000 acres near Pryor is diverted about 30 miles above this station.

REGULATION.—None.

ACCURACY.—Results good.

Discharge measurements of Pryor Creek at Coburn, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 11	J. M. Ray	4.53	73
Apr. 22	W. A. Lamb	5.40	178
Aug. 10	....do	3.86	20.0

Daily discharge, in second-feet, of Pryor Creek at Coburn, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	28	55	36	41	60	60	50	25	18
2	28	60	32	36	60	60	50	352	19
3	28	60	.....	32	50	55	50	136	14
4	32	50	.....	32	50	55	50	41	14
5	36	41	.....	32	60	70	41	32	14
6	80	41	.....	41	60	81	32	25	14
7	80	41	.....	55	50	70	32	25	19
8	100	41	.....	70	60	70	32	25	19
9	100	36	.....	60	81	70	32	25	19
10	111	36	.....	81	81	60	32	20	14
11	70	50	.....	55	219	60	32	14	14
12	36	41	.....	50	273	50	32	14	19
13	36	36	.....	46	170	50	32	19	32
14	32	32	.....	41	107	50	32	14	41
15	23	36	.....	46	81	50	107	14	41
16	28	36	.....	55	81	50	50	14	41
17	28	32	.....	60	122	50	32	19	41
18	23	36	.....	55	394	50	28	14	41
19	28	36	.....	55	332	50	25	16	41
20	28	32	.....	60	190	50	25	14	36
21	28	36	.....	70	136	55	25	14	81
22	28	32	.....	159	93	50	32	19	107
23	32	32	.....	122	93	50	32	19	70
24	36	46	.....	93	93	55	32	19	41
25	55	55	.....	93	93	60	32	19	32
26	50	41	.....	81	81	583	25	14	32
27	50	36	.....	70	81	405	25	19	32
28	55	32	.....	60	70	136	25	14	32
29	55	32	.....	60	60	60	25	14	32
30	50	36	.....	60	60	50	25	19	32
31	55	.....	.....	.....	60	.....	25	19	.....

NOTE.—Daily discharge determined from a rating curve well defined between 14 and 300 second-feet and poorly defined above 300 second-feet. No gage records Dec. 3 to Mar. 31. Mean discharge Dec. 1-31 estimated from records of discharge at Huntley, Mont., 40 second-feet.

Monthly discharge of Pryor Creek at Coburn, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	111	23	46.7	2,870	A.
November	60	32	40.2	2,390	A.
December	.....	.....	[a] 40	2,460	C.
April	159	32	62.4	3,710	A.
May	394	50	113	6,950	B.
June	583	50	88.8	5,280	B.
July	107	25	35.5	2,180	A.
August	352	14	33.8	2,080	A.
September	107	14	33.4	1,990	A.

[a] Estimated. See footnote to table of daily discharge.

PRYOR CREEK AT HUNTLEY, MONT.

LOCATION.—In the SW. ¼ sec. 25, T. 2 N., R. 27 E., at the steel highway bridge half a mile from the railroad station at Huntley.

DRAINAGE AREA.—800 square miles.

RECORDS AVAILABLE.—August 6, 1904, to September 30, 1914.

GAGE.—Chain gage, installed June 16, 1906, at the highway bridge crossing the new channel, into which the creek was at that time turned by the United States Reclamation Service; datum unchanged since 1906. Observers, E. V. Carpenter and B. H. Simon.

DISCHARGE MEASUREMENTS.—Made from the bridge to which the gage is attached, or by wading.

CHANNEL AND CONTROL.—Bed composed of clay and gravel and may change somewhat; banks steep and uniformly graded, clean, and not subject to overflow; current moderate.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.8 feet at 4 p. m. June 27 (discharge, 840 second-feet); minimum stage recorded, 1.1 feet at 11 a. m. and 3 p. m. March 21–23 (discharge, 15 second-feet).

1904–1914: Maximum stage recorded, 7.2 feet July 3, 1912 (discharge, 1,560 second-feet); creek reported dry July 26–28, 1908.

WINTER FLOW.—Stream freezes over during the winter months.

DIVERSIONS.—Water to irrigate about 1,000 acres is diverted above the station.

REGULATION.—None.

ACCURACY.—Results considered fair.

Discharge measurements of Pryor Creek at Huntley, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	J. M. Ray	1.48	36	June 26	W. A. Lamb	3.78	549
Apr. 22	W. A. Lamb	1.90	105	Aug. 9	....do	1.20	17.5

Daily discharge, in second-feet, of Pryor Creek at Huntley, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	40	58	65	51	.....	40	40	46	51	19	19
2	36	65	65	51	.....	31	40	36	51	216	19
3	38	92	61	51	.....	31	40	40	40	40	19
4	40	74	58	51	.....	31	40	40	40	31	19
5	46	51	54	51	.....	31	58	58	36	24	19
6	51	54	54	51	.....	40	101	82	31	22	19
7	158	58	54	58	.....	82	65	58	24	19	19
8	120	54	46	65	.....	101	65	58	22	19	19
9	120	51	48	65	.....	101	58	51	22	19	19
10	196	51	51	58	.....	158	58	40	24	19	17
11	177	51	51	65	65	196	82	46	24	19	24
12	120	51	51	58	51	101	282	36	24	19	19
13	82	51	51	51	51	65	196	40	24	19	24
14	51	48	54	51	46	58	101	40	24	19	24
15	46	40	54	51	40	58	74	36	24	19	24
16	40	43	54	51	40	58	82	36	82	17	24
17	40	46	51	58	40	139	196	31	40	17	24
18	40	49	49	58	40	158	382	31	24	14	28
19	37	51	47	65	31	82	236	31	24	19	28
20	36	51	40	58	31	51	130	28	24	19	51
21	37	51	58	.....	15	82	120	31	24	19	120
22	40	51	58	.....	15	101	120	31	24	19	65
23	40	58	58	.....	15	139	101	31	22	22	46
24	40	65	58	.....	31	65	101	36	22	19	82
25	40	65	58	.....	31	74	82	41	22	19	101
26	65	65	58	.....	46	82	74	544	22	19	120
27	110	70	58	.....	40	82	74	840	22	19	82
28	65	58	65	.....	36	65	65	660	22	19	40
29	82	28	65	.....	31	65	65	101	19	19	40
30	101	46	65	.....	40	51	58	58	19	19	40
31	65	.....	65	.....	36	.....	51	.....	19	19	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve except as follows: Jan. 21–31, estimated at 50 second-feet; Feb. 1–28, estimated at 40 second-feet; Mar. 1–10, estimated at 45 second-feet; discharge relation affected by ice about Jan. 21 to Mar. 10. No gage records June 18 (discharge interpolated), June 22–25 (discharge estimated), and July 5 (discharge interpolated).

Monthly discharge of Pryor Creek at Huntley, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	196	36	70.9	4,360	B.
November	92	28	54.9	3,270	B.
December	65	40	55.6	3,420	B.
January	65	.....	[a] 53.8	3,310	C.
February	.....	.....	[b] 40	2,220	D.
March	65	15	[a] 39.4	2,420	C.
April	196	31	80.6	4,800	B.
May	382	40	104	6,400	B.
June	840	28	[a] 108	6,430	B.
July	51	19	28.8	1,770	B.
August	216	19	26.5	1,630	B.
September	120	17	39.8	2,370	B.
The year	840	15	58.6	42,400	

[a] Partly estimated. [b] Estimated.

NOTE.—See footnote to table of daily discharge.

BIGHORN RIVER NEAR HARDIN, MONT.

LOCATION.—In the SW. ¼ sec. 13, T. 1 S., R. 33 E., on the Crow Indian Reservation, at the bridge of the Chicago, Burlington & Quincy Railroad Co., about half a mile above junction of Bighorn and Little Bighorn rivers, 2 miles from Hardin.

DRAINAGE AREA.—20,700 square miles.

RECORDS AVAILABLE.—June 16, 1904, September 30, 1914.

GAGE.—A chain attached to west span of railroad bridge was read up to October 11, 1913. After that date a temporary staff gage, set to the datum of the chain gage but located 20 feet farther downstream, was read. Staff gage reads 0.07 lower than chain gage owing to its different location. Gage heights after October 11, 1913, have been corrected to read same as chain gage. Observer, H. R. Kean.

DISCHARGE MEASUREMENTS.—Made from railroad bridge.

CHANNEL AND CONTROL.—Composed of gravel; free from vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.3 feet at 9 a. m. June 6 (discharge, 28,300 second-feet); minimum stage recorded, 2.65 feet at 9 a. m. September 8–13 (discharge, 1,520 second-feet).

1904–1914: Maximum stage recorded, 9.8 feet June 17, 1908 (discharge, 40,800 second-feet); minimum stage recorded, 2 feet November 11 and 12, 1911 (discharge 870 second-feet).

Open-season records; flow may have been lower during the winter months.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Water is diverted a few miles above the station by a private irrigation company to irrigate land on west side of the river.

ACCURACY.—Results good.

Discharge measurements of Bighorn River near Hardin, Mont., during the year ending Sept. 30, 1914.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Apr. 23	3.60	3,650
Aug. 9	4.00	4,410

Daily discharge, in second-feet, of Bighorn River near Hardin, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,550	1,950	.....	1,950	4,310	16,800	10,800	3,900	1,860
2	2,440	2,040	.....	1,950	4,030	18,600	10,800	4,030	1,860
3	2,550	2,040	.....	2,140	3,760	20,600	10,300	5,210	1,860
4	2,340	2,340	.....	2,140	4,030	24,000	10,300	5,860	1,860
5	2,440	2,240	.....	2,240	4,030	26,800	9,750	5,860	1,860
6	2,550	2,340	.....	2,240	4,460	28,300	9,750	5,860	1,680
7	3,010	2,240	.....	2,240	4,310	27,600	10,300	5,860	1,600
8	3,130	2,340	.....	3,760	4,310	24,700	9,750	5,210	1,520
9	2,770	2,240	.....	3,760	4,170	20,600	9,750	4,600	1,520
10	2,550	2,140	.....	3,900	5,210	18,000	9,230	3,900	1,520
11	2,440	1,950	.....	2,890	6,920	14,600	8,720	3,500	1,520
12	2,340	1,950	.....	2,890	6,920	12,400	8,720	3,500	1,520
13	2,240	1,950	.....	2,770	6,550	10,800	9,230	3,380	1,520
14	2,340	2,040	.....	2,340	6,550	10,800	8,720	3,250	1,600
15	2,240	1,950	2,340	2,340	6,200	10,800	8,230	3,010	1,680
16	2,340	1,860	2,550	2,340	5,860	10,300	8,230	2,770	1,770
17	2,240	1,860	2,890	2,550	6,550	11,900	7,320	2,550	1,770
18	2,340	1,950	2,890	2,890	8,720	12,900	7,320	2,440	1,860
19	2,240	1,860	2,770	4,600	11,300	14,600	6,550	2,340	1,860
20	2,340	1,950	2,660	3,760	12,400	15,600	6,200	2,340	1,860
21	2,240	1,860	2,660	3,900	13,500	17,400	5,860	2,240	1,950
22	2,240	1,950	2,140	3,630	16,200	20,000	5,530	2,140	1,950
23	2,240	.....	2,140	3,500	16,800	20,600	5,210	2,140	2,040
24	2,340	.....	2,140	3,760	18,000	18,000	5,210	2,140	2,140
25	2,240	.....	2,140	5,210	21,200	16,800	4,600	1,950	2,240
26	2,340	.....	2,140	5,210	21,200	16,800	4,310	1,950	2,240
27	2,240	.....	2,140	5,210	20,600	16,200	4,170	2,040	2,340
28	2,340	.....	1,950	5,210	19,300	14,600	3,760	1,950	2,440
29	2,240	.....	1,950	5,210	18,600	12,400	3,630	1,950	2,770
30	1,950	.....	1,950	4,900	16,800	11,300	3,500	1,950	2,550
31	1,950	.....	1,950	.....	16,800	.....	3,250	1,860	.....

NOTE.—Discharge determined from a fairly well defined rating curve. No gage records Nov. 23 to Mar. 14.

Monthly discharge of Bighorn River near Hardin, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	3,130	1,950	2,380	146,000	B.
November 1-22	2,340	1,860	2,050	89,500	B.
March 15-31	2,890	1,950	2,320	78,200	B.
April	5,210	1,950	3,380	201,000	B.
May	21,200	3,760	10,300	633,000	B.
June	28,300	10,300	17,200	1,020,000	B.
July	10,800	3,250	7,390	454,000	B.
August	5,860	1,860	3,280	202,000	B.
September	2,770	1,520	1,890	112,000	B.

SHOSHONE RIVER AT CORBETT DAM, WYO.

LOCATION.—In the NE. ¼ sec. 7, T. 53 N., R. 100 W., at the Corbett diversion dam, 8 miles below Cody.

DRAINAGE AREA.—Not measured at this station; the drainage area above Cody is 1,400 square miles. Sage Creek, the only important tributary that enters between this station and Cody, drains about 25 square miles.

RECORDS AVAILABLE.—April 20, 1908, to September 30, 1914.

GAGE.—Forty feet above the crest of the dam; readings represent height of water above crest.

DETERMINATION OF DISCHARGE.—The discharge is computed by considering the dam as a weir and the sluice gates as submerged orifices. The following formula for discharge over the crest was developed from measurements at Cody, Wyo.: $Q=3.50\ bh^{1.58}$. The dam is of reinforced concrete of the buttressed type, having on the upstream side a deck 2½ feet thick sloping 1 to 1 and supported by buttresses 2 feet thick spaced 14 feet on centers; it raises the low-water elevation of the river 10.2 feet; the length between abutments is 400 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 2.9 feet at 8 a. m. June 4 (discharge, 7,530 second-feet); minimum stage recorded, 0.28 foot at 8 a. m. August 21 (discharge, 191 second-feet).

1908–1914: Maximum stage recorded, 4.79 feet July 4, 1909 (discharge, 15,400 second-feet); river reported dry October 21 to November 19, 1909.

WATER FLOW.—Discharge relation not seriously affected by ice; open-channel rating curve assumed applicable.

DIVERSIONS AND STORAGE.—Little water is diverted above this station, but the Shoshone reservoir with a capacity of 456,000 acre-feet controls the flow.

ACCURACY.—Results apparently good.

COOPERATION.—Records of gage heights and of discharge into Corbett tunnel furnished by the United States Reclamation Service.

Daily discharge, in second-feet, of Shoshone River, including sluices and tunnels, at Corbett dam, Wyo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	715	546	376	344	344	282	582	607	5,480	4,230	1,350	547
2	731	497	377	344	344	282	582	612	6,140	4,080	1,420	529
3	714	639	376	344	344	282	582	612	7,070	4,100	1,420	515
4	699	575	377	344	344	270	530	602	7,730	3,900	1,460	498
5	659	559	379	344	344	270	545	607	7,150	3,770	1,320	499
6	761	543	379	344	344	270	545	587	7,070	3,790	1,260	507
7	809	483	381	344	344	270	545	539	5,630	3,700	1,160	549
8	799	422	381	344	344	270	545	539	5,420	3,430	1,100	549
9	816	390	382	330	344	320	545	548	4,050	3,280	898	573
10	833	379	384	344	344	370	545	548	3,620	3,140	810	557
11	644	385	384	358	344	420	545	768	3,380	3,140	792	568
12	603	385	376	344	344	465	545	820	2,980	3,100	756	554
13	557	381	368	344	351	515	561	900	2,950	2,970	664	590
14	560	391	369	344	358	565	561	900	3,360	2,900	632	547
15	540	377	370	344	358	614	577	1,250	3,410	2,770	622	578
16	533	377	371	344	358	614	580	1,640	3,810	2,590	580	599
17	590	377	372	344	336	614	581	2,430	4,530	2,470	552	602
18	582	350	372	344	314	614	645	3,150	5,110	2,310	503	602
19	571	350	372	344	292	582	588	3,420	5,790	2,110	426	586
20	571	350	372	344	269	582	575	3,820	6,050	1,930	474	586
21	555	350	372	344	246	582	588	5,160	6,860	1,830	400	629
22	571	346	386	344	252	582	556	5,040	6,870	1,660	423	833
23	555	368	372	344	258	582	556	5,040	5,660	1,640	448	833
24	539	368	344	344	258	582	588	5,320	4,880	1,580	630	879
25	571	370	344	358	270	582	588	5,000	4,470	1,490	662	861
26	571	386	358	358	270	582	549	4,340	5,090	1,370	657	861
27	523	383	358	358	282	582	549	4,000	4,940	1,280	656	1,280
28	523	377	358	344	282	582	595	4,020	3,940	1,200	661	1,320
29	523	376	344	344	.....	582	579	4,000	4,040	1,160	629	725
30	521	376	344	344	.....	582	607	4,000	4,140	1,040	583	624
31	530	.....	344	344	.....	582	.....	4,470	.....	1,200	533	.....

NOTE.—Gage readings show height of water above crest of dam and were used only to compute flow over the dam. No gage records Nov. 5–9, Dec. 2–18, Feb. 11–15, 17–20, 22, Feb. 28 to Mar. 7, Mar. 9–14, 16–21, 23–28, and Mar. 30 to Apr. 2. All the water was flowing through the sluice gates Nov. 5–9 and Dec. 2–18. Discharge determined by adding the flow through the tunnel (reported by the United States Reclamation Service) to the flow over the crest of the dam. The flow over the dam was obtained from a rating table computed by the formula 3.50 BH 1.58. (See "Determination of discharge.") Discharge interpolated for days for which gage heights were missing.

Monthly discharge of Shoshone River, including sluices and tunnels at Corbett dam, Wyo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	833	521	622	38,200	B.
November	639	346	415	24,700	B.
December	386	344	369	22,700	B.
January	358	330	345	21,200	B.
February	358	246	317	17,600	B.
March	614	270	480	29,500	B.
April	645	530	569	33,900	B.
May	5,220	539	2,430	149,000	B.
June	7,730	2,950	5,050	300,000	B.
July	4,230	1,040	2,550	157,000	B.
August	1,460	400	790	48,600	B.
September	1,320	498	666	39,600	B.
The year	7,730	246	1,220	882,000	

NOTE.—See footnote to table of daily discharge.

Daily discharge, in second-feet, of Corbett tunnel at Corbett dam, Wyo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	85	28	18	.....	25	187	118	131	105
2	84	27	19	.....	30	187	157	131	87
3	84	26	18	.....	30	187	182	131	87
4	85	25	18	12	36	197	182	131	98
5	29	41	19	27	41	186	182	124	99
6	29	57	18	27	69	31	196	115	89
7	94	29	19	27	69	52	196	124	79
8	101	0	18	27	69	159	198	123	79
9	101	0	18	27	78	98	203	115	87
10	101	21	19	27	78	86	203	95	87
11	94	41	18	27	121	86	203	77	98
12	85	41	9	27	139	100	223	126	98
13	87	37	.....	27	151	121	234	162	24
14	101	33	.....	27	151	126	243	162	45
15	112	33	.....	27	151	177	247	194	108
16	63	33	.....	30	173	177	247	180	81
17	24	33	.....	31	173	207	242	180	52
18	32	32	.....	31	154	207	227	209	52
19	37	32	.....	38	102	207	227	216	52
20	37	32	.....	41	102	207	237	216	52
21	37	32	.....	54	116	141	237	209	47
22	37	28	.....	54	102	153	215	189	33
23	37	24	.....	54	102	153	194	166	33
24	37	24	.....	54	102	122	180	160	25
25	37	26	.....	54	126	122	180	160	25
26	37	28	.....	47	161	82	187	139	25
27	37	25	.....	47	183	95	197	122	32
28	37	19	.....	29	198	95	223	127	27
29	37	18	.....	29	180	95	220	127	27
30	35	18	.....	25	180	91	181	127	26
31	28	.....	.....	.....	187	.....	120	119	.....

NOTE.—Discharge records furnished by the United States Reclamation Service and represent quantity of water diverted for irrigation.

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Monthly discharge of Corbett Tunnel at Corbett Dam, Wyo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	112	24	60.1	3,700
November	57	0	28.1	1,670
December 1-12	19	9	17.6	419
April 4-30	54	12	34.3	1,840
May	198	25	115	7,070
June	207	31	138	8,210
July	247	118	203	12,500
August	216	77	148	9,100
September	108	24	62.0	3,690

SOAP CREEK NEAR ST. XAVIER, MONT.

LOCATION.—In the NE. ¼ sec. 20, T. 5 S., R. 32 E., at Frank Annerer's ranch, about 8 miles southeast of St. Xavier.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 25 to September 30, 1914. From September 11, 1911, to December 31, 1913, a station was maintained above the head of Soap Creek ditch, in the W. ½ NW. ¼ sec. 2, T. 6 S., R. 32 E., about 9 miles south of St. Xavier. See "Diversion."

GAGE.—Chain gage on a footbridge near the observer's home. Observers, W. G. Warrett and Frank Annerer.

DISCHARGE MEASUREMENTS.—Made by wading at low stages and from the footbridge at high stages.

CHANNEL AND CONTROL.—Slightly shifting. Bed of stream is gravel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 12.8 feet at 12 m. May 11 (approximate discharge computed from extension of rating curve, 440 second-feet); minimum stage recorded (2.1 feet at 7 a. m. and 6 p. m.) September 10 (discharge, 1.0 second-foot).

1911-1914: Maximum stage recorded, 12.8 feet May 11, 1914 (approximate discharge computed from extension of rating curve, 440 second-feet); minimum stage recorded, 2.1 feet September 10, 1914 (discharge, 1.0 second-foot).

WINTER FLOW.—Stream frozen during the winter months.

DIVERSION.—Soap Creek ditch diverts water above the gage during the irrigation season.

ACCURACY.—Results fair.

Discharge measurements of Soap Creek near St. Xavier, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 7	J. M. Ray	3.34	22	June 25	W. A. Lamb	[a] 2.99	11.6
Apr. 25	W. A. Lamb	[a] 4.05	42	Aug. 7	do	[a] 2.82	9.9

[a] Measurement made at new site. See "Records available."

Daily discharge, in second-feet, of Soap Creek near St. Xavier, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	45	39	.....	34	24	13	9.3	17
2	37	37	.....	33	23	12	11	18
3	29	35	.....	35	23	12	9.3	17
4	22	33	.....	41	26	13	8.6	8.9
5	22	30	.....	60	26	11	8.9	3.1
6	22	27	.....	48	23	12	7.5	3.3
7	22	24	.....	40	20	10	7.5	3.3
8	25	22	.....	28	18	8.6	8.6	5.7
9	28	23	.....	19	22	5.7	8.9	1.5
10	30	24	.....	21	16	8.0	7.5	1.0
11	33	25	.....	303	16	8.9	7.5	1.8
12	32	26	.....	160	17	14	8.6	2.8
13	31	27	.....	53	16	12	7.5	13
14	30	28	.....	44	18	9.8	8.6	14
15	28	29	.....	38	14	17	10	14
16	26	28	.....	38	14	14	11	14
17	24	27	.....	35	13	14	13	13
18	22	26	.....	32	12	14	12	14
19	22	25	.....	31	15	15	14	14
20	23	24	.....	32	17	14	17	13
21	23	23	.....	32	17	12	18	31
22	24	22	.....	30	18	11	20	18
23	24	23	.....	30	16	11	18	12
24	25	24	.....	26	16	9.8	18	9.8
25	25	25	42	26	15	8.9	18	11
26	27	26	55	26	34	8.7	20	11
27	29	27	40	26	30	8.6	19	11
28	31	28	41	23	24	13	20	10
29	33	29	44	24	18	12	20	9.8
30	35	29	36	21	13	13	22	9.3
31	37	.....	.....	23	.....	9.8	17	.....

NOTE.—Daily discharge determined as follows: Oct. 4 to Nov. 30, from a poorly-defined rating curve; Apr. 25 to Sept. 30, from a rating curve fairly well defined between 8 and 50 second-feet and poorly defined at other stages. Discharge estimates May 11 and 12 approximate; computed from extension of rating curve. No gage records Oct. 1-3, 5, 7-10, 12-17, 19-24, 26-31, Nov. 2-7, 9-14, 16-21, 23-28, and Nov. 30 to Apr. 24; discharge interpolated for days during October and November for which gage heights are not recorded.

Monthly discharge of Soap Creek near St. Xavier, Mont., for the year ending Sept 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	45	22	27.9	1,720	C.
November	39	22	27.2	1,620	C.
April 25-30	55	36	43.0	512	B.
May	303	19	45.5	2,800	C.
June	34	12	19.1	1,140	B.
July	17	5.7	11.5	707	B.
August	22	7.5	13.1	806	B.
September	31	1.0	10.8	643	B.

NOTE.—See footnote to table of daily discharge.

ROTTENGRASS CREEK NEAR ST. XAVIER, MONT.

LOCATION.—In the NW. ¼ sec. 6, T. 5 S., R. 33 E., on the Crow Indian Reservation, one-fourth mile above the crossing of the Bighorn canal, about 4 miles southeast of St. Xavier.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 9, 1911, to September 30, 1914.

GAGE.—Overhanging chain gage on left bank. Observer, Warren Stanley.

DISCHARGE MEASUREMENTS.—Made by wading above the gage.

CHANNEL AND CONTROL.—Likely to change. Bed of stream is composed of sand and silt. The channel is deep and current sluggish for several hundred feet above and below the gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.4 feet at 6.25 a. m. May 13 (discharge, 122 second-feet); minimum stage recorded, 2.5 feet at 9.30 a. m. August 13 and 23 (discharge, 1.0 second-foot).

1911–1914: Maximum stage recorded, 9.2 feet May 4, 1912 (discharge, 290 second-feet); minimum stage recorded, 2.3 feet, September 27, 1911 (discharge, 0.3 second-foot).

WINTER FLOW.—Discharge relation seriously affected by ice.

DIVERSIONS.—None.

ACCURACY.—Results fair.

Discharge measurements of Rottengrass Creek near St. Xavier, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 7	J. M. Ray	3.35	7.4	June 25	W. A. Lamb	2.67	2.0
Apr. 26	W. A. Lamb	4.76	39	Aug. 8	....do	2.77	1.3

Daily discharge, in second-feet, of Rottengrass Creek near St. Xavier, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	14	.....	21	13	23	17	10
2	13	.....	19	9	23	16	17
3	13	.....	17	8	22	15	18
4	14	.....	19	7	21	9	19
5	14	.....	32	4	16	2.5	17
6	15	.....	42	2.5	10	2.2	15
7	15	.....	46	3.2	10	2.0	16
8	15	.....	38	3.2	10	2.2	17
9	16	.....	23	2.5	8	2.5	15
10	17	.....	21	3.2	7	2.0	13
11	17	.....	23	4	11	1.5	12
12	16	.....	104	4	15	1.2	11
13	15	.....	122	3.2	14	1.0	10
14	15	.....	86	5	13	1.2	10
15	13	.....	35	4	10	1.5	10
16	11	.....	29	2.5	6	6.2	9
17	10	.....	26	3.2	8	11	10
18	9	.....	42	2.5	10	6.7	10
19	9	.....	29	2.0	10	2.5	10
20	9	.....	32	2.0	10	2.5	9
21	9	.....	26	2.0	10	2.5	8
22	9	.....	23	2.0	9	1.8	8
23	7	.....	21	2.0	11	1.0	8
24	8	.....	26	2.0	13	1.2	9
25	10	.....	23	2.0	12	1.5	8
26	12	35	19	2.2	11	1.8	8
27	13	32	21	2.5	12	2.0	9
28	11	32	21	2.5	13	3.0	10
29	10	26	17	2.5	13	4.0	10
30	9	26	17	2.5	13	4.0	10
31	9	.....	15	.....	15	4.0	.....

NOTE.—Discharge determined from a rating curve well defined between 0.3 and 100 second-feet. Discharge estimated June 21 to July 1 and interpolated for other days for which gage readings are not available, as follows: Oct. 1, 3, 4, 5, 8, 9, 11, 12, 13, 15, 17, 19, 21, 23, 25, 26, 28, 29, 31, June 21 to July 1, all odd-numbered days in July, even-numbered days in August, and odd-numbered days in September. No gage-height record Nov. 1 to Apr. 25.

Monthly discharge of Rottengrass Creek near St. Xavier, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	17	7	12.2	750	B.
April 26–30	35	26	30.2	300	A.
May	122	15	33.4	2,050	A.
June	13	2.0	3.67	218	B.
July	23	6.0	12.5	769	B.
August	17	1.0	4.28	263	B.
September	19	8	11.5	684	B.

NOTE.—See footnote to table of daily discharge.

LITTLE BIGHORN RIVER NEAR WYOLA, MONT.

LOCATION.—In the N. ½ SW. ¼ sec. 28, T. 8 S., R. 35 E., on the Crow Indian Reservation, one-fourth mile below proposed headworks of Little Bighorn canal No. 3, 4 miles southwest of Wyola, and about 16 miles above the mouth of Lodgegrass Creek.

DRAINAGE AREA.—260 square miles.

RECORDS AVAILABLE.—September 7, 1911, to September 30, 1914.

GAGE.—Overhanging chain gage on right bank. Observer, Leslie Schroeder.

DISCHARGE MEASUREMENTS.—At low stages made by wading at ford below gage; at high stages from a cable.

CHANNEL AND CONTROL.—Slightly shifting; bed of stream composed of gravel and cobblestones.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.4 feet at 8 a. m. May 25 (discharge, 1,010 second-feet); minimum stage recorded, 4.15 feet at 8 a. m. and 5 p. m. March 16–19 (discharge, 86 second-feet).

1912–1914: Maximum stage recorded, 6.4 feet June 1–2, 1913 (discharge, 1,080 second-feet); minimum stage recorded, 4.15 feet March 16–19, 1914 (discharge, 86 second-feet). Datum unchanged; difference in discharge relation due to shifting channel.

Open-season records; flow may have been lower at times in winter months.

WINTER FLOW.—Channel filled with ice during the winter months.

DIVERSIONS.—None.

ACCURACY.—Results good.

Discharge measurements of Little Bighorn River near Wyola, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	J. M. Ray	4.36	116	June 26	W. A. Lamb	5.18	429
Apr. 24	W. A. Lamb	4.61	190	Aug. 8	.....do	4.38	126

Daily discharge, in second-feet, of Little Bighorn River near Wyola, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	114	114	.....	102	132	800	255	132	122
2	114	122	.....	93	172	800	255	132	122
3	105	114	.....	102	202	800	219	122	122
4	122	114	.....	93	274	800	219	132	111
5	132	114	.....	102	186	724	219	111	122
6	122	114	.....	111	186	699	202	111	122
7	122	114	.....	122	172	578	202	111	.....
8	122	105	.....	111	172	555	202	132	.....
9	114	105	.....	102	186	509	202	122	.....
10	114	105	.....	122	398	464	186	132	.....
11	114	114	.....	102	420	420	202	132	.....
12	114	105	.....	102	314	420	186	132	.....
13	114	105	.....	102	294	420	186	132	.....
14	114	105	.....	111	294	398	157	122	.....
15	114	105	.....	111	294	377	157	122	.....
16	114	98	86	122	420	356	157	122	.....
17	105	98	86	144	602	356	157	132	.....
18	114	98	86	122	650	335	157	122	.....
19	114	105	86	122	650	356	157	122	.....
20	114	98	93	132	724	377	157	122	.....
21	114	105	93	172	852	356	144	132	.....
22	114	98	86	172	774	335	132	122	.....
23	114	98	93	144	959	294	132	132	.....
24	105	98	86	202	959	294	132	122	.....
25	132	98	93	255	1,010	274	132	122	.....
26	114	105	93	202	800	442	132	122	.....
27	122	98	86	186	749	294	132	122	.....
28	132	98	86	157	800	274	122	122	.....
29	122	98	93	144	699	294	132	122	.....
30	114	98	111	144	650	255	122	122	.....
31	114	.....	102	.....	674	.....	122	122	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Nov. 30, from a fairly well defined rating curve; Mar. 16 to Sept. 6, from a rating curve fairly well defined between 110 and 550 second-feet.
No records Dec. 1 to Mar. 15 and Sept. 7–30.

Monthly discharge of Little Bighorn River near Wyola, Mont., for the year ending Sept. 30, 1914.

[Drainage area, 260 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	132	105	116	0.446	0.51	7,130	B.
November	122	98	105	.404	.45	6,250	B.
March 16–31	111	86	91.2	.351	.21	2,890	B.
April	255	93	134	.515	.57	7,970	B.
May	1,010	132	505	1.94	2.24	31,160	B.
June	800	255	455	1.75	1.95	27,100	B.
July	255	122	170	.654	.75	10,500	B.
August	132	111	124	.477	.55	7,620	B.
September 1–6	122	111	120	.462	.10	1,430	B.

LITTLE BIGHORN RIVER NEAR CROW AGENCY, MONT.

LOCATION.—In the W. ½ sec. 18, T. 3 S., R. 35 E., on the Crow Indian Reservation at the Chicago, Burlington & Quincy Railroad bridge, 2 miles south of Crow Agency; about 14 miles above junction with Bighorn River.

DRAINAGE AREA.—1,190 square miles.

RECORDS AVAILABLE.—March 24, 1905, to June 30, 1906; September 7, 1911, to September 30, 1914.

GAGE.—Chain gage on railroad bridge. Records March 24, 1905, to June 30, 1906, were obtained from a standard chain gage attached to the upstream side of the railroad bridge at Crow Agency, about 2 miles farther downstream. No tributaries between the two stations. Observer, Archie McLauchlin.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge 200 feet below gage. Low-water measurements made by wading at the ford about 75 feet above bridge.

CHANNEL AND CONTROL.—Permanent; bed of stream is coarse gravel and cobblestones; current sluggish at gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.9 feet at 2 p. m. May 25 (discharge, 2,500 second-feet); minimum stage recorded, 4.1 feet at 5.30 p. m. August 17, 1 p. m. September 2, 11 a. m. September 5, and 6 p. m. September 6 (discharge, 94 second-feet.)

1905–6 and 1912–1914: Maximum stage recorded, 8.6 feet July 4, 1912 (discharge, 3,380 second-feet); minimum stage recorded, 1.8 feet September 25–29, 1905 (discharge, 60 second-feet).

Open-season records; flow may have been lower at times in winter months.

WINTER FLOW.—Discharge relation affected by ice, which forms at control below bridge.

DIVERSIONS.—Water is diverted from main stream and tributaries. Crow Agency ditch diverts water between present station and old site at Crow Agency.

ACCURACY.—Results good.

Discharge measurements of Little Bighorn River near Crow Agency, Mont., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 6	J. M. Ray	4.50	202	June 25	W. A. Lamb	4.84	339
Apr. 24	W. A. Lamb	4.85	373	Aug. 7	....do	4.25	127

Daily discharge in second-feet, of Little Bighorn River near Crow Agency, Mont., for the year ending Sept. 30, 1914.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	570	390	1,320	445	170	115
2	.....	475	390	1,320	390	170	94
3	.....	390	340	1,440	445	170	115
4	.....	365	390	1,440	340	170	115
5	.....	340	390	1,560	268	155	94
6	.....	445	505	1,320	290	140	94
7	.....	475	445	1,320	290	140	115
8	.....	445	445	1,200	245	170	115
9	.....	365	390	1,200	205	115	115
10	.....	390	390	1,090	225	104	115
11	.....	445	570	1,090	245	128	115
12	.....	315	640	1,090	245	115	115
13	.....	390	715	990	245	115	115
14	.....	418	715	640	245	115	115
15	.....	390	640	340	188	115	115
16	340	340	570	505	205	104	140
17	315	365	758	475	205	94	140
18	290	390	1,090	445	170	104	140
19	290	365	1,320	390	170	104	140
20	268	390	1,320	390	155	115	140
21	245	365	1,560	365	170	115	140
22	188	445	2,080	445	170	115	170
23	290	418	1,820	390	170	115	170
24	290	390	2,220	340	170	140	170
25	268	445	2,500	390	155	115	170
26	290	570	2,220	315	170	115	170
27	205	445	1,950	570	170	115	170
28	340	505	1,690	505	170	115	140
29	315	445	1,820	445	170	115	140
30	245	445	1,690	505	155	115	140
31	268	.....	1,440	.....	170	115	.....

NOTE.—Daily discharge determined from a rating curve well defined between 110 and 1,000 second-feet and poorly defined at other stages. No gage records Oct. 1–4 and Dec. 23 to Mar. 15. Gage records Oct. 5 to Dec. 22, as published in Water-Supply Paper 356, are of doubtful accuracy; therefore discharge for that period has not been estimated.

Monthly discharge of Little Bighorn River near Crow Agency, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 16–31	340	188	278	8,820	C.
April	570	370	418	24,900	A.
May	2,500	340	1,080	66,400	B.
June	1,560	315	794	47,200	B.
July	445	155	228	14,000	A.
August	170	94	126	7,750	A.
September	170	94	131	7,800	A.
The period				177,000	

LODGEGRASS CREEK NEAR LODGEGRASS, MONT.

LOCATION.—In the SW. ¼ sec. 29, T. 6 S., R. 35 E., above road crossing one-fourth mile above headworks of Lodgegrass ditch, about 6 miles southwest of Lodgegrass.

DRAINAGE AREA.—142 square miles.

RECORDS AVAILABLE.—September 9, 1911, to September 30, 1914.

GAGE.—Overhanging chain gage on left bank. On July 3, 1913, a new gage was installed 50 feet below the old station and at the same datum. The control and channel are practically the same as at the former site. Observers, Florence Campbell and T. L. Hehir.

DISCHARGE MEASUREMENTS.—Made by wading at ford below gage.

CHANNEL AND CONTROL.—Bed of stream at gage composed of mud and silt. Current sluggish at gage at low stages. Firm gravel and cobblestones at the ford below the gage; slightly shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.7 feet at 4 p. m., June 3–9 (discharge, 211 second-feet); minimum stage recorded, 3.3 feet at 6 p. m. July 28 to September 12, 20, and 26–30 (discharge, 14 second-feet).

1911–1914: Maximum stage recorded, 6.8 feet, June 1, 3, 4, 5, 6, 1913 (discharge 628 second-feet); minimum stage recorded, 3.3 feet July 28 to September 12, 20, and 26–30, 1914 (discharge, 14 second-feet).

WINTER FLOW.—Discharge relation seriously affected by ice.

DIVERSION.—None.

ACCURACY.—Results fair.

Discharge measurements of Lodgegrass Creek near Lodgegrass, Mont., during the year ending Sept. 30, 1914.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Apr. 24	3.70	46
June 26	4.01	101
Aug. 8	3.32	15

Daily discharge, in second-feet, of Lodgegrass Creek near Lodgegrass, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	29	33	126	126	194	94	14	14
2	29	33	126	126	194	94	14	14
3	29	33	126	94	211	78	14	14
4	29	33	126	94	211	78	14	14
5	29	32	126	110	211	78	14	14
6	28	32	78	94	211	63	14	14
7	28	31	63	94	211	63	14	14
8	28	31	63	110	211	63	14	14
9	28	31	78	110	211	63	14	14
10	28	31	63	110	194	63	14	14
11	27	30	78	110	177	63	14	14
12	27	30	50	94	177	94	14	14
13	27	30	63	94	177	78	14	18
14	27	30	63	110	160	78	14	18
15	26	29	63	110	160	63	14	22
16	26	29	63	110	143	63	14	22
17	25	29	63	177	143	63	14	22
18	25	29	63	194	143	63	14	22
19	25	28	50	194	143	50	14	22
20	25	28	50	194	143	50	14	14
21	26	27	39	160	126	39	14	30
22	27	27	50	160	126	39	14	26
23	28	27	50	160	110	30	14	22
24	29	27	50	143	110	30	14	18
25	29	27	63	143	94	22	14	18
26	29	26	143	126	126	22	14	14
27	29	26	143	126	126	22	14	14
28	30	26	143	143	110	14	14	14
29	31	25	126	143	110	14	14	14
30	31	25	126	143	94	14	14	14
31	32	.....	.....	194	.....	14	14	.....

NOTE.—Daily discharge determined from two fairly well defined rating tables applicable Oct. 1 to Nov. 30 and Apr. 1 to Sept. 30. No gage records Oct. 1 to Mar. 31 (except Oct. 9, 12, 19, 26, Nov. 2, 9, 16, and 23); discharge interpolated.

Monthly discharge of Lodgegrass Creek near Lodgegrass, Mont., for the year ending Sept. 30, 1914.

[Drainage area, 142 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	32	25	27.9	0.196	0.23	1,720	C.
November	33	25	29.2	.206	.23	1,740	C.
April	143	39	83.8	.590	.66	4,990	B.
May	194	94	132	.930	1.07	8,120	B.
June	211	94	159	1.12	1.25	9,460	B.
July	94	14	53.6	.377	.43	3,300	B.
August	14	14	14.0	.099	.11	861	B.
September	30	14	17.1	1.20	.13	1,020	B.

LITTLE MISSOURI RIVER NEAR ALZADA, MONT.

LOCATION.—Near the southwest corner of T. 8 S., R. 60 E., at Walker's ranch, 2 miles below mouth of Thompson Creek, 300 yards below the site of the proposed diversion dam and 4 miles below Alzada.

DRAINAGE AREA.—About 780 square miles.

RECORDS AVAILABLE.—June 18, 1911, to September 30, 1914, at present site; April 30, 1904, to November 30, 1906, at Alzada. Several important tributaries enter between the stations; records not directly comparable. Observer, John Walker.

GAGE.—Overhanging chain gage on right bank. During 1911 a vertical staff 150 feet farther downstream on left bank. Datum of chain gage 0.08 foot lower than that of staff gage; principal control points also different.

DISCHARGE MEASUREMENTS.—At ordinary stages made by wading; at flood stages from a cable.

CHANNEL AND CONTROL.—Bed of stream is of gravel; may shift during high water; banks cut 5 to 15 feet in the sandy soil.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.33 feet at 6 p. m. August 3 (discharge, 2,630 second-feet); minimum stage recorded, 1.87 feet at 5.30 a. m. July 28 (discharge, 0.1 second-foot).

1911–1914: Maximum stage recorded, 15.3 feet April 6, 1912 (discharge, 4,550 second-feet); minimum stage recorded, 0.4 foot to −0.25 foot July 6 to August 7 and 0.4 to 0.3 foot October 14–18, 1911 (old gage); 1.85 to 1.76 feet September 9–15, 1913 (new gage); discharge 0.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—None.

ACCURACY.—Results excellent.

Discharge measurements of Little Missouri River near Alzada, Mont., during the year ending Sept. 30, 1914.

[Made by B. E. Jones.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Aug. 1	3.23	172	Aug. 3	10.05	2,200	Aug. 4	5.29	729
1	4.05	402	3	11.00	2,590	5	3.29	141
2	6.00	988	4	9.99	2,120	5	2.78	82
2	7.06	1,270	4	8.93	1,790	6	2.56	49
2	8.29	1,690	4	7.36	1,340			

Daily discharge, in second-feet, of Little Missouri River near Alzada, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	13	4.6	4.2	3.8	4.6	5.4	5.0	225	7
2	9.5	5.4	4.6	6.2	4.2	3.8	3.4	1,250	9
3	8.0	5.0	4.2	8.0	3.8	3.0	1.8	2,400	7
4	7.5	5.0	5.0	5.4	3.4	3.4	1.0	1,510	7
5	11	5.0	5.4	4.2	3.4	106	.9	99	6
6	115	5.4	5.4	2.6	3.4	39	.8	38	7
7	265	5.0	5.0	2.2	3.4	12	.6	31	7
8	265	5.8	5.0	1.8	2.8	6.2	.5	23	7
9	71	5.8	5.0	1.4	2.4	3.0	.4	19	5
10	35	4.2	5.0	1.4	2.2	2.0	.3	15	4
11	21	4.2	5.8	1.0	5.0	2.4	16	19	4
12	16	4.2	5.8	1.0	16	3.0	88	19	4
13	13	4.2	5.8	1.0	24	51	51	16	4
14	9.0	4.2	5.8	1.0	13	65	34	12	3
15	7.0	4.6	5.8	.8	7.5	97	9.5	10	3
16	6.6	5.8	5.8	.8	4.2	65	5.8	10	4
17	6.2	5.8	5.8	.8	3.0	34	3.0	10	4
18	5.0	5.8	5.8	1.0	5.0	16	1.6	10	3
19	4.6	5.8	5.8	1.2	19	7.5	1.2	10	3
20	5.0	5.4	7.0	1.4	9.5	10	.8	9	3
21	4.6	5.0	7.0	2.6	10	6.2	.6	9	4
22	3.8	5.0	7.0	3.8	3.4	88	.5	10	6
23	4.2	5.0	7.0	7.0	295	72	.4	14	6
24	4.2	5.0	7.5	5.8	295	28	.3	52	6
25	5.0	5.0	8.0	4.6	365	9.5	.1	16	4
26	5.8	5.0	8.0	4.6	265	5.0	.1	15	5
27	5.0	5.0	8.0	5.4	106	3.4	.1	13	4
28	5.0	4.2	8.0	5.4	19	2.6	.1	12	4
29	5.4	4.2	8.0	5.0	16	1.6	265	7	4
30	4.6	4.2	8.0	5.4	10	3.0	2,100	7	4
31	4.2	.....	8.0	.....	8.0	.....	1,390	6	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to July 30, from a rating curve well defined at all stages; July 31 to Sept. 30, from a rating curve well defined over 200 second-feet, fairly well defined from 10 to 200 second-feet, and poorly defined below 10 second-feet.

Monthly discharge of Little Missouri River near Alzada, Mont., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	265	3.8	30.5	1,880	A.
November	5.8	4.2	4.96	295	A.
December	8	4.2	6.21	382	A.
April	8	.8	3.22	192	A.
May	365	2.2	49.4	3,040	A.
June	106	1.6	25.1	1,490	A.
July	2,100	.1	128	7,870	A.
August	2,400	6	190	11,700	A.
September	9	3	4.9	292	C.

KNIFE RIVER NEAR BRONCHO, N. DAK.

LOCATION.—In the SE. ¼ sec. 4, T. 142 N., R. 90 W., at C. D. Smith's ranch, at former site of the post office of Broncho; present post office is about 6 miles from old site. Spring Creek enters about 15 miles below station and Elm Creek half a mile above.

DRAINAGE AREA.—1,260 square miles; drainage area at the present site is practically the same as at the original site, 2 miles farther downstream, the area at the lower point being perhaps 5 square miles greater.

RECORDS AVAILABLE.—May 29, 1903, to September 30, 1914.

GAGE.—Chain gage on left bank just below observer's house; datum unchanged since March 23, 1905, when station was moved from original site, about 2 miles farther downstream. Observer, C. D. Smith.

DISCHARGE MEASUREMENTS.—At high stages made from car and cable 500 feet below gage; at low stages by wading.

CHANNEL AND CONTROL.—Practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year, 24.0 feet June 26, determined by leveling from flood marks (approximate discharge computed from extension of rating curve, 7,700 second-feet); minimum discharge estimated at 4 second-feet January 28 to March 8.

1903–1914. Maximum stage recorded, 24.0 feet; June 26, 1914, determined by leveling from flood marks (approximate discharge computed from extension of rating curve, 7,700 second-feet); river reported dry September 6–8, 1905; September 18–19, 1908.

WINTER FLOW.—Discharge relation affected by ice.

ACCURACY.—Results fair.

Discharge measurements of Knife River near Broncho, N. Dak., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 11	O. Christianson	4.37	46	Sept. 5	E. F. Chandler	3.69	12.2
Aug. 13	E. F. Chandler	3.82	13.5				

Daily discharge, in second-feet, of Knife River near Broncho, N. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	9	13	.....	27	22	9	525	161	19
2	9	13	.....	57	17	13	438	103	17
3	9	13	.....	57	22	9	177	48	17
4	9	13	.....	78	22	13	103	27	17
5	9	13	.....	1,170	48	9	103	27	17
6	9	13	.....	627	57	13	103	22	13
7	9	13	.....	244	117	13	78	17	13
8	9	13	.....	244	193	40	78	17	13
9	9	17	.....	67	177	227	67	17	13
10	9	17	.....	67	161	193	67	17	13
11	9	17	.....	57	146	27	67	17	13
12	13	17	.....	48	253	33	57	17	13
13	13	17	.....	48	244	27	57	17	13
14	13	17	.....	40	131	549	57	17	13
15	13	17	.....	40	146	459	40	17	13
16	13	17	.....	33	103	438	40	17	13
17	13	17	27	67	78	356	40	17	13
18	13	13	22	33	48	298	33	17	13
19	13	13	27	27	57	78	33	17	13
20	13	13	22	22	33	67	33	17	13
21	13	13	27	27	48	40	33	17	13
22	13	13	22	22	33	502	33	17	13
23	13	13	33	27	40	574	33	17	13
24	13	13	27	22	27	1,400	33	27	13
25	13	13	33	27	27	3,160	33	33	13
26	13	13	27	22	22	7,700	22	36	13
27	13	13	33	27	22	7,000	22	33	13
28	13	13	27	17	17	6,400	22	33	11
29	13	13	33	22	17	3,160	17	24	11
30	13	13	27	17	13	2,980	13	22	11
31	13	.....	33	.....	17	.....	40	22	.....

NOTE.—Water over the gage June 26–28; discharge estimated; see "Extremes of discharge." Discharge relation affected by ice about Nov. 30 to Mar. 16 (no gage records). Discharge estimated Nov. 30. Mean discharge Mar. 1 to 16 estimated at 7 second-feet. Discharge for other days when gage was read, computed from a fairly well defined rating curve.

Monthly discharge of Knife River near Broncho, N. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	13	9	11.6	712	B.
November	17	13	14.2	845	B.
March	.....	.....	17.2	1,060	D.
April	1,170	17	109	6,520	C.
May	253	13	76.1	4,680	B.
June	7,700	9	1,190	70,900	C.
July	525	13	80.1	4,960	B.
August	161	17	29.3	1,800	B.
September	19	11	13.5	803	C.

NOTE.—See footnote to table of daily discharge.

HEART RIVER NEAR RICHARDTON, N. DAK.

LOCATION.—In or near sec. 21, T. 138 N., R. 92 W., about 11 miles south of Richardton, opposite observer's house, which is a mile below highway bridge at which station was formerly maintained.

DRAINAGE AREA.—1,250 square miles.

RECORDS AVAILABLE.—May 18, 1903, to September 30, 1914.

GAGE.—Overhanging chain gage installed May 31, 1913, opposite observer's house, at same site and datum as gage used during 1912, which was destroyed by flood March 31, 1913. Gage reader, W. F. Church.

DISCHARGE MEASUREMENTS.—At high stages made from bridge; at ordinary stages by wading.

CHANNEL AND CONTROL.—Not permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year (new chain gage), 31.7 feet at 10 a. m. June 29 (discharge, 1,550 second-feet); river reported dry July 22–27.

1903–1914: Maximum stage recorded, 25.9 feet (old staff gage) June 10, 1906 (discharge, 8,020 second-feet; river reported dry July 26 to August 11, August 20–23, 1903; September 1–19, 1905; July 22–27, 1914.

WINTER FLOW.—Discharge relation affected by ice.

ACCURACY.—Results only fair. Measurements of high and medium stages insufficient to define upper part of rating curve.

Discharge measurements of Heart River near Richardton, N. Dak., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 12	O. Christianson	24.90	82
Aug. 12	E. F. Chandler	24.50	27
Sept. 6	.....do.....	[a] 24.74	7.2

[a] Beaver dam below station.

Daily discharge, in second-feet, of Heart River near Richardton, N. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.
1	6	15	15	.....	20	17	862	390
2	6	15	15	.....	20	17	372	320
3	8	15	15	.....	20	20	241	138
4	8	15	15	.....	20	14	181	113
5	8	15	15	1,390	20	75	125	91
6	8	15	15	901	28	55	70	.....
7	8	15	.....	256	32	119	41	.....
8	10	15	.....	188	28	131	70	.....
9	10	15	.....	145	36	55	60	.....
10	15	15	.....	107	41	36	50	.....
11	15	15	.....	85	50	28	41	.....
12	15	15	.....	55	55	24	36	.....
13	15	15	.....	85	65	20	32	.....
14	12	15	.....	75	96	65	28	.....
15	12	15	.....	65	218	707	24	.....
16	12	15	.....	65	188	596	20	.....
17	10	15	.....	55	145	515	17	.....
18	10	15	.....	46	102	1,200	14	.....
19	10	15	.....	46	85	862	11	.....
20	10	15	.....	36	456	354	3	.....
21	15	15	.....	36	159	218	1.5	.....
22	15	15	.....	36	102	337	.6	.....
23	15	15	.....	28	75	381	.2	.....
24	15	15	.....	28	55	555	.1	.....
25	15	15	.....	28	46	466	.0	.....
26	15	15	.....	20	41	437	.0	.....
27	15	15	.....	20	36	428	.0	.....
28	15	15	.....	20	32	1,060	1.0	.....
29	15	15	.....	20	28	1,550	1,080	.....
30	15	15	.....	20	20	1,390	1,480	.....
31	15	.....	.....	.....	20	.....	836	.....

NOTE.—Discharge determined as follows: Oct. 1 to Dec. 6 and Apr. 5 to Sept. 30, from two well-defined rating curves. Discharge relation affected by ice Dec. 7 to Apr. 4 (gage records fragmentary) about one-fourth mile below gage and by beaver dams from about Aug. 6 to Sept. 30. Dams repeatedly destroyed under direction of gage observer, but persistently rebuilt by beavers. Mean discharge Apr. 1–4 estimated at 5 second-feet; Aug. 6–31 at 30 second-feet; Sept. 1–30, at 8 second-feet.

Monthly discharge of Heart River near Richardton, N. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	15	6	12.0	738	C.
November	15	15	15.0	893	C.
April	1,390	.....	[a] 129	7,680	B.
May	456	20	75.4	4,640	B.
June	1,550	14	391	23,300	B.
July	1,480	0	184	11,300	B.
August	390	.....	[a] 59.1	3,630	D.
September	.....	.....	[b] 8	476	

[a] Partly estimated. [b] Estimated.

NOTE.—See footnote to table of daily discharge.

CANNONBALL RIVER NEAR STEVENSON, N. DAK.

LOCATION.—Near south side of sec. 20, T. 133 N., R. 82 W., on the Standing Rock Indian Reservation, at M. H. Burdick's house immediately above the ford, about a mile southeast of the Stevenson schoolhouse and about 5 miles south of Timmer; about a mile above gage at old Stevenson station, at which observations are occasionally made.

DRAINAGE AREA.—3,650 square miles.[1]

RECORDS AVAILABLE.—June 10, 1903, to November 30, 1908; August 9, 1911, to September 30, 1914.

GAGE.—Chain gage on projecting cantilever timber on west side of river. Gage reader, Mrs. M. H. Burdick.

DISCHARGE MEASUREMENTS.—At low and medium stages made by wading at ford 15 rods below gage or at the riffle 55 rods below; at high stages measurements may be made by use of car and cable at old Stevenson station, about a mile downstream. Discharge practically the same at the two points, except that a small draw, which enters midway between the gage and the cable on the north side carries a small flow for a few hours after a rain.

CHANNEL AND CONTROL.—Bed of stream composed of gravel and stones; in places covered with silt to the depth of a foot. During floods the silt may be washed away and later redeposited in places. At the rapids 600 feet below the gage the bed is of clean gravel and stones.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 19.8 feet at 8 p. m., June 27 (discharge, 5,160 second-feet); river reported dry October 19–24, November 9–12, 18–19, and December 18–19, 26–31.

1903–1908 and 1911–1914: Maximum stage recorded, 21.0 feet April 2, 1912 (discharge, 6,360 second-feet); river reported dry August 12–15, September 10–11, 1904; September 29 to October 15, 1905; October 22, October 25 to November 24, 1906; September 2, 3, 10, 17, 18, November 24, 1907; August 27–28, September 13–16, 21–23, October 3–6, 11–12, 31, November 3–7, 10–14, 1908; October 19–24, November 9–12, 18–19, December 18–19, 26–31, 1913.

WINTER FLOW.—Discharge relation affected by ice.

ACCURACY.—Results only fair.

Discharge measurements of Cannonball River near Stevenson, N. Dak., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 9	O. Christianson	13.01	49	Aug. 10	E. F. Chandler	13.07	37
June 26	E. F. Chandler	17.08	1,760	Sept. 7	.....do	12.78	12.9

[1] Revised since publication of Water-Supply Paper 356 in 1915.

Daily discharge, in second-feet, of Cannonball River near Stevenson, N. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	1	4	3	83	70	83	1,030	90	28
2	1	4	2	137	47	70	718	52	28
3	1	3	1	97	42	97	612	47	20
4	1	2	1	70	32	28	545	42	20
5	2	2	1	47	590	293	380	32	14
6	4	2	1	70	310	260	380	47	20
7	7	1	2	64	146	276	293	42	14
8	7	1	1	32	97	215	202	42	14
9	12	.4	2	37	70	166	120	37	17
10	7	.7	1	64	52	420	104	42	9
11	4	.4	2	32	76	142	128	37	11
12	3	.7	2	37	146	32	120	37	9
13	2	1	1	37	64	660	112	32	17
14	2	1	3	70	58	2,140	90	28	37
15	2	1	2	83	47	1,130	76	28	112
16	1	1	1	97	37	768	76	20	14
17	1	1	1	90	47	310	83	17	156
18	1	.4	.4	70	42	276	76	28	70
19	.7	.4	.4	97	37	260	76	58	37
20	.4	1	.....	146	37	215	70	70	28
21	.4	1	.....	166	32	850	64	58	20
22	.4	1	.....	276	37	3,260	52	47	14
23	.3	1	.....	146	28	1,940	47	64	14
24	.3	1	.....	97	32	718	42	52	14
25	1	2	.....	70	37	568	37	37	11
26	3	2	.....	58	47	1,180	32	42	9
27	19	3	.....	64	58	4,680	24	28	5
28	18	1	.....	58	70	4,440	17	28	2
29	12	1	.....	64	137	2,820	718	24	2
30	7	2	.....	52	83	1,310	260	20	2
31	5	.....	.....	.....	97	.....	137	20	.....

NOTE.—Discharge determined from two fairly well defined rating curves applicable Oct. 1 to Dec. 20 and Mar. 2 to Sept. 30. Discharge Oct. 31 estimated at 5 second-feet.

Discharge relation affected by ice about Dec. 19 to Mar 31; observer reported river frozen Dec. 19 and "frozen to bottom" Feb. 14; "water over ice" Mar. 3, 12, and 31; and "ice gone" Apr. 4.

No gage height record available Oct. 31; Dec. 20, 22-25, 28, 31; Jan. 1-3, 5, 7, 9, 12, 14, 16, 18-30; Feb. 1-13, 15-26, 28; and Mar. 1.

Monthly discharge of Cannonball River near Stevenson, N. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	19	0.3	4.08	251	C.
November	4	.3	1.43	85	C.
April	276	32	83.7	4,980	C.
May	590	28	87.3	5,370	C.
June	4,680	28	987	58,700	B.
July	1,030	17	217	13,300	B.
August	90	17	40.3	2,480	A.
September	37	2	25.6	1,520	B.

NOTE.—See footnote to table of daily discharge.

NORTH BRANCH OF GRAND RIVER AT HALEY, N. DAK.

LOCATION.—Near the northeast corner of sec. 36, T. 129 N., R. 100 W., about 20 rods south of the post office at Haley.

DRAINAGE AREA.—500 square miles.

RECORDS AVAILABLE.—May 17, 1908, to September 30, 1914.

GAGE.—Gage heights obtained by measuring distance from bench mark to water surface by means of a metallic tape weighted at the end. Observer, H. N. Lungwitz.

DISCHARGE MEASUREMENTS.—Made from highway bridge at gage.

CHANNEL AND CONTROL.—Bed of stream composed of gravel and silt.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.45 feet, at 7.50 p. m., June 21 (discharge, 5,060 second-feet, from discharge measurement); river reported dry October 1 to November 8 and May 25 to June 13.

1908–1914: Maximum stage recorded, 9.85 feet, at 12 m., March 31, 1913 (discharge, 5,810 second-feet, from discharge measurement); river reported dry August 9–15, 1908; October 1 to November 8, 1913; May 25 to June 13, 1914. Datum unchanged; difference in discharge relation is due to shifting channel and changing stage.

WINTER FLOW.—Discharge relation affected by ice.

ACCURACY.—Results fair except for low stages, when the percentage of error is very large.

Discharge measurements of North Branch of Grand River at Haley, N. Dak., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 3	H. N. Lungwitz	6.95	401	June 21	H. N. Lungwitz	10.52	5,000
3	do	5.20	367	21	do	11.35	5,060
3	do	5.95	465	22	do	9.90	2,360
3	do	5.45	663	22	do	6.80	1,110
4	do	3.75	279	22	do	6.10	836
4	do	4.15	304	Aug. 9	E. F. Chandler	1.29	3.4
5	do	2.85	128				

Daily discharge, in second-feet, of North Branch of Grand River at Haley, N. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.3	0.3	.....	39	1.3	0.0	39	156	3.9
2	.3	.3	.....	180	1.3	.0	30	144	3.9
3	.3	.3	.....	530	1.3	.0	26	132	3.9
4	.3	.3	.....	292	1.3	.0	16	108	3.9
5	.3	.3	.....	96	1.3	.0	11	78	3.9
6	.3	.3	.....	66	1.3	.0	11	55	3.9
7	.3	.3	.....	39	1.3	.0	11	22	3.9
8	.3	.3	.....	13	1.3	.0	9	11	3.9
9	.3	.....	.....	9	1.3	.0	7	5	3.9
10	.3	.....	.....	7	1.3	.0	7	5	3.9
11	.3	.....	.....	5	1.3	.0	7	5	3.9
12	.3	.....	.....	3.3	1.3	.0	6	3.3	3.9
13	.3	.....	.....	2.2	1.3	.3	5	3.3	3.9
14	.3	.....	39	1.3	1.3	6	5	2.2	3.9
15	.3	.....	34	1.3	1.3	39	5	2.2	3.9
16	.3	.....	39	1.3	1.3	55	3.3	2.2	3.9
17	.3	.....	49	1.3	1.3	16	3.3	2.2	2.2
18	.3	.....	49	1.3	1.3	7	3.3	2.2	2.2
19	.3	.....	11	1.3	5	4	3.3	310	2.2
20	.3	.....	5	1.3	3.3	3.3	3.3	138	2.2
21	.3	.....	2.2	1.3	2.2	1,350	3.3	90	2.2
22	.3	.....	3.3	1.3	2.2	1,940	2.2	72	2.2
23	.3	.....	7	1.3	1.7	324	2.2	60	2.2
24	.3	.....	11	1.3	1.3	168	2.2	44	2.2
25	.3	.....	11	1.3	.5	108	2.2	30	2.2
26	.3	.....	11	1.3	.5	60	2.2	13	2.2
27	.3	.....	11	1.3	.2	49	2.2	7	2.2
28	.3	.....	11	1.3	.2	49	2.2	6	2.2
29	.3	.....	11	1.3	.2	44	138	5	2.2
30	.3	.....	11	1.3	.0	39	213	5	2.2
31	.3	.....	11	.....	.0	.....	162	5	.....

NOTE.—Discharge Oct. 1 to Nov. 8, computed from a rating curve fairly well defined at the prevailing stage; Mar. 14 to Sept. 30, computed from a fairly well defined rating curve; see "Accuracy." Observer reported as follows: Nov. 8, river frozen; Mar. 14, ice running; Apr. 1, ice gone. No gage records Nov. 9 to Mar. 13.

Monthly discharge of North Branch of Grand River at Haley, N. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	0.3	0.3	0.30	18	(a)
November	.3	.3	.30	18	
March 14-31	49	2.2	18.1	646	(a)
April	530	1.3	43.5	2,590	B.
May	5	.0	1.32	81	(a)
June	b1,940	.0	142	8,450	C.
July	213	2.2	24.0	1,480	B.
August	310	2.2	49.1	3,020	B.
September	3.9	2.2	3.11	185	(a)

a See "Accuracy" in station description.
b Mean for the day. Maximum discharge, about 5,000 second-feet.

GRAND RIVER NEAR WAKPALA, S. DAK.

LOCATION.—In the SW. ¼ sec. 9, T. 19 N., R. 29 E., at new steel highway bridge, 4 miles south of Wakpala, a station on Chicago, Milwaukee & St. Paul Railway.

DRAINAGE AREA.—5,410 square miles.[1]

RECORDS AVAILABLE.—September 9, 1911, to September 30, 1914.

GAGE.—Standard chain gage on foot guardrail at downstream side of highway bridge. Observers, George Baine and James Soft.

DISCHARGE MEASUREMENTS.—Made from highway bridge; at very low stages measurements may be made by wading at the ford, 40 rods below the bridge.

CHANNEL AND CONTROL.—Bed composed of soft silt or quicksand; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.3 feet at 9.20 a. m. June 15–16 (discharge, 3,950 second-feet); river reported dry October 1–4. 1911–1914: Maximum stage recorded, 12.3 feet June 15–16, 1914 (discharge, 3,950 second-feet); river reported dry October 1–4, 1913.

ACCURACY.—Results fair.

Discharge measurements of Grand River near Wakpala, S. Dak., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 1	O. Christianson	a 2.70	13	June 24	E. F. Chandler	11.07	3,170
Apr. 8	do	5.82	622	Aug. 7	do	4.81	190
June 23	E. F. Chandler	7.49	1,650	Sept. 8	do	3.99	51
24	do	9.98	2,890				

a Ice present at gage.

[1] Revised since last report was issued, in 1915.

Daily discharge, in second-feet, of Grand River near Wakpala, S. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.1	13	a 100	20	8	1,300	1,300	140
2	a .1	.....	a 150	15	195	950	1,200	130
3	a .2	.....	a 200	11	195	310	1,200	120
4	.2	.....	a 300	11	290	72	450	86
5	a 12	.....	a 400	33	310	a 390	310	50
6	a 36	.....	a 500	270	450	700	195	a 38
7	96	.....	a 600	550	355	650	120	26
8	a 103	.....	650	1,150	195	550	60	60
9	110	.....	a 600	950	102	400	a 73	33
10	a 54	.....	a 400	700	60	400	86	a 30
11	28	.....	a 300	120	60	377	86	26
12	a 25	.....	195	165	165	195	79	41
13	22	.....	120	180	195	102	60	26
14	a 22	.....	86	270	3,500	94	41	26
15	a 18	.....	a 65	230	3,950	26	26	17
16	a 17	.....	41	140	3,950	17	a 23	15
17	a 15	.....	a 35	140	3,300	13	20	11
18	13	.....	26	86	2,800	11	17	a 22
19	a 13	.....	a 35	120	2,450	5	165	33
20	a 13	.....	50	102	1,900	8	355	50
21	a 13	.....	a 40	60	1,900	6	800	60
22	a 13	.....	a 30	20	1,850	6	950	a 72
23	13	.....	23	11	1,520	5	800	72
24	a 10	.....	15	6	3,250	5	750	45
25	9	.....	11	6	2,450	5	600	41
26	a 10	.....	a 20	8	2,200	3	a 500	26
27	a 10	.....	23	8	2,050	3	400	26
28	a 11	.....	23	a 8	2,150	2	a 320	a 23
29	a 12	.....	20	8	2,120	1.7	230	20
30	a 12	.....	a 20	10	1,350	1.5	230	a 18
31	a 12	.....	.....	9	.....	1,300	165	.....

a Estimated or interpolated; gage not read.

NOTE.—Discharge determined from two well-defined rating curves applicable Oct. 1–31 and Apr. 8 to Sept. 30. Discharge relation affected by ice about Nov. 1 to Apr. 7. No gage records Nov. 2 to Mar. 31.

Monthly discharge of Grand River near Wakpala, S. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	110	0.1	23.3	1,430	C.
April	650	11	169	10,100	D.
May	1,150	6	175	10,800	B.
June	3,950	8	1,510	89,800	B.
July	1,300	1.5	255	15,700	B.
August	1,300	17	375	23,100	B.
September	140	11	46.1	2,740	C.

NOTE.—See footnote to table of daily discharge.

CHEYENNE RIVER NEAR CASCADE SPRINGS, S. DAK.

LOCATION.—In sec. 9, T. 9 S., R. 5 E., a mile above the dam site of the proposed Angostura irrigation project, and about 5 miles south of Cascade Springs; 2½ miles below Cascade Creek, the nearest tributary.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 11 to 30, 1914. A station was maintained at Edgemont June 19, 1903, to November 30, 1906, but the flow is not directly comparable with that at this station as a number of small tributaries intervene.

A. CHAIN GAGE ON BRIDGE NEAR WASTA.

B. SLOPE GAGE AND WATER-STAGE RECORDER NEAR CASCADE SPRINGS.

GAGING STATIONS ON CHEYENNE RIVER, S. DAK.

GAGE.—Friez water-stage recorder. Observer, Fred Noerenberg.

DISCHARGE MEASUREMENTS.—Made from cable during high water and by wading at low stages. (See Pl. III, *B*.)

CHANNEL AND CONTROL.—Data too meager to determine.

WINTER FLOW.—The spring water from Cascade Creek is said to prevent formation of ice except for brief periods.

DIVERSIONS.—Permits granted for diversions above this station of 93.4 second-feet from Cheyenne River and of 43.38 second-feet from Cascade Springs.

ACCURACY.—Conditions favorable for accurate results; base data apparently excellent.

COOPERATION.—Station maintained in cooperation with the State engineer, who was making a wading measurement when the photograph reproduced in Plate III, *B*, was taken.

Discharge measurements of Cheyenne River near Cascade Springs, S. Dak., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 11	Derr and Fletcher	1.28	51
12	....do	1.17	42
18	....do	1.00	28

Daily discharge, in second-feet of Cheyenne River near Cascade Springs, S. Dak., for the year ending Sept. 30, 1914.

Day.	Sept.	Day.	Sept.	Day.	Sept.	Day.	Sept.
11	57	16	34	21	29	26	28
12	42	17	31	22	29	27	28
13	40	18	28	23	28	28	27
14	38	19	28	24	27	29	27
15	36	20	29	25	27	30	27

NOTE.—Discharge determined from a well-defined rating curve. No gage records Sept. 13–17, 19, and 26; discharge interpolated. Mean discharge, September 11–30, 32.0 second-feet (1,270 acre-feet).

CHEYENNE RIVER NEAR WASTA, S. DAK.

LOCATION.—In sec. 2, T. 1 N., R. 14 E., at the highway bridge 3 miles east of Wasta. (See Pl. III, *A*.) Nearest tributary, a small stream entering from the south a short distance upstream.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 30 to September 30, 1914.

GAGE.—Chain gage fastened to bridge; read morning and evening.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Shifting.

WINTER FLOW.—Channel freezes over and observations are temporarily discontinued.

DIVERSIONS.—Permits granted for diversion of 484.62 second-feet for irrigation from Cheyenne River and its tributaries between the Cascade Springs and Wasta stations and of 1,277 second-feet for power from tributaries. Below the Wasta station permits have been granted for diversions of 207 second-feet for irrigation from the Cheyenne and its tributaries.

COOPERATION.—Station maintained in cooperation with the State engineer.

No estimates of discharge because of insufficient measurements and shifting control.

Discharge measurements of Cheyenne River near Wasta, S. Dak., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 16	Follansbee and Derr		113
30	Derr and Quinney	2.47	730
Sept. 8	do	1.71	170

Daily gage height, in feet, of Cheyenne River near Wasta, S. Dak., for the year ending Sept. 30, 1914.

[R. B. Keller, observer.]

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1		1.05	1.50	11		3.50	1.49	21		1.46	1.30
2		4.85	1.56	12		2.03	1.41	22		2.86	1.30
3		4.16	1.82	13		1.82	2.32	23		3.01	1.28
4		2.83	1.47	14		1.75	1.94	24		2.06	1.28
5		2.65	1.38	15		1.74	1.86	25		2.86	1.28
6		2.14	1.43	16		1.73	1.60	26		2.27	1.28
7		2.12	1.56	17		2.16	1.32	27		1.86	1.28
8		1.92	1.69	18		1.86	1.28	28		1.66	1.26
9		1.67	1.63	19		1.88	1.30	29		1.58	1.26
10		1.39	1.56	20		1.55	1.30	30	2.02	1.58	1.26
								31	1.08	1.56	

BELLE FOURCHE RIVER NEAR BELLE FOURCHE, S. DAK.

LOCATION.—In sec. 2, T. 8 N., R. 2 E., at the diversion dam of the Belle Fourche irrigation project, 1½ miles below Belle Fourche.

DRAINAGE AREA.—4,270 square miles.

RECORDS AVAILABLE.—May 10 to November 30, 1906; January 1, 1912, to September 30, 1914. Records of flow which did not account for certain diverted water returned to river below station were obtained in 1910 and 1911, but have not been published, May 26, 1903, to June 23, 1906, a station was maintained at the west outskirts of Belle Fourche. Records at this point are not directly comparable with those at this station as Redwater River enters between the two stations

GAGE.—Inclined staff 100 feet from the crest of the diversion dam, and a gage in the canal. See "Computation of discharge."

COMPUTATION OF DISCHARGE.—The following information was supplied by the United States Reclamation Service:

The records of daily discharge represent the entire flow of the river at the diversion dam and have been corrected for such quantities as were diverted through Inlet canal and such as passed through the sluice gates. The diversion dam acts as a weir; the crest is 400 feet long; the gage is located about 100 feet from the crest and is read twice daily. Careful discharge measurements were made in the river above and below the dam before the coefficient was established, and the discharge rating table as originally computed has not been changed. The amount diverted is determined at a gaging station maintained on Inlet canal, and the discharge rating curve is checked by frequent discharge measurements. The sluice gates are seldom used, and the flow through them is estimated.

DIVERSIONS.—In that part of the drainage area in Wyoming there were prior to July 1, 1914, adjudicated diversions of 25 second-feet from Belle Fourche River and 237 second-feet from tributaries. In South Dakota there are authorized diversions of 102 second-feet from Belle Fourche River and approximately 2,500 second-feet from tributaries. Below the station there are authorized diversions of 3,102 second-feet from Belle Fourche River.

ACCURACY.—The United States Reclamation Service considers the records as of a fair to good degree of accuracy.

COOPERATION.—Station maintained and records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Belle Fourche River near Belle Fourche, S. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	490	275	245	330	330	330	295	329	346	72	1,100	197
2	490	275	245	330	330	400	312	329	312	72	3,750	197
3	490	275	245	330	330	400	365	329	312	72	4,930	197
4	490	275	245	330	330	400	365	329	312	72	1,970	99
5	512	275	245	330	330	400	346	329	1,010	72	779	197
6	420	275	245	330	330	400	346	329	831	72	653	197
7	400	275	245	330	330	330	346	329	479	72	518	197
8	350	275	245	330	330	330	295	295	365	53	322	197
9	320	275	245	330	330	330	295	295	295	53	279	197
10	320	275	245	330	330	344	295	295	246	53	340	197
11	320	275	245	330	330	362	295	387	246	305	200	197
12	320	275	245	330	330	362	295	413	246	192	262	197
13	320	270	245	330	330	362	295	346	596	71	197	197
14	320	270	245	330	330	321	228	321	1,350	89	181	197
15	320	270	245	330	330	279	228	295	312	140	153	197
16	320	270	245	330	365	279	228	517	312	140	153	197
17	320	270	245	330	400	295	228	479	197	72	127	197
18	320	270	245	330	400	295	262	793	197	53	127	197
19	320	270	245	330	330	295	262	518	167	53	127	197
20	320	270	245	330	330	295	262	479	167	37	*127	197
21	320	270	245	330	330	262	262	479	167	72	153	200
22	320	270	245	330	330	262	295	479	154	72	167	400
23	320	260	245	330	330	279	295	479	140	72	556	400
24	320	260	245	330	330	295	295	1,180	116	72	365	400
25	320	260	245	330	330	295	295	756	116	72	295	400
26	320	250	245	330	330	295	295	756	72	0	279	400
27	320	245	245	330	330	295	148	854	72	0	279	400
28	320	245	245	330	330	295	165	556	72	0	279	330
29	320	245	245	330	.....	295	329	479	72	0	279	260
30	320	245	245	330	.....	295	329	346	72	1,030	197	260
31	320	.....	245	330	.....	295	.....	346	.....	556	197	.....

NOTE.—Records show the combined flow of river and canal at the diversion dam.

Monthly discharge of Belle Fourche River near Belle Fourche, S. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	512	245	355	21,800
November	275	245	267	15,900
December	245	245	245	15,100
January	330	330	330	20,300
February	400	330	336	18,700
March	400	262	322	19,800
April	365	148	285	17,000
May	1,180	295	466	28,700
June	1,350	72	312	18,600
July	1,030	0	121	7,440
August	4,930	127	624	38,400
September	400	99	243	14,500
The year	4,930	0	326	236,000

NOTE.—Monthly discharge computed by engineers of the United States Geological Survey.

WHITE RIVER NEAR INTERIOR, S. DAK.

LOCATION.—Near the southwest corner of sec. 7, T. 4 S., R. 18 E., at steel highway bridge on the Pine Ridge Indian Reservation, where the boundary line between Stanley and Pennington counties intersects White River, 3 miles southwest of Interior, a station on Chicago, Milwaukee & St. Paul Railway.

DRAINAGE AREA.—4,090 square miles. The area above present site is about 15 square miles less than that above the station maintained 1904–1906.

RECORDS AVAILABLE.—August 24, 1911, to September 30, 1914. June 24, 1904, to November 30, 1906, at old station near the southwest corner of sec. 10, T. 4 S., R. 18 E. (records given in following tables).

GAGE.—A vertical rod attached to lower side of first pier (nearest the shore) at left end of bridge, installed August 31, 1911, and supposed to read the same as temporary rod gage placed August 24 on a tree on left bank at turn of river near southwest corner of the NW. ¼ sec. 17. Gages used at this station 1904–1906 are described in Water-Supply Papers 130, page 181; 172, page 166; 208, page 135. Observers, G. L. Johnson and George Carlbom.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Control probably changes gradually. Bed composed of sand and some quicksand; left bank steep and clean; right bank gently sloping and clean; current medium. At low stages all the water may pass under one span (67-foot) of bridge; at highest stage water passes under two 67-foot spans and 120 feet of trestle approach, but probably two-thirds of the flow passes under the two spans.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.8 feet at 8.30 p. m. June 30 (discharge, 2,630 second-feet); river reported dry July 13–15, 19–29, and September 26–30.

1904–1906 and 1911–1914: Maximum stage recorded, 15.1 feet July 4, 1905 (discharge, 14,900 second-feet); river reported dry Augusta 27–28, 1905, and July 13–15, 19–29, September 26–30, 1914.

WINTER FLOW.—Discharge relation affected by ice.

ACCURACY.—Results fair. See footnote to table of daily discharge relative to period June 24, 1904, to November 30, 1906.

Discharge measurements of White River near Interior, S. Dak., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 28	O. Christianson	[a] 3.50	6.2
Apr. 5	....do	3.76	61
Aug. 3	E. F. Chandler	3.99	102

[a] Ice at gage.

Daily discharge, in second-feet, of White River near Interior, S. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	20	19	35	.....	55	651	105	657	657	23
2	20	19	38	.....	54	595	99	300	690	33
3	20	23	33	.....	54	537	256	188	485	129
4	20	33	30	657	52	272	280	90	365	42
5	170	38	90	342	52	264	235	49	260	27
6	248	105	55	240	52	205	188	33	105	26
7	240	135	18	300	47	188	120	26	42	25
8	135	81	15	880	47	142	222	16	18	21
9	53	48	20	950	45	105	95	12	7	16
10	55	42	38	657	45	73	212	10	5	14
11	53	38	36	329	42	226	102	9	850	13
12	33	36	20	312	42	657	240	3	460	18
13	48	33	15	288	42	300	120	0	205	163
14	35	33	15	264	42	248	75	0	42	188
15	33	33	15	248	42	198	222	0	410	75
16	33	33	.....	248	42	111	152	260	170	23
17	33	33	.....	198	55	99	210	152	71	17
18	32	35	.....	198	135	75	108	65	32	14
19	32	35	.....	163	90	765	81	0	18	9
20	32	35	.....	184	55	613	135	0	10	6
21	32	35	.....	170	45	272	387	0	26	5
22	32	36	.....	135	42	264	188	0	765	5
23	32	42	.....	99	63	240	105	0	410	4
24	33	41	.....	111	613	177	52	0	90	4
25	33	39	.....	105	222	142	42	0	33	4
26	33	37	.....	81	807	111	35	0	25	0
27	20	38	.....	55	1,270	280	28	0	24	0
28	19	39	.....	105	1,370	260	450	0	20	0
29	20	38	.....	73	868	188	565	0	19	0
30	20	35	.....	59	816	135	1,950	20	18	0
31	19	.....	.....	55	.....	105	.....	188	17	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve except as follows: Oct. 27 to Nov. 4 and Dec. 3–15 (discharge relation affected by ice) from gage-height and temperature records; mean discharge Dec. 16–31 (discharge relation affected by ice) estimated at 14 second-feet; Mar. 1–3 (discharge relation affected by ice) estimated at 270 second-feet. Observer reported river frozen solid Feb. 6 and ice breaking Mar. 3. Water standing in pools July 13–15, 19–29, and Sept. 26–30 (no gage records). Gage not read Dec. 14–19, 21–31, Jan. 1, 2, 4–9, 11–16, 18–23, 25–30, Feb. 1–13, 15–20, 22–27.

Apparent discrepancies between measured discharge as given in the table of discharge measurements and mean discharge for the same day as given above are due for the most part to the "flashiness" of the stream. The river was falling rapidly when the discharge measurement was made on Aug. 3.

Monthly discharge of White River near Interior, S. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	248	.....	[a] 52.8	3,250	B.
November	135	.....	[a] 42.2	2,510	B.
December	90	.....	[a] 22.5	1,380	C.
March	950	55	[a] 268	16,500	B.
April	1,370	42	2.40	14,300	B.
May	765	73	274	16,800	B.
June	1,950	28	232	13,800	B.
July	657	.....	67.0	4,120	B.
August	850	5	205	12,600	B.
September	188	.....	30.1	1,790	B.

[a] Partly estimated. See footnote to table of daily discharge.

Discharge measurements of White River near Interior, S. Dak., from 1904–1906; 1912–13.

Date.	Made by—	Gage height.[a]	Discharge.	Date.	Made by—	Gage height.[a]	Discharge.
1904.		*Feet.*	*Sec.-ft.*	1906.		*Feet.*	*Sec.-ft.*
June 24	F. M. Madden	1.90	79	Apr. 4	John E. Stewart	2.70	335
Aug. 11	do	1.55	9.5	May 24	do	2.58	192
Sept. 21	do	1.55	4.7	Aug. 30	do	3.29	483
1905.				1912.			
May 24	H. D. Comstock	1.80	88	June 28	E. F. Chandler	[b] 1.68	27.6
June 29	do	3.06	479	1913.			
Aug. 31	do	2.03	88	Apr. 6	W. B. Stevenson	[c] 6.12	2,130
				June 14	do	(d)	1,650

[a] Referred to datum of gage at old station.
[b] Gage at new station read 3.32 feet.
[c] Gage at new station read 6.42 feet.
[d] Gage at new station read 6.27 feet.

Daily discharge, in second-feet, of White River near Interior, S. Dak., for the period June 24, 1904, to Nov. 30, 1906.

Old station.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1904.					1904.				
1		39	14	2,520	16		128	3	10
2		28	14	892	17		128	141	10
3		238	14	316	18		268	238	10
4		405	76	115	19		102	89	10
5		181	28	89	20		102	50	10
6		1,040	76	141	21		209	14	6
7		715	63	141	22		154	6	6
8		223	28	168	23		102	3	10
9		209	14	89	24	76	50	1.8	10
10		181	14	63	25	76	154	1.4	10
11		209	10	39	26	76	50	1.0	21
12		445	6	39	27	63	28	.8	10
13		445	6	21	28	50	28	.5	10
14		485	6	21	29	28	28	1.0	10
15		300	3	10	30	28	50	181	10
					31		28	128	

	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1904–5.									
1	14	10		445	115	386	790	3,020	89
2	14	10		980	284	1,880	6,240	1,440	63
3	14	3		1,440	1,060	1,740	12,700	1,040	63
4	6	3		445	3,840	1,060	14,900	870	154
5	50	3		268	2,710	141	3,180	525	141
6	14	3		238	2,520	89	2,210	405	115
7	28	3		181	1,410	89	1,500	333	63
8	14	3		195	640	115	1,470	181	39
9	14	6		181	425	89	1,280	154	50
10	14	6		181	386	50	1,110	154	50
11	14	14		181	284	39	1,500	128	50
12	14	28		128	253	89	1,470	1,540	50
13	154	21		300	223	39	1,060	1,500	50
14	50	28		300	168	115	843	1,040	50
15	50	28		665	168	223	465	1,080	50
16	50	39		665	141	465	425	892	50
17	39	50		445	115	1,060	351	815	50
18	39	50		368	115	16,500	253	765	50
19	28	50	368	300	89	2,250	223	765	50
20	28	39	333	268	89	2,250	952	525	50
21	28	50	333	238	89	1,670	425	405	50
22	28	50	316	238	63	1,540	1,540	268	50
23	21	50	316	209	115	1,340	592	209	50
24	14	50	333	128	89	1,220	505	154	50
25	14	63	333	128	115	1,110	386	154	50
26	14	63	405	102	115	1,060	351	128	28
27	14	50	425	102	115	460	316	128	28
28	14	39	405	102	115	660	1,060	128	28
29	14	28	425	102	1,940	980	3,180	128	14
30	14	28	181	102	592	925	3,180	128	14
31	10		154		465		3,180	128	

Daily discharge, in second-feet, of White River near Interior, S. Dak., for the period June 24, 1904, to Nov. 30, 1906—Continued.

	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1905–6.									
1	28	115	.....	640	2,020	505	76	300	223
2	28	223	.....	640	2,470	640	76	181	195
3	50	89	.....	547	1,510	316	50	76	195
4	50	89	.....	316	870	316	50	154	141
5	50	89	.....	284	1,080	253	50	128	115
6	50	89	.....	253	333	253	268	102	89
7	50	89	.....	223	209	284	102	102	89
8	50	89	.....	195	102	350	76	128	89
9	50	89	.....	141	102	253	50	128	141
10	50	89	.....	141	50	195	50	128	141
11	63	89	268	141	14	141	14	102	115
12	63	89	268	386	14	141	6	102	115
13	63	89	268	350	14	115	3	76	898
14	76	89	268	253	765	115	870	76	465
15	76	89	268	223	405	89	570	76	386
16	76	89	268	195	102	195	300	28	465
17	63	89	268	223	102	740	102	14	386
18	50	89	268	253	102	592	102	14	386
19	76	89	268	223	102	547	76	268	952
20	154	89	268	223	102	425	76	3,410	1,280
21	128	89	268	223	102	350	50	3,070	952
22	128	89	268	253	128	223	50	1,700	386
23	128	89	268	253	445	168	50	1,200	316
24	102	89	1,840	350	181	168	14	445	316
25	102	89	4,740	740	268	115	6	368	592
26	102	89	3,180	505	570	790	6	925	1,540
27	102	115	2,560	253	268	386	1,200	715	842
28	128	141	2,210	223	405	168	368	715	547
29	128	141	2,470	350	1,380	115	300	485	465
30	128	141	925	842	765	115	238	268	168
31	102	.....	815	.....	570	.....	28	268	.....

Day.	Oct.	Nov.	Day.	Oct.	Nov.	Day.	Oct.	Nov.
1906.			1906.			1906.		
1	168	238	11	141	154	21	842	102
2	141	209	12	141	181	22	640	102
3	168	154	13	141	128	23	386	102
4	195	102	14	141	102	24	386	102
5	195	102	15	141	102	25	351	102
6	195	102	16	141	102	26	284	102
7	195	102	17	141	102	27	253	102
8	168	102	18	141	102	28	195	102
9	168	102	19	1,470	102	29	195	128
10	141	102	20	952	102	30	168	128
						31	195	.....

NOTE.—Discharge determined by Stout's method for shifting channels. The standard rating curve was determined from 9 discharge measurements made at the station during 1904, 1905, and 1906, and 2 measurements made at the new station, 4 miles upstream, in 1913, and referred to datum of gage at old station; the rating curve is not well defined. The changes made in gage heights before using the rating table did not exceed 0.25 foot in any month, and in most months were relatively small. The results thus obtained are apparently fair, but as they are subject to some uncertainty, particularly at low stages, because of the shifting channel and control, the results should be used with due caution.

Monthly discharge of White River near Interior, S. Dak., for the period June 24, 1904, to Nov. 30, 1906.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1904.				
June 24–30	76	28	56.7	787
July	1,040	28	218	13,400
August	238	.5	39.7	2,440
September	2,520	6	161	9,580
1904–5.				
October	154	6	26.9	1,650
November	63	3	28.9	1,720
March 19–31	425	154	333	8,590
April	1,440	102	321	19,100
May	3,840	63	608	37,400
June	16,500	39	1,320	78,600
July	14,900	223	2,150	132,000
August	3,020	128	617	37,900
September	154	14	56.3	3,350
1905–6.				
October	154	28	80.5	4,950
November	223	89	100	5,950
March 11–31	4,740	268	1,060	44,100
April	842	141	328	19,500
May	2,470	14	501	30,800
June	790	89	302	18,000
July	1,200	3	170	10,500
August	3,410	14	508	31,200
September	1,540	89	433	25,800
1906.				
October	1,470	141	296	18,200
November	238	102	119	7,080

NOTE.—See footnote to table of daily discharge.

WHITE RIVER NEAR WESTOVER, S. DAK.

LOCATION.—In sec. 33, T. 3 S., R. 29 E., on the Rosebud Indian Reservation, at steel highway bridge near Westover, about 12 miles south and slightly east of Murdo, a station on the Chicago, Milwaukee & St. Paul Railway; about 2 miles below entrance of Little White River and about 40 rods above site of original station established in 1911.

DRAINAGE AREA.—7,850 square miles.

RECORDS AVAILABLE.—August 25, 1911, to September 30, 1914.

GAGE.—Standard chain gage on steel highway bridge; gage reader, J. E. Rawhauser. Zero of gage 2 feet higher than that of original gage. August 18, 1913, a staff gage reading same as chain gage was fastened to downstream face of left abutment of bridge.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Composed of sand and silt; likely to scour and fill at flood stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.6 feet May 4 (discharge 3,630 second-feet); minimum stage recorded, 6.7 feet July 26–31 (discharge, 26 second-feet).

1911–1914: Maximum stage recorded, 11.59 feet August 25, 1911 (discharge, 7,370 second-feet, from discharge measurement); minimum stage recorded, 5.3 November 11, 1912 (discharge, 4 second-feet).

Open-season records; flow may have been lower at times in winter months.

WINTER FLOW.—Discharge relation affected by ice.

ACCURACY.—Results apparently only fair.

Discharge measurements of White River near Westover, S. Dak., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	O. Christianson	6.96	82	Aug. 6	E. F. Chandler	8.03	631
Apr. 6	do	7.30	258	Sept. 10	do	7.16	103

Daily discharge, in second-feet, of White River near Westover, S. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	193	166	.....	290	2,010	600	100	39	75
2	193	166	.....	290	1,810	600	1,810	600	510
3	193	166	.....	290	1,440	600	1,440	1,440	430
4	193	166	.....	290	3,630	600	600	1,440	300
5	166	166	.....	290	2,220	600	600	600	205
6	166	166	.....	290	2,220	1,810	430	600	205
7	193	166	2,980	375	2,010	1,270	430	300	165
8	430	166	2,290	430	600	1,270	300	130	130
9	375	166	2,290	570	600	1,110	165	75	75
10	254	141	2,550	655	820	600	75	75	115
11	193	141	2,290	570	820	600	75	75	100
12	193	141	1,880	570	960	600	300	75	100
13	193	141	2,080	500	2,010	600	205	1,620	100
14	193	141	1,880	495	2,010	600	205	1,440	100
15	193	141	1,700	330	1,620	600	130	600	100
16	193	141	1,700	330	1,440	600	130	300	100
17	166	141	1,530	254	1,440	600	75	300	130
18	166	141	1,530	254	1,270	510	75	300	130
19	166	141	1,530	254	820	360	75	300	130
20	166	166	1,380	254	600	360	75	300	130
21	166	166	1,380	254	1,270	360	39	205	130
22	166	166	1,230	254	3,150	360	39	300	75
23	166	193	1,230	254	1,810	360	39	300	75
24	166	193	970	1,100	1,110	250	39	205	39
25	166	222	750	750	1,110	250	39	205	39
26	166	193	655	1,620	960	250	26	600	39
27	166	193	495	2,910	820	165	26	600	39
28	166	193	495	2,910	820	100	26	40	39
29	166	193	330	2,220	820	100	26	75	39
30	166	193	290	2,010	820	100	26	75	39
31	166	.....	330	.....	820	.....	26	75	.....

NOTE.—Discharge determined from two well-defined rating curves, one applicable Oct. 1 to Nov. 30, 1913, and Mar. 16 to Apr. 25, 1914, and the other Apr. 26 to Sept. 30, 1914. Gage record subject to some uncertainty. Discharge relation affected by ice about Dec. 1 to Mar. 6; mean discharge Mar. 1–6, estimated at 600 second-feet. Gage not read Dec. 23 to Mar. 5. Observer reported river frozen Dec. 22 and ice gone Mar. 7.

Monthly discharge of White River near Westover, S. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	430	166	194	11,900	C.
November	222	141	166	9,880	D.
March	2,980	.....	[a] 1,270	78,100	C.
April	2,910	254	731	43,400	B.
May	3,630	600	1,420	86,700	C.
June	1,810	100	560	33,300	C.
July	1,810	26	247	15,200	C.
August	1,620	39	441	27,100	B.
September	510	39	129	7,680	C.

[a] Partly estimated.

SOUTH FORK OF WHITE RIVER[1] NEAR WESTOVER, S. DAK.

LOCATION.—At the southwest corner of the SE. ¼ sec. 10, T. 43 N., R. 28 W., at C. H. Kendall's ranch on the Rosebud Indian Reservation about 4 miles south of Westover and about 2 miles above mouth of stream.

DRAINAGE AREA.—1,590 square miles.

RECORDS AVAILABLE.—June 26, 1912, to September 30, 1914.

GAGE.—Standard projecting timber chain gage 5 or 6 rods below the cable and on right bank; gage reader, Mrs. C. H. Kendall. A staff gage about 10 rods below cable was used in 1913 prior to September 18. A staff gage about 30 rods below the cable was used during 1912. All gages referred to same datum.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Sandy; slightly shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.95 feet at 4 p. m. April 24, 11 a. m. May 5, and 3 p. m. August 3 (discharge, 700 second-feet); minimum stage recorded, 1.95 feet (various hours) July 8–30, August 5–6, 10–13, 19 (discharge 37 second-feet).

1912–1914: Maximum stage recorded, 3.3 feet April 1, 1913 (discharge, 962 second-feet); minimum stage recorded, 1.75 feet August 23, 1913 (discharge, 31 second-feet).

Open-season records; flow may have been lower at times in winter months.

WINTER FLOW.—Discharge relation affected by ice.

ACCURACY.—Results fair.

Discharge measurements of South Fork of White River near Westover, S. Dak., during year the ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	O. Christianson	2.09	160	Aug. 5	E. F. Chandler	2.04	57
Apr. 7	do	2.22	157	Sept. 9	do	2.01	52

[1] Formerly known as Little White River.

Daily discharge, in second-feet, of South Fork of White River near Westover, S. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	49	75	.....	90	270	90	90	44	90
2	49	113	.....	90	270	90	70	37	50
3	49	113	.....	115	308	90	50	50	50
4	49	113	.....	102	289	140	50	700	50
5	49	113	.....	90	700	345	50	37	50
6	49	113	.....	90	140	140	50	37	48
7	49	113	.....	140	140	140	44	50	86
8	49	113	.....	170	58	140	37	44	48
9	49	113	.....	170	90	170	37	40	50
10	49	113	.....	170	140	140	37	37	48
11	49	113	.....	170	50	140	37	37	45
12	49	132	.....	170	82	140	37	37	45
13	49	123	.....	170	115	140	37	37	45
14	49	113	.....	170	115	90	37	50	45
15	49	113	.....	170	115	90	37	37	45
16	49	113	.....	170	102	115	37	44	42
17	49	123	.....	115	102	90	37	50	42
18	49	161	.....	115	90	70	37	50	42
19	49	161	.....	90	90	50	37	37	42
20	49	161	.....	70	90	50	37	115	42
21	49	161	.....	50	90	70	37	50	40
22	49	161	.....	50	90	90	37	115	45
23	49	161	.....	50	140	70	37	50	40
24	49	172	200	700	115	50	37	50	40
25	49	172	140	152	102	50	37	50	40
26	62	161	140	270	90	50	37	50	38
27	62	161	140	500	90	50	37	90	38
28	75	161	140	140	90	50	37	90	38
29	75	151	90	345	90	70	37	90	38
30	75	161	90	270	90	90	37	90	38
31	75	.....	90	.....	90	.....	50	90	.....

NOTE.—Discharge Oct. 1 to Nov. 30 determined from a fairly well defined rating curve. Discharge relation affected by ice about Dec. 1 to Mar. 23; mean discharge Mar. 1–23 estimated from gage-height and temperature records at 290 second-feet. Mar. 24 to Sept. 5 discharge determined from a well-defined rating curve; Sept. 6–30, by the indirect method for shifting channels. Observer reported ice breaking Mar. 5 and ice gone Mar. 24. Gage records not available Oct. 10, 12, 14, 18, 29, Nov. 4, 30, Dec. 21, Jan. 1–12, Jan. 14 to Mar. 4, May 12, 20, 25, 28, 31, June 21, July 7, 14, 19, 23, Aug. 1, 9, 16, 30, 31, Sept. 20, 24, and 27. Discharge recorded in table for days on which gage was not read, interpolated.

Monthly discharge of South Fork of White River near Westover, S. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	75	49	53.2	3,270	C.
November	172	75	134	7,970	C.
March	.....	.....	[a]248	15,200	D.
April	700	50	172	10,200	B.
May	700	50	143	8,790	B.
June	345	50	103	6,130	B.
July	90	37	42.1	2,590	B.
August	700	37	76.9	4,730	B.
September	90	38	46.7	2,780	B.

[a] Partly estimated. See footnote to table of daily discharge.

NIOBRARA RIVER NEAR LYNCH, NEBR.

LOCATION.—In sec. 2, T. 32 N., R. 10 W., at highway bridge, 5 miles south of Lynch Nearest tributary, Red Bird Creek, enters below.

DRAINAGE AREA.—Approximately 9,800 square miles.

RECORDS AVAILABLE.—August 1, 1913, to September 30, 1914.

GAGE.—Vertical staff, read daily, in the morning. Observer, N. E. Baker.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.4 feet at 7 a. m. May 24 (discharge not estimated); minimum stage recorded, 1.55 feet at 8 a. m. August 9 (discharge, 725 second-feet).

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions from Niobrara River of 321 second-feet for irrigation and 2,855 second-feet for power above the station, and 3,700 second-feet for power below. In Wyoming there are adjudicated diversions of 23 second-feet.

ACCURACY.—Owing to the shifting channel the results apparently are only fair.

COOPERATION.—Station maintained in cooperation with the State engineer, by whom the field data are furnished.

Discharge measurements of Niobrara River near Lynch, Nebr., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 16	D. P. Weeks, jr	2.15	1,410	June 10	D. P. Weeks, jr	1.70	1,510
Dec. 13	W. M. Jefferys	2.10	(a)	July 11	do	1.55	741
Apr. 4	D. P. Weeks, jr	1.93	1,760	Aug. 7	do	1.72	799
May 8	do	1.91	1,880	Sept. 2	do	2.08	1,060

a River frozen.

Daily discharge, in second-feet, of Niobrara River near Lynch, Nebr., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,370	1,200	.....	2,050	2,520	1,700	1,500	930	895
2	1,480	1,250	.....	1,620	1,740	1,700	1,320	912	1,000
3	1,370	1,300	.....	1,620	2,340	1,770	1,390	895	930
4	1,370	1,300	.....	1,750	2,170	1,700	1,400	860	965
5	1,360	1,200	.....	1.620	2,170	1,770	1,200	800	930
6	1,360	1,170	.....	1,920	1,880	2,500	980	800	1,000
7	1,350	1,260	.....	2,420	1,880	1,900	980	800	1,320
8	1,350	1,170	.....	2,620	1,650	1,750	980	830	1,270
9	1,340	1,360	.....	2,070	1,650	2,200	1,000	725	1,170
10	1,340	1,360	.....	2,620	2,320	1,510	870	800	1,170
11	1,330	1,470	.....	2,440	2,150	1,510	860	750	1,050
12	1,330	1,580	.....	2,440	2,320	1,550	800	860	930
13	1,320	1,580	.....	1,790	2,150	2,300	830	874	1,220
14	1,430	1,580	.....	2,260	2,000	1,900	860	860	1,220
15	1,430	1,710	.....	1,940	2,320	1,550	895	895	1,170
16	1,370	1,410	.....	2,280	2,360	2,050	860	860	965
17	1,370	1,580	1,500	2,280	2,400	1,900	812	930	860
18	1,370	1,470	1,950	2,110	2,440	1,500	848	860	1,000
19	1,180	1,360	2,400	2,280	2,480	1,400	965	860	1,000
20	1,370	1,360	2,200	2,460	6,000	1,400	916	1,000	860
21	1,370	1,470	2,200	2,480	3,000	1,340	916	1,000	860
22	1,270	1,580	2,200	2,300	2,100	1,280	930	1,040	1,080
23	1,180	1,470	2,200	2,130	2,280	1,500	874	1,080	860
24	1,370	1,360	2,600	2,680	4,200	1,340	860	895	944
25	1,370	1,360	2,500	2,680	1,360	1,380	930	1,000	1,000
26	1,370	1,580	2,400	2,700	1,690	1,250	930	860	1,080
27	1,120	1,470	1,750	2,500	1,540	1,250	860	1,000	986
28	1,200	1,470	2,050	2,900	1,920	1,360	930	1,000	1,000
29	1,200	1,580	1,900	2,500	1,770	1,400	916	930	930
30	1,200	1,470	1,750	2,500	1,770	1,620	3,060	1,000	860
31	1,200	.....	1,750	.....	1,790	.....	1,120	944	.....

NOTE.—Discharge computed by indirect method for shifting channels. Gage records not available Oct. 5–12, 17, 25, 29, 30, Nov. 2, 11; Dec. 10, 22–28; Dec. 31 to Mar. 16; Mar. 18, 21, 22, 29; Apr. 19; May 16–18, 21; June, 14 21; July 5, 13; Aug. 2, 22, and Sept. 11. Discharge recorded in table for days on which gage was not read, interpoalted. Gage records for December published in Water-Supply Paper 356; discharge not estimated because of lack of information regarding period when discharge relation was affected by ice.

Monthly discharge of Niobrara River near Lynch, Nebr., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,480	1,120	1,320	81,200
November	1,710	1,170	1,420	84,500
March 17-31	2,600	1,500	2,090	62,200
April	2,900	1,620	2,270	135,000
May	6,000	1,360	2,270	140,000
June	2,500	1,250	1,640	97,600
July	3,060	800	1,050	64,600
August	1,080	725	898	55,200
September	1,320	860	1,020	60,700

ROCK RIVER AT LUVERNE, MINN.

LOCATION.—At the Chicago, Rock Island & Pacific Railway bridge at Luverne, 3½ miles above mouth of Elk Creek.

DRAINAGE AREA.—440 square miles.

RECORDS AVAILABLE.—August 23, 1911, to September 30, 1914, when station was discontinued.

GAGE.—Vertical staff; read daily, in the morning. Observer, C. W. Pinkerton.

DISCHARGE MEASUREMENTS.—Made from highway bridge one-fourth mile above gage or by wading.

CHANNEL AND CONTROL.—Sand and gravel; may shift during high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.0 feet June 13 (discharge about 11,200 second-feet); minimum stage recorded, 1.50 feet October 1–4 and December 17–20 (discharge about 9 second-feet). Open-season records; station temporarily discontinued during winter.

WINTER FLOW.—Discharge relation affected by ice; observations discontinued.

REGULATION.—One dam of low rock above gage; does not regulate flow but raises water level about 2 feet.

ACCURACY.—Owing to shifting channel records apparently only fair.

Discharge measurements of Rock River at Luverne, Minn., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 25	S. B. Soulé	1.84	[a] 28	June 8	J. B. Stewart	6.52	1,260
25	do	1.84	[a] 26	9	do	5.87	809
June 7	J. B. Stewart	7.73	2,850	Aug. 7	do	2.18	[a] 38
8	do	6.72	1,580				

[a] Measurements made by wading.

Daily discharge in second-feet, of Rock River at Luverne, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	9	16	16	.....	30	88	107	325	59	40
2	9	14	14	.....	28	88	81	308	54	35
3	9	14	14	.....	28	69	81	299	46	32
4	9	13	13	.....	28	69	88	258	40	28
5	10	13	13	.....	25	69	670	210	42	24
6	10	13	13	.....	24	69	3,220	174	40	23
7	10	14	13	.....	24	69	2,800	148	39	24
8	11	16	13	.....	24	69	1,370	133	34	22
9	13	13	12	.....	21	58	912	131	30	24
10	16	13	12	.....	21	48	6,850	128	26	32
11	18	13	12	.....	18	44	3,780	114	23	34
12	19	13	12	.....	17	64	3,080	99	23	51
13	18	13	12	.....	16	64	11,200	73	49	61
14	17	14	11	.....	16	81	9,520	69	49	156
15	17	13	10	.....	16	58	3,220	59	34	419
16	16	13	10	.....	16	48	1,150	57	26	708
17	16	13	9	.....	14	39	786	54	24	544
18	14	13	9	.....	16	35	1,500	49	23	326
19	14	13	9	.....	18	31	1,500	44	26	247
20	13	13	9	.....	18	39	670	44	24	149
21	13	13	.....	.....	17	39	571	43	20	121
22	13	13	.....	.....	17	35	479	43	26	108
23	12	16	.....	.....	16	48	413	47	59	95
24	12	17	.....	.....	24	289	413	44	108	95
25	11	18	.....	31	24	1,620	725	44	121	82
26	11	18	.....	31	39	912	1,150	43	82	70
27	11	17	.....	30	58	697	755	40	82	63
28	11	17	.....	30	75	350	571	54	70	59
29	12	16	.....	31	94	250	479	44	66	54
30	12	16	.....	31	94	163	392	102	59	40
31	16	.....	.....	31	.....	134	.....	82	49	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to June 30, from a rating curve fairly well defined between 9 and 4,000 second-feet and poorly defined above 4,000 second-feet; July 1–15, by indirect method for shifting channels; July 16 to Sept. 30, from a rating curve not well defined. No gage records Dec. 21 to Mar. 24; mean discharge Dec. 21–31 estimated at 7 second-feet. Discharge estimates Oct. 1 to Dec. 20, 1913, differ from those published in Water-Supply Paper 356 because of revised rating curve based on discharge measurements made in September, 1913, and April, 1914.

Monthly discharge of Rock River at Luverne, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 440 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	19	9	13.0	0.030	0.03	799	B.
November	18	13	14.4	.033	.04	857	B.
December	.....	.....	10.1	.023	.03	621	B.
March 25–31	31	30	30.7	.070	.02	426	A.
April	94	14	29.2	.066	.07	1,740	A.
May	1,620	31	185	.420	.48	11,400	B.
June	11,200	81	1,950	4.43	4.94	116,000	B.
July	325	40	108	.245	.28	6,640	B.
August	121	20	46.9	.107	.12	2,880	A.
September	708	22	126	.286	.32	7,500	A.

NOTE.—See footnote to table of daily discharge.

NORTH PLATTE RIVER ABOVE PATHFINDER, WYO.[1]

LOCATION.—In sec. 27, T. 26 N., R. 84 W., about 25 miles above Pathfinder dam; three-fourths mile below the mouth of Black Canyon, and 900 feet below the mouth of Lost Creek, the nearest tributary. Backwater from Pathfinder reservoir reaches within two and one-half miles of the station.

DRAINAGE AREA.—Approximately 8,700 square miles (measured from General Land Office map).

RECORDS AVAILABLE.—October 7, 1913, to September 30, 1914.

GAGE.—Friez water-stage recorder.

[1] Station formerly known as North Platte River above Pathfinder reservoir, Wyo.

CHANNEL AND CONTROL.—Station is at the lower end of a pool 600 feet long, and just above rapids. Control practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year (Friez gage), 5.85 feet at 12 m. June 6 (discharge 12,700 second-feet); minimum discharge occurs during winter months when station is temporarily discontinued.

DISCHARGE MEASUREMENTS.—Made from car and cable.

WINTER FLOW.—Discharge relation affected by ice; records discontinued.

DIVERSIONS.—Prior to July 1, 1912, there were adjudicated diversions of 58 second-feet from the North Platte between Saratoga and the station above Pathfinder; and diversions of 1,270 second-feet from intervening tributaries.

ACCURACY.—Results, apparently excellent.

COOPERATION.—Station maintained in cooperation with the United States Reclamation Service.

Discharge measurements of North Platte River above Pathfinder, Wyo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 12	R. H. Fletcher	1.17	505	July 22	M. J. Anderson	1.69	1,050
Apr. 17	do	2.80	3,290	22	do	1.69	1,090
18	do	3.13	3,620	Sept. 2	R. H. Fletcher	1.00	501
19	do	2.98	3,240	6	do	.98	419
June 18	Robert Follansbee	4.20	6,820				

Daily discharge in second-feet, of North Platte River above Pathfinder, Wyo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	535	392	.....	1,310	2,760	10,500	2,220	1,490	399
2	.....	620	294	.....	1,350	2,740	10,700	2,180	1,650	425
3	.....	693	373	.....	1,500	2,920	11,600	2,200	1,510	412
4	.....	665	300	.....	1,820	3,180	12,100	2,200	1,470	406
5	.....	665	.....	.....	2,300	3,400	12,100	2,150	1,410	412
6	.....	665	.....	.....	2,780	3,520	12,300	2,110	1,200	418
7	780	665	.....	.....	4,220	3,500	11,400	2,160	1,050	406
8	693	665	.....	.....	4,530	3,160	10,100	2,150	923	354
9	665	665	.....	.....	3,420	3,230	8,700	1,920	840	324
10	611	638	.....	.....	2,630	3,890	7,490	1,760	820	304
11	584	638	.....	.....	2,180	4,950	6,510	1,590	741	284
12	567	611	.....	.....	1,860	5,720	6,190	1,560	694	267
13	551	611	.....	665	1,620	5,720	6,190	1,480	638	262
14	535	638	.....	684	1,530	5,250	7,000	1,400	593	272
15	543	665	.....	712	1,620	4,950	7,320	1,310	551	278
16	620	674	.....	800	2,240	5,100	7,160	1,130	519	318
17	629	656	.....	912	2,820	5,250	7,160	1,100	481	373
18	575	620	.....	1,240	3,450	5,870	6,670	1,080	453	467
19	551	575	.....	1,100	3,180	6,350	6,350	1,080	439	519
20	559	611	.....	1,230	2,440	6,670	6,030	1,080	425	467
21	519	638	.....	750	2,160	7,160	6,190	1,080	432	425
22	535	611	.....	850	2,500	7,830	6,350	1,060	503	399
23	543	551	.....	1,010	3,180	8,340	6,190	1,050	503	380
24	567	446	.....	1,020	3,400	9,040	5,720	1,380	511	418
25	575	432	.....	870	3,480	9,760	4,950	1,340	503	412
26	569	418	.....	912	3,230	10,100	4,330	1,160	488	406
27	563	495	.....	976	3,250	9,760	3,680	1,040	481	399
28	557	484	.....	934	3,450	9,400	3,160	998	474	380
29	551	472	.....	965	3,230	9,940	2,240	1,020	406	366
30	545	460	.....	1,020	2,970	10,300	2,440	1,140	399	360
31	540	.....	.....	1,160	.....	10,500	.....	1,350	392	.....

NOTE.—Discharge computed from a rating curve well defined below 7,000 second-feet. Above that point discharge rating curve is based on an extension of the area and mean-velocity curves. No gage records Oct. 26–31, Nov. 6, 7, Dec. 5 to Mar. 12, and July 12–17. Discharge recorded in table for days on which gage was not read, interpolated. Discharge relation Nov. 28 and 29 affected by ice.

Monthly discharge of North Platte River above Pathfinder, Wyo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October 7-31	780	519	581	28,800	A.
November	693	418	593	35,300	A.
March 13-31	1,240	665	937	35,300	A.
April	4,530	1,310	2,660	158,000	A.
May	10,500	2,740	6,140	378,000	A.
June	12,300	2,440	7,310	435,000	B.
July	2,220	998	1,500	92,200	A.
August	1,650	392	742	45,600	A.
September	519	262	377	22,400	A.

NORTH PLATTE RIVER AT PATHFINDER, WYO.

LOCATION.—In sec. 24, T. 29 N., R. 84 W., one-third mile south of Pathfinder, and 800 feet below the mouth of the canyon. The nearest tributary is Canyon Creek, which enters 2 miles above.

DRAINAGE AREA.—12,000 square miles (measured from General Land Office map).

RECORDS AVAILABLE.—May 9, 1905, to September 30, 1914.

GAGE.—Chain gage; datum unchanged.

DISCHARGE MEASUREMENTS.—Made from car and cable.

CHANNEL AND CONTROL.—Practically permanent.

WINTER FLOW.—Ice causes slight backwater for short periods.

REGULATED FLOW.—The Pathfinder dam, one-fourth mile above station, forms a reservoir of 1,025,000 acre-feet capacity. This reservoir materially changes the natural run-off of the river.

DIVERSIONS.—Prior to July 1, 1912, there were adjudicated diversions of 279 second-feet from tributaries entering the North Platte between this station and that above Pathfinder. Near Whalen, 150 miles below, the water from the Pathfinder reservoir is diverted by the Interstate canal for irrigation in Nebraska and Wyoming. Other canals are contemplated by the Reclamation Service.

COOPERATION.—Station maintained and records furnished by the United States Reclamation Service.

No discharge measurement was made at this station in the year ending September 30, 1914.

Daily discharge, in second-feet, of North Platte River at Pathfinder, Wyo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	760	4	5	5	5	5	5	5	4,220	3,790	4,560	5,020
2	760	4	5	5	5	5	5	5	4,220	3,650	4,560	5,020
3	740	4	5	5	5	5	5	5	4,220	3,730	4,560	5,020
4	760	4	5	5	5	5	5	5	4,220	4,140	4,560	5,020
5	760	4	5	5	5	5	5	1,400	4,220	4,470	4,560	5,020
6	760	5	5	5	5	5	5	2,030	4,080	4,470	4,560	4,570
7	760	5	5	5	5	5	5	530	4,220	4,470	4,560	5,380
8	760	5	5	5	5	5	5	5	4,220	4,470	4,560	5,050
9	760	5	5	5	5	5	5	5	4,220	4,470	4,560	5,020
10	760	5	5	5	5	5	5	2,260	4,300	4,780	4,560	4,520
11	760	5	5	5	5	5	5	3,000	4,300	5,020	4,560	4,560
12	760	5	5	5	5	5	5	3,000	4,300	4,410	4,560	4,560
13	194	5	5	5	5	5	5	3,000	4,300	5,080	4,560	4,560
14	4	5	5	5	5	5	5	3,000	4,300	5,020	4,250	4,560
15	4	5	5	5	5	5	5	3,000	4,300	5,020	5,440	4,560
16	4	5	5	5	5	5	5	3,000	4,300	5,020	5,340	4,560
17	4	5	5	5	5	5	5	3,500	4,300	5,580	5,520	4,560
18	4	5	5	5	5	5	5	4,060	4,300	5,620	5,520	4,560
19	4	5	5	5	5	5	5	4,060	4,340	4,860	5,520	4,560
20	4	5	5	5	5	5	5	4,060	4,470	4,560	5,140	4,760
21	4	5	5	5	5	5	5	4,060	3,680	4,560	5,020	4,560
22	4	5	5	5	5	5	5	4,060	4,780	4,560	5,020	4,560
23	4	5	5	5	5	5	5	4,060	5,090	4,560	5,020	4,560
24	4	5	5	5	5	5	5	4,060	5,100	4,560	5,020	4,560
25	4	5	5	5	5	5	5	4,060	5,060	4,560	5,020	4,560
26	4	5	5	5	5	5	5	4,100	5,150	4,560	5,020	4,560
27	4	5	5	5	5	5	5	4,140	4,900	4,560	5,020	4,560
28	4	5	5	5	5	5	5	4,140	4,180	4,560	5,020	4,560
29	4	5	5	5	.....	5	5	4,140	4,140	4,560	5,020	4,560
30	4	5	5	5	.....	5	5	4,140	3,960	4,560	5,020	4,560
31	4	.....	5	5	.....	5	.....	4,180	.....	4,560	5,020	.....

NOTE.—United States Reclamation Service records reduced to three significant figures. Table shows outflow from Pathfinder reservoir.

Monthly discharge of North Platte River at Pathfinder, Wyo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	760	4	302	18,600
November	5	4	4.8	287
December	5	5	5	307
January	5	5	5	307
February	5	5	5	278
March	5	5	5	307
April	5	5	5	298
May	4,180	5	2,740	168,000
June	5,150	3,680	4,380	261,000
July	5,620	3,650	4,610	283,000
August	5,520	4,250	4,880	300,000
September	5,380	4,520	4,700	280,000
The year	5,620	4	1,810	1,310,000

NORTH PLATTE RIVER AND INTERSTATE CANAL AT WHALEN, WYO.

LOCATION.—In sec. 11, T. 26 N., R. 65 W., at the head of the Interstate canal at Whalen. The nearest important tributary is Cottonwood Canyon Creek, an intermittent stream which enters 1½ miles below.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 1, 1909, to September 30, 1914. Records represent the discharge passing the overfall weir at Whalen, and also the quantity of water passing the head gates of the canal, which are located just above the Whalen weir.

GAGE.—Vertical staff used to determine flow over weir. Zero of gage is at weir crest. The discharge is then computed by a weir formula. Discharge is also computed through the four sluice gates in the dam. Another gage in the river, 75 feet downstream from the crest gage, having its zero 10.00 feet below that of the weir gage, is used only in computing the discharge through the gates when the openings are submerged. The discharge through the head gates of the canal is computed from the nine gate openings. A vertical staff in the canal 1,000 feet below the head gates is used in computing the discharge when the head-gate openings are submerged.

DISCHARGE MEASUREMENTS.—In order to check the coefficients used in computing the discharge, a car and cable have been erected a mile downstream.

REGULATED FLOW.—Water stored in Pathfinder reservoir for use in the Interstate canal.

DIVERSIONS.—Prior to July 1, 1914, there were adjudicated diversions from North Platte River of 321 second-feet between the Pathfinder reservoir and the Wyoming-Nebraska line, exclusive of the diversion by the United States Reclamation Service. Percentage of diversion above the stations unknown.

COOPERATION.—Station maintained and records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of North Platte River and Interstate canal at Whalen, Wyo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,080	294	215	190	235	255	370	2,480	4,170	4,020	5,280	4,750
2	984	300	175	190	210	304	370	2,700	4,080	3,930	4,620	4,750
3	984	308	180	200	215	320	402	3,060	4,080	3,800	4,390	4,820
4	1,080	305	190	200	215	320	469	3,190	4,040	3,620	4,380	4,940
5	1,050	294	225	195	210	380	537	3,460	3,990	3,620	4,380	4,920
6	1,050	294	175	200	160	340	593	2,750	3,990	4,110	4,370	4,850
7	1,050	295	175	210	170	429	621	2,520	3,990	4,220	4,340	4,780
8	926	290	215	210	170	429	798	2,770	3,790	4,170	4,300	4,680
9	926	285	175	205	175	459	956	3,300	3,940	4,190	4,300	5,120
10	867	280	180	205	175	495	956	2,430	4,000	4,200	4,360	4,920
11	869	280	190	210	185	503	924	2,070	4,020	4,220	4,300	4,870
12	869	275	275	215	175	470	829	1,850	4,030	4,330	4,300	4,550
13	818	260	225	220	185	537	708	3,890	4,060	4,540	4,320	4,380
14	818	260	185	222	185	503	566	4,080	4,110	4,260	4,320	4,360
15	818	255	195	225	185	537	544	4,260	4,110	4,680	4,320	4,350
16	818	255	210	223	195	565	679	3,960	4,110	4,650	4,200	4,290
17	656	255	195	210	195	503	924	4,000	4,130	4,660	4,980	4,320
18	555	255	205	212	205	469	1,300	3,960	4,120	4,660	4,980	4,240
19	458	245	205	225	205	317	1,510	4,230	4,140	5,000	5,040	4,510
20	433	240	195	230	205	402	1,220	4,710	4,140	5,010	5,100	4,540
21	425	235	205	222	210	256	1,100	4,760	4,180	4,600	5,150	4,540
22	399	235	215	220	225	339	1,310	4,810	4,180	4,400	4,880	4,760
23	382	235	225	225	210	370	1,780	4,690	3,670	4,410	4,780	4,540
24	369	235	225	220	230	402	2,170	4,600	4,130	4,410	4,780	4,540
25	364	170	245	215	250	402	2,170	4,600	4,500	4,410	4,890	4,570
26	352	165	238	225	270	503	1,980	4,350	4,490	4,410	4,800	4,560
27	329	170	238	225	225	469	2,070	4,260	4,520	4,410	4,850	4,550
28	329	255	255	212	240	402	2,270	4,260	4,520	4,410	5,010	4,560
29	306	225	238	223	.....	402	2,170	4,260	4,520	4,390	4,840	4,550
30	301	210	196	222	.....	402	2,170	4,260	4,520	4,420	4,780	4,550
31	301	.....	190	218	.....	402	.....	4,260	.....	5,060	4,780	.....

NOTE.—Records of United States Reclamation Service reduced to three significant figures.

Combined monthly discharge of North Platte River and Interstate canal at Whalen, Wyo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,080	301	676	41,600
November	308	165	255	15,200
December	275	175	208	12,800
January	230	190	214	13,200
February	270	160	204	11,300
March	565	255	416	25,600
April	2,270	370	1,150	68,400
May	4,810	1,850	3,700	228,000
June	4,520	3,670	4,140	246,000
July	5,060	3,620	4,360	268,000
August	5,280	4,200	4,650	286,000
September	5,120	4,240	4,620	275,000
The year	5,280	160	2,060	1,490,000

NOTE.—Estimates changed slightly to conform to computation rules of United States Geological Survey.

Daily discharge, in second-feet, of Interstate canal at Whalen, Wyo., for the period May 5 to Sept. 30, 1914.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	1,340	1,400	1,380	1,400	16	570	1,400	1,420	1,420	1,160
2	.....	1,360	1,420	1,390	1,400	17	715	1,400	1,430	1,420	1,180
3	.....	1,360	1,420	1,390	1,400	18	810	1,390	1,430	1,420	1,200
4	.....	1,380	1,420	1,380	1,370	19	810	1,390	1,430	1,420	1,010
5	205	1,380	1,420	1,380	1,320	20	985	1,380	1,430	1,420	965
6	558	1,380	1,420	1,370	1,330	21	1,100	1,390	1,370	1,420	965
7	580	1,380	1,420	1,390	1,320	22	1,200	1,400	1,390	1,420	970
8	675	1,380	1,430	1,390	1,330	23	1,270	1,380	1,400	1,440	975
9	765	1,400	1,420	1,400	1,330	24	1,290	1,380	1,400	1,440	965
10	815	1,400	1,420	1,400	1,300	25	1,300	1,390	1,400	1,440	890
11	815	1,410	1,430	1,400	1,300	26	1,320	1,380	1,400	1,440	885
12	815	1,410	1,430	1,400	1,310	27	1,320	1,400	1,400	1,440	880
13	815	1,400	1,430	1,410	1,250	28	1,320	1,400	1,400	1,440	890
14	659	1,400	1,430	1,420	1,220	29	1,320	1,400	1,400	1,440	880
15	530	1,400	1,420	1,420	1,220	30	1,320	1,400	1,410	1,440	880
						31	1,320	.....	1,390	1,440	.....

Monthly discharge of Interstate canal at Whalen, Wyo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 5–31	1,320	205	933	49,900
June	1,410	1,340	1,390	82,700
July	1,430	1,370	1,410	86,700
August	1,440	1,370	1,410	86,700
September	1,400	880	1,150	68,400
The period	.....	.....	.....	374,000

NORTH PLATTE RIVER AT HENRY, NEBR.

LOCATION.—On the west line of sec. 3, T. 23 N., R. 58 W., one-half mile south of Henry post office, within half a mile of the Nebraska-Wyoming line. The nearest tributary is Spring Creek, which enters just below station.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 11, 1912, to September 30, 1914.

GAGE.—Vertical staff placed in each of three channels; two gages have same datum, but gage in the third channel is 1 foot lower to avoid negative readings. Gage readings taken on gage in second channel.

DISCHARGE MEASUREMENTS.—Made from the bridge.

CHANNEL AND CONTROL.—Shifting; river flows in three channels.

WINTER FLOW.—No data; observations discontinued.

DIVERSIONS.—Prior to September 1, 1914, there was an approved diversion of 209 second-feet from the North Platte between the Wyoming-Nebraska State line and this station. In addition, the Mitchell canal diverts water just beyond the State line; it has no approved diversion, but takes out water for approximately 16,000 acres.

ACCURACY.—Although channel shifts, measurements have been made daily with a few exceptions. Estimates are based directly on them.

COOPERATION.—Station maintained in cooperation with the State engineer, by whom the field data are furnished.

Daily discharge, in second-feet, of North Platte River at Henry, Nebr., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,410	517	.....	2,640	2,980	2,640	3,810	2,640
2	1,320	a 516	.....	2,630	2,760	2,650	a 3,390	3,010
3	1,020	516	.....	a 3,460	2,520	2,440	2,970	3,170
4	1,340	559	.....	4,280	2,640	a 2,420	3,000	3,180
5	a 1,380	511	.....	4,100	3,280	a 2,400	3,030	3,150
6	1,430	544	.....	3,720	3,500	2,380	2,790	a 3,080
7	1,480	560	.....	3,820	a 3,680	2,460	2,990	3,020
8	1,490	508	.....	2,770	3,850	2,460	2,970	3,080
9	1,580	a 488	.....	2,750	4,070	2,410	2,940	3,160
10	1,410	468	.....	a 3,080	4,260	2,320	2,690	3,220
11	1,460	540	.....	3,400	4,250	2,300	2,620	3,330
12	a 1,300	532	.....	2,020	4,110	a 2,550	2,640	3,440
13	1,150	496	.....	1,720	3,720	2,800	2,680	a 3,440
14	1,170	.....	.....	3,700	a 3,630	2,720	2,710	3,440
15	1,240	.....	.....	3,960	3,540	2,780	2,720	3,090
16	1,230	.....	.....	3,530	2,990	2,780	2,590	3,060
17	1,190	.....	.....	a 3,360	2,860	2,710	2,620	2,940
18	1,150	.....	.....	3,190	.....	2,630	3,020	2,860
19	a 1,130	.....	.....	3,300	.....	a 2,760	3,100	3,170
20	1,110	.....	1,750	3,330	.....	a 2,900	3,180	a 2,980
21	706	.....	1,720	3,830	.....	3,030	3,300	2,800
22	a 719	.....	1,810	3,960	.....	2,880	3,340	2,920
23	732	.....	a 1,940	3,840	.....	2,860	a 3,090	2,860
24	718	.....	2,060	a 3,620	.....	2,800	2,840	2,850
25	727	.....	2,070	3,410	.....	2,780	2,980	2,950
26	a 735	.....	a 2,190	3,410	.....	a 2,800	3,010	2,860
27	743	.....	2,310	3,160	.....	2,820	3,030	a 2,860
28	730	.....	2,370	3,170	.....	2,600	3,040	2,860
29	707	.....	2,160	2,920	3,150	2,680	2,910	a 2,860
30	681	.....	a 2,400	3,020	3,170	2,680	a 2,960	a 2,860
31	599	.....	.....	a 3,000	.....	2,640	3,010	.....

a No measurement made; discharge interpolated.

NOTE.—Daily discharge estimated from discharge measurements except for days on which none was obtained.

Monthly discharge of North Platte River at Henry, Nebr., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,580	599	1,090	67,000
November 1–13	560	468	520	13,400
April 20–30	2,400	1,720	2,070	45,200
May	4,280	1,720	3,290	202,000
June				
July	3,030	2,300	2,650	163,000
August	3,810	2,590	2,970	183,000
September	3,440	2,640	3,040	181,000

NOTE.—See footnotes to table of daily discharge and "Accuracy."

NORTH PLATTE RIVER AT NORTH PLATTE, NEBR.

LOCATION.—In sec. 28, T. 14 N., R. 30 W., at highway bridge half a mile north of North Platte, a mile below mouth of Scout Creek, and 4½ miles above junction with the South Platte.

DRAINAGE AREA.—28,500 square miles.

RECORDS AVAILABLE.—February 25, 1895, to September 30, 1914.

GAGE.—Staff gage installed October 15, 1910, to replace chain gage used March 25 to July 1, 1910, when it was stolen. From October 5, 1894, to May 31, 1910, a vertical staff at the railroad bridge, 2 miles east of North Platte, 2 miles downstream from present site. No relation between datums of gages. Observers, Hendy and Ogier.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.6 feet, morning and afternoon reading, May 3 (discharge, 8,150 second-feet); minimum discharge occurs in winter months; record discontinued.

WINTER FLOW.—River very shallow and frequently freezes to bottom.

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions of 5,600 second-feet between this station and that at Henry

ACCURACY.—Owing to shifting channel and uncertainty of gage records results prior to July 1 are apparently poor and those for rest of year only fair.

COOPERATION.—Station maintained in cooperation with the State engineer, by whom the field data are furnished.

Discharge measurements of North Platte River at North Platte, Nebr., during the year ending Sept. 30, 1914.

[Made by C. J. McNamara.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
March 29	3.3	1,820	June 14	3.65	1,360	August 3	3.05	1,080
April 15	3.25	1,670	June 28	2.95	1,300	August 16	3.15	1,290
May 2	3.9	4,260	July 13	2.29	184	September 2	3.5	2,820
May 17	3.4	2,860	July 18	2.40	265	September 13	3.6	3,160
May 31	3.5	2,940	July 19	2.75	733			

Daily discharge, in second-feet, of North Platte River at North Platte, Nebr., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,650	1,500	1,820	1,570	5,800	2,450	1,120	1,160	2,820
2	2,500	1,500	1,700	1,570	7,850	2,350	1,120	1,160	2,820
3	2,470	1,500	2,100	1,570	8,150	1,920	1,120	1,000	2,820
4	2,250	1,500	2,400	1,570	7,600	1,780	960	795	2,820
5	1,950	1,500	2,550	1,570	6,950	1,680	885	860	2,820
6	1,950	1,500	2,900	1,570	6,350	1,360	885	860	2,820
7	1,700	1,500	4,050	1,570	6,000	1,260	700	1,540	2,820
8	1,700	1,500	2,900	1,570	6,000	1,180	700	1,250	2,820
9	1,820	1,500	2,250	1,570	5,800	950	760	1,160	2,820
10	1,700	1,500	1,700	1,570	5,800	750	540	1,000	3,160
11	2,100	1,500	1,700	1,570	5,250	1,000	340	1,000	2,990
12	1,950	1,500	1,060	1,570	4,750	975	270	860	2,820
13	1,950	1,500	980	1,570	4,100	655	145	860	3,160
14	1,950	1,700	980	1,810	3,850	1,360	145	860	3,540
15	1,950	1,700	980	1,810	3,400	2,050	455	1,000	3,160
16	1,820	1,700	915	1,810	3,200	2,450	410	1,160	3,160
17	1,700	1,700	980	1,810	2,860	2,350	250	1,160	3,160
18	1,950	1,500	915	1,810	2,350	2,180	285	1,160	3,160
19	1,950	1,500	1,060	1,810	3,000	2,050	525	1,160	3,160
20	1,950	1,700	1,130	1,810	5,650	1,650	575	1,340	3,160
21	1,820	1,820	.....	1,810	6,850	1,780	680	1,160	3,350
22	1,950	1,500	.....	1,810	5,250	1,780	680	1,440	3,350
23	1,950	1,500	.....	2,050	4,150	1,800	1,410	1,730	3,540
24	1,950	1,500	.....	2,350	4,150	1,800	1,620	2,480	3,540
25	1,950	1,500	.....	2,650	4,150	1,800	2,120	2,650	3,350
26	1,950	1,500	.....	3,000	4,150	1,450	2,120	3,700	3,540
27	1,700	1,600	.....	3,000	3,750	1,330	1,850	500	3,970
28	1,700	1,700	.....	3,400	3,300	1,200	1,540	4,210	3,760
29	1,500	1,700	.....	3,400	2,750	1,120	1,540	3,350	3,970
30	1,700	1,730	.....	3,400	2,600	1,120	1,440	3,160	3,970
31	1,700	.....	.....	.....	2,940	.....	1,160	2,990	.....

NOTE.—Discharge determined by indirect method for shifting channels from 7 rating curves, each covering a short period; results apparently poor. See "Accuracy." No gage records Nov. 9, 16, 23, 30 (discharge interpolated) and Dec. 21 to Mar. 31.

Monthly discharge of North Platte River at North Platte, Nebr., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	2,650	1,500	1,930	119,000
November	1,820	1,500	1,570	93,400
December 1–20	4,050	915	1,750	69,400
April	3,400	1,570	2,000	119,000
May	8,150	2,350	4,800	295,000
June	2,450	655	1,590	94,600
July	2,120	145	915	56,300
August	6,500	795	1,760	108,000
September	3,970	2,820	3,210	191,000

NOTE.—See footnote to table of daily discharge.

PLATTE RIVER NEAR ELM CREEK, NEBR.

LOCATION.—On west line of sec. 4, T. 8 N., R. 18 W., at highway bridge, 2 miles south of town of Elm Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 27, to September 30, 1914.

GAGE.—Vertical staff; read twice daily.

DISCHARGE MEASUREMENTS.—Made from pile bent bridge.

CHANNEL AND CONTROL.—Shifting.

WINTER FLOW.—No information.

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions of 4,488 second-feet for irrigation, and 200 second-feet for power from Platte River between North Platte and Elm Creek.

COOPERATION.—Station maintained in cooperation with the State engineer, by whom the field data are furnished.

Data insufficient for estimates of discharge.

Discharge measurements of Platte River near Elm Creek, Nebr., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
July 12	C. J. McNamara	0.93	247	July 29	C. J. McNamara	1.5	1,180
15	do	.13	18.6	Aug. 19	do	1.36	555
27	C. P. Mason	1.4	664	Sept. 27	do	2.0	2,360

Daily gage height, in feet, of Platte River near Elm Creek, Nebr., for the year ending Sept. 30, 1914.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	1.29	1.85	11	.....	1.15	2.04	21	.....	1.10	2.04
2	.....	.....	1.85	12	.....	1.12	2.75	22	.....	1.16	1.92
3	.....	1.28	1.81	13	.....	.97	.....	23	.....	.....	1.96
4	.....	1.24	1.78	14	.....	.88	2.16	24	.....	1.05	1.99
5	.....	1.16	1.84	15	.....	.80	2.05	25	.....	1.25	2.02
6	.....	.98	.....	16	.....	.....	1.96	26	.....	1.81	2.07
7	.....	.74	1.81	17	.....	.00	2.02	27	1.39	2.12	.....
8	.....	.28	1.86	18	.....	.91	2.13	28	1.51	2.26	2.05
9	.....	.....	2.08	19	.....	1.35	2.09	29	1.50	2.45	2.05
10	.....	.50	2.07	20	.....	1.30	.....	30	1.42	.....	2.07
								31	1.21	2.03	.....

PLATTE RIVER NEAR COLUMBUS, NEBR.

LOCATION.—On line between sec. 36, T. 17 N., R. 1 W., and sec. 31, T. 17 N., R. 1 E., at Meridian Bridge, 3 miles south of Columbus, 5 miles above the mouth of Loup River, and about 10 miles below mouth of Prairie Creek.

DRAINAGE AREA.—56,900 square miles.

RECORDS AVAILABLE.—June 4, 1895, to September 30, 1914.

GAGE.—Chain gage in main channel installed July 25, 1910; read once daily. Gage stolen September 5, 1914, and reinstalled September 8 at same datum. Bridge and original gage were washed out early in 1910. Site of present gage same as that of old gage but datum is possibly slightly different. Observer, W. B. Benson.

DISCHARGE MEASUREMENTS.—Made from bridge spanning each channel.

CHANNEL AND CONTROL.—Extremely shifting; river flows in three channels, known as the main, middle, and south channels.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.5 feet at 2 p. m. June 13 and 12 m. June 15 (discharge, 16,500 second-feet); minimum discharge recorded, 0 July 21–23 and July 26 to August 22.

WINTER FLOW.—River freezes over; records temporarily discontinued.

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions of 325 second-feet from Platte River between Elm Creek and Columbus.

ACCURACY.—Owing to the extremely shifting channel, the estimates have been obtained by the indirect method and are apparently only approximate.

COOPERATION.—Station maintained in cooperation with the State engineer, by whom the field data were furnished.

Discharge measurements of Platte River near Columbus, Nebr., made by D. P. Weeks, jr., during the year ending Sept. 30, 1914.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Mar. 17	3.15	3,400	May 3	4.25	5,960	July 13	1.85	264
29	3.66	4,040	9	4.40	8,080	25	1.20	a 20
Apr. 5	3.14	1,870	31	4.20	6,780	Sept. 1	2.90	1,940
19	2.28	677	June 9	4.10	6,640	8	2.51	943
25	2.70	1,190	23	3.80	5,100	20	3.05	1,790

a Estimated.

Daily discharge, in second-feet, of Platte River near Columbus, Nebr., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	0	850	1,800	2,500	4,400	6,780	4,300	0	2,500
2	0	638	1,800	2,100	5,350	8,900	4,050	0	2,200
3	0	700	2,300	2,050	5,960	10,200	3,000	0	1,940
4	0	925	.....	2,000	7,200	8,250	3,440	0	1,600
5	0	1,100	.....	1,750	7,200	7,650	3,650	0	1,440
6	0	1,200	.....	1,350	7,950	7,200	1,720	0	1,270
7	0	810	.....	1,350	8,400	9,050	1,600	0	1,100
8	300	420	.....	1,150	8,640	6,000	1,230	0	940
9	2,120	145	.....	1,250	8,640	6,300	1,070	0	1,220
10	465	262	.....	1,070	7,750	5,700	820	0	1,220
11	375	170	.....	950	7,430	5,120	565	0	2,140
12	325	98	.....	1,130	8,940	9,050	315	0	1,750
13	270	98	.....	1,130	10,700	16,500	264	0	1,600
14	215	225	.....	1,030	9,250	14,200	165	0	1,600
15	160	338	.....	860	8,940	16,500	80	0	2,200
16	105	465	.....	970	8,940	12,700	50	0	2,500
17	50	465	.....	770	8,030	12,400	40	0	2,650
18	0	465	.....	745	8,640	11,500	20	0	2,020
19	0	420	.....	745	8,940	10,700	20	0	1,790
20	155	520	.....	800	8,940	9,350	20	0	1,790
21	310	575	.....	800	8,640	7,500	0	0	1,650
22	465	498	.....	800	8,340	5,980	0	0	1,550
23	465	420	.....	910	11,800	5,100	0	30	1,550
24	575	640	.....	1,050	9,950	4,550	60	30	1,550
25	575	685	.....	1,100	9,250	4,050	20	60	1,450
26	575	730	.....	1,260	8,340	4,840	0	40	1,350
27	850	820	.....	2,080	8,640	5,360	0	40	1,260
28	612	872	.....	2,850	7,430	5,650	0	40	1,260
29	375	900	.....	5,650	7,430	4,300	0	30	1,170
30	538	1,650	.....	5,100	6,780	4,050	0	60	1,260
31	700	.....	.....	.....	6,780	.....	0	1,600	.....

NOTE.—Discharge determined by indirect method for shifting channels. See "Accuracy." No gage records Oct. 1–7, 12–21, 28, 30, Nov. 7, 22, 25, 28, Dec. 4, 5, 19, Dec. 21 to Mar. 31, July 10, 11, 21–23, July 26 to Aug. 22, and Sept. 5–7. Discharge relation affected by ice during last part of December. Mean discharge Dec. 1–31 estimated at 500 second-feet. Observer reported "sand against gage" July 10 and 11, and "gage stolen" Sept. 5–7. Discharge recorded in table for days for which gage was not read, estimated or interpolated.

Monthly discharge of Platte River near Columbus, Nebr., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	2,120	0	341	21,000
November	1,650	98	603	35,900
December	.....	.....	[a] 500	30,700
April	5,650	745	1,580	94,000
May	11,800	4,400	8,180	503,000
June	16,500	4,050	8,180	487,000
July	4,300	0	855	52,600
August	1,600	0	62.3	3,830
September	2,650	940	1,650	98,200

[a] Estimated.

NOTE.—See footnote to table of daily discharge.

PLATTE RIVER NEAR FREMONT, NEBR.

LOCATION.—In sec. 35, T. 17 N., R. 8 E., at highway bridge about 1½ miles south of Fremont.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 12, 1913, to September 30, 1914.

GAGE.—Painted on south abutment of bridge; second gage established July 28, 1913, at datum 2.00 feet lower. All readings prior to that date reduced to datum of second gage. Gage read at noon and at night. Observers, G. K. Leonard and George Keeler.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.4 feet at 12 m., June 15 (discharge, 22,800 second-feet); minimum stage recorded, 0.70 foot during August 11 and 12 (discharge, 940 second-feet). Record discontinued during winter months.

1913–14: Maximum stage recorded, 5.4 feet June 15, 1914 (discharge, 22,800 second-feet); minimum stage recorded, 0.70 foot during August 11 and 12, 1914 (discharge, 940 second-feet).

WINTER FLOW.—No data; observations discontinued.

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions of 4,500 second-feet for power from Platte River between the mouth of Loup River and this station. Below there were approved diversions of 2,500 second-feet for power.

ACCURACY.—Results apparently only fair.

COOPERATION.—Field data furnished by the State engineer.

Discharge measurements of Platte River near Fremont, Nebr., during the year ending Sept. 30, 1914.

[Made by D. P. Weeks, jr.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Mar. 20	2.85	5,500	June 11	3.45	8,620
Apr. 24	2.30	3,510	July 13	1.35	2,380
May 9	3.62	10,700			

Daily discharge, in second-feet, of Platte River near Fremont, Nebr., for the years 1913–14.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
1	.....	1,770	1,300	2,380	2,240	.....	6,310	8,800	8,780	6,800	1,550	2,650
2	.....	1,680	1,260	2,240	2,240	.....	5,720	8,450	9,000	11,800	1,340	4,400
3	.....	1,590	1,320	2,120	2,240	.....	5,530	10,100	9,400	8,700	1,440	4,400
4	.....	1,500	1,320	2,120	2,480	.....	5,450	12,500	10,200	6,980	1,440	4,190
5	.....	1,290	1,320	2,180	2,800	.....	4,890	11,700	9,700	8,600	1,550	3,700
6	.....	1,290	1,320	2,240	3,260	.....	4,780	11,200	8,550	6,300	1,550	3,400
7	3,830	1,330	1,370	2,310	3,260	.....	4,530	11,200	8,100	5,260	1,550	3,400
8	3,090	1,290	1,420	2,380	.....	.....	4,420	11,200	7,720	4,400	1,340	3,130
9	3,340	1,290	1,520	2,450	.....	.....	4,180	10,900	8,100	3,980	1,140	3,770
10	3,340	1,650	1,540	2,510	.....	.....	4,080	10,900	8,700	3,430	1,180	4,400
11	2,600	2,010	1,730	2,570	.....	.....	3,840	10,600	8,620	3,040	940	6,520
12	2,210	2,110	1,730	2,540	.....	.....	3,680	10,600	7,740	2,800	940	4,580
13	2,060	2,600	1,710	2,510	.....	.....	3,540	11,900	12,300	2,370	1,240	4,960
14	1,910	2,710	1,930	2,540	.....	.....	3,510	11,300	18,300	2,110	9,540	5,340
15	1,860	2,470	2,150	2,510	.....	.....	3,510	10,600	22,300	1,990	6,300	5,140
16	1,960	2,880	1,940	2,240	.....	.....	3,340	9,780	19,600	1,730	3,100	5,500
17	1,840	4,180	1,830	2,240	.....	.....	3,180	10,000	18,900	1,550	2,500	5,420
18	1,720	3,390	1,650	2,320	.....	.....	3,580	9,610	16,200	1,510	1,770	5,500
19	1,700	2,600	1,540	2,400	.....	.....	3,510	10,000	16,000	1,550	1,660	4,680
20	1,500	2,200	1,540	2,490	.....	.....	3,410	10,600	13,900	1,380	1,570	4,400
21	1,720	2,000	1,540	2,570	.....	6,030	3,510	10,000	9,380	1,340	1,550	4,330
22	1,840	1,780	1,650	3,070	.....	5,260	3,410	10,000	10,500	1,340	1,360	4,330
23	2,600	1,680	1,810	3,420	.....	3,740	3,180	10,600	14,900	1,300	6,520	4,080
24	2,340	1,690	1,980	2,980	.....	3,580	3,510	13,000	13,000	1,260	3,100	4,020
25	1,910	1,700	2,160	2,800	.....	3,740	3,410	12,100	12,500	1,550	2,950	4,050
26	1,960	1,710	2,220	2,800	.....	4,600	3,340	12,400	10,500	2,500	2,650	3,910
27	1,940	1,710	2,120	2,800	.....	4,360	5,600	11,000	9,480	2,650	2,500	3,700
28	1,910	1,590	2,140	3,030	.....	5,340	6,500	10,900	8,600	1,590	2,740	3,580
29	1,840	1,480	2,160	3,260	.....	5,840	10,100	11,700	7,780	1,880	2,500	3,580
30	1,840	1,460	2,380	2,660	.....	7,830	9,250	10,600	7,200	1,770	3,100	3,550
31	1,770	1,380	.....	2,240	.....	6,030	.....	9,450	.....	1,680	3,700	.....

NOTE.—Discharge estimated by indirect method for shifting channels. No estimates of discharge prior to July 6, 1913, as first discharge measurement was made July 10. No gage records Apr. 13, 20, 26, 28, May 11, 19, 20, June 1, 8, 15, 16, 22, 29, July 4–6, 13, 27, Aug. 3, 10, 18, 24, 31, Sept. 7, 14, 24, 28, Oct. 5–9, 18–20, 26, 28, and Nov. 2, 1913; Nov. 8, 1913, to Mar. 20, 1914; Sept. 13, 1914. Daily discharge recorded in table for days on which gage was not read, interpolated.

Monthly discharge of Platte River near Fremont, Nebr., for the years 1913–14.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1913.				
July 7–31	3,830	1,500	2,190	109,000
August	4,180	1,290	1,940	119,000
September	2,380	1,260	1,720	102,000
1913–14.				
October	3,420	2,120	2,550	157,000
November 1–7	3,260	2,240	2,650	36,800
March 21–31	7,830	3,580	5,120	112,000
April	10,100	3,180	4,560	271,000
May	13,000	8,450	10,800	664,000
June	22,300	7,200	11,500	684,000
July	11,800	1,260	3,390	208,000
August	9,540	940	2,460	151,000
September	6,520	2,650	4,290	255,000

NOTE.—See footnote to table of daily discharge.

DOUGLAS CREEK NEAR KEYSTONE, WYO.

LOCATION.—In sec. 16, T. 14 N., R. 79 W., 600 feet below the proposed diversion dam of the Bell supply canal No. 2, a mile above the old mining camp at Keystone.

DRAINAGE AREA.—26 square miles.

RECORDS AVAILABLE.—June 18 to November 15, 1914.

GAGE.—Bristol water-stage recorder.

DISCHARGE MEASUREMENTS.—At ordinary stages made by wading; in flood, from cable. Velocity extremely high in flood.

CHANNEL AND CONTROL.—Practically permanent.

WINTER FLOW.—Small. Ice causes backwater at gage.

DIVERSIONS.—None above this point in 1914.

COOPERATION.—Station maintained and records furnished by Laramie Water Co.

Discharge measurements of Douglas Creek, near Keystone, Wyo., in 1912 and for the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1912.		*Feet.*	*Sec.-ft.*	1914.		*Feet.*	*Sec.-ft.*
July 25	R. I. Meeker		43	July 3	George Ebner	1.51	34
Aug. 9	do		14	Aug. 8	do	1.25	16
1914.				Sept. 8	do	1.01	5.7
June 18	Geo. Ebner	2.14	160	28	do	1.00	5.4

Daily discharge, in second-feet, of Douglas Creek near Keystone, Wyo., for the year ending Sept. 30, 1914.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		54	19	13	16		16	9	15
2		48	17	8	17		16	8	9
3		36	19	6	18		19	15	8
4		41	17	6	19	155	17	12	7
5		41	14	6	20	180	19	9	6
6		31	12	6	21	202	27	11	11
7		28	10	6	22	162	84	18	7
8		26	13	6	23	116	26	14	6
9		23	11	5	24	94	15	12	6
10		21	11	6	25	84	14	11	6
11		23	11	6	26	72	14	13	5
12		21	11	6	27	68	26	11	5
13		23	11	8	28	60	24	9	5
14		24	10	10	29	51	21	8	5
15		20	9	17	30	51	36	9	6
					31		33	8	

NOTE.—Gage read 4.19 feet June 1.

Monthly discharge of Douglas Creek near Keystone, Wyo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
June 19-30	202	51	108	2,570
July	84	14	28.0	1,720
August	19	8	12.0	738
September	17	5	7.4	440
The period				5,470

NORTH SPRING CREEK NEAR SARATOGA, WYO.

LOCATION.—In sec. 19, T. 16 N., R. 85 W., at Boock's ranch, 14 miles southwest of Saratoga. Nearest tributary, Methodist Creek, enters a few miles below.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 23, 1913, to September 30, 1914.

GAGE.—Vertical staff; read morning and evening.

DISCHARGE MEASUREMENTS.—Made from footbridge during high water and by wading at other times.

CHANNEL AND CONTROL.—Shifting at high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.1 feet on afternoon of June 4 and morning of June 5 (discharge 268 second-feet); minimum stage recorded, 0.45 foot October 1–5 and 15–19 (discharge, 2 second-feet).

WINTER FLOW.—No data.

DIVERSIONS.—Prior to July 1, 1914, there were adjudicated diversions of 80 second-feet from North Spring Creek; proportion of diversions above the station unknown.

ACCURACY.—Estimates apparently only fair, owing to shifting control.

Discharge measurements of North Spring Creek near Saratoga, Wyo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	R. H. Fletcher	0.50	4.2	July 28	M. D. Anderson	1.10	16
June 9	do	2.06	149	Sept. 21	Robert Follansbee	.98	9.7

Daily discharge, in second-feet, of North Spring Creek near Saratoga, Wyo., for the period Aug. 23, 1913, to Sept. 30, 1914.

Day.	Aug.	Sept.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1		9	2		25	225	68	17	6
2		9	2		25	245	61	17	6
3		9	2		30	265	61	17	6
4		9	2		48	358	61	17	6
5		13	2		42	325	68	17	6
6		9	5		36	285	54	11	6
7		9	8		48	225	48	11	6
8		9	8		61	205	48	11	6
9		16	8		83	165	48	8	6
10		9	8		100	155	42	6	6
11		9	8		91	145	36	6	6
12		9	8		68	165	36	6	6
13		9	8		61	195	36	6	6
14		9	4		75	195	36	6	6
15		9	2		68	185	30	6	6
16		9	2		81	185	25	6	6
17		9	2		108	165	25	6	6
18		9	2		145	175	25	6	6
19		9	2		165	165	21	6	6
20		9	2		165	185	17	6	6
21		9	2	40	165	155	17	6	6
22		9	2	42	185	145	25	6	6
23	9	9	2	42	265	117	17	6	6
24	9	9	3	42	275	108	17	6	6
25	9	9	3	42	245	100	17	6	6
26	12	6	3	42	205	91	17	6	6
27	12	5	3	30	185	75	17	6	6
28	9	2	4	25	205	75	17	6	6
29	9	2	4	25	205	75	25	6	6
30	9	2	4	25	205	68	17	6	6
31	10		4		205		21	6	

NOTE.—Daily discharge determined as follows: Aug. 23, 1913, to May 20, 1914, by indirect method for shifting channel; May 21 to Sept. 30, from fairly well-defined rating curve.

Monthly discharge of North Spring Creek near Saratoga, Wyo., for the period Aug. 23, 1913, to Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
August 23–31	12	9	9.8	175	C.
September	16	2	8.4	500	C.
October	8	2	3.9	240	C.
April 21–30	42	25	35.5	704	C.
May	275	25	125	7,690	C.
June	358	68	174	10,400	B.
July	68	17	34.0	2,090	C.
August	17	6	8.3	512	D.
September	8	6	6.1	361	D.

JACK CREEK AT MATHESON'S RANCH, NEAR SARATOGA, WYO.

LOCATION.—About sec. 36, T. 17 N., R. 86 W., at Matheson's ranch, about 14 miles southwest of Saratoga. Nearest tributary, North Jack Creek, which enters some distance below the gage.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 23, 1913, to September 30, 1914.

GAGE.—Vertical staff, read morning and evening. Observer, Riley Burdett.

DISCHARGE MEASUREMENTS.—Made from foot bridge during high water and by wading at ordinary stages.

CHANNEL AND CONTROL.—Practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.7 feet at 6 p. m. June 4 (discharge, 220 second-feet); minimum stage recorded, 0.35 foot at 5 p. m. August 13 and 6 p. m. October 5 (discharge, 3 second-feet).

WINTER FLOW.—Discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1914, there were adjudicated diversions of 95 second-feet from Jack Creek; the amount above the station is not known.

ACCURACY.—Conditions favorable for fairly accurate results, records apparently good.

Discharge measurements of Jack Creek at Matheson's ranch, near Saratoga, Wyo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 31	R. H. Fletcher	0.52	6.5	July 27	M. D. Anderson	0.52	9.0
Apr. 21	Robert Follansbee	1.18	44	Sept. 21	Robert Follansbee	.41	[a]6.4
June 9	R. H. Fletcher	2.38	112				

[a] Estimated by means of floats.

Daily discharge, in second-feet, of Jack Creek at Matheson's ranch, near Saratoga, Wyo., for the period Aug. 23, 1913, to Sept. 30, 1914.

Day.	Aug.	Sept.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.										
1	.....	4	6	8	.....	39	138	45	11	6
2	.....	4	7	9	.....	50	152	39	9	5
3	.....	4	7	10	.....	50	152	39	10	5
4	.....	4	5	9	.....	64	190	39	8	5
5	.....	5	13	8	.....	67	170	48	8	5
6	.....	5	9	8	.....	53	160	39	7	5
7	.....	5	7	7	.....	53	152	34	7	5
8	.....	5	8	7	.....	70	152	31	7	5
9	.....	6	9	6	.....	108	126	30	8	5
10	.....	6	8	8	.....	120	96	31	7	5
11	.....	5	8	7	.....	114	87	31	7	5
12	.....	5	8	11	.....	102	90	31	6	5
13	.....	4	10	10	.....	84	102	25	4	6
14	.....	4	12	9	.....	87	102	20	5	7
15	.....	5	10	5	.....	102	102	20	5	8
16	.....	4	7	5	.....	102	96	18	5	8
17	.....	4	8	9	.....	138	90	14	5	6
18	.....	4	7	8	.....	145	90	16	5	7
19	.....	4	9	9	.....	152	90	14	5	5
20	.....	4	8	9	33	152	96	14	5	5
21	.....	4	9	7	46	152	90	14	5	5
22	.....	4	8	.....	58	152	87	18	6	5
23	3	5	8	.....	48	170	78	13	5	5
24	2	5	8	.....	53	180	70	11	5	5
25	2	5	10	.....	42	170	61	9	5	5
26	2	5	7	.....	50	145	61	8	6	4
27	3	5	10	.....	39	138	64	10	6	4
28	3	5	10	.....	34	138	48	34	5	4
29	4	6	10	.....	34	145	50	17	5	4
30	4	6	9	.....	34	138	45	18	5	4
31	5	.....	9	.....	.....	138	.....	16	6	.....

NOTE.—Discharge computed from a rating curve fairly well defined below 120 second-feet. Above 150 second-feet the curve is somewhat uncertain owing to overflow. No gage records Oct. 28, Nov. 5, Nov. 22 to Apr. 19, Apr. 21, June 16, Sept. 7–9, 20, 23, 25, 26, and 29; discharge recorded in table for days on which gage was not read, interpolated.

Monthly discharge of Jack Creek at Matheson's ranch, near Saratoga, Wyo., for the period Aug. 23, 1913, to Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1913.					
August 23–31	5	2	3.1	56	B.
September	6	4	4.7	280	B.
October	13	5	8.5	524	B.
November	11	5	8.0	335	B.
1914.					
April 20–30	58	33	42.8	935	B.
May	180	39	113	6,950	B.
June	190	45	108	6,130	B.
July	48	8	24.1	1,480	B.
August	11	4	6.2	383	B.
September	8	4	5.3	314	B.

ROCK CREEK AT ARLINGTON, WYO.[1]

LOCATION.—In sec. 25, T. 19 N., R. 79 W., at highway bridge, at Arlington post office, a mile below mouth of Overland Creek, the nearest tributary.

DRAINAGE AREA.—70 square miles (measured from Forest atlas).

RECORDS AVAILABLE.—April 22, 1911, to September 30, 1914.

GAGE.—Bristol water-stage recorder; prior to 1912, staff gage referred to same datum.

[1] Described in previous reports as "near" Arlington; location of the post office has been changed.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Shifting.

WINTER FLOW.—Ice causes backwater during the winter months; flow is interrupted by snow slides above which temporarily block the channel.

DIVERSIONS.—Prior to July 1, 1914, there were adjudicated permits for diversion from Rock Creek of approximately 7 second-feet above and 220 second-feet below the station.

COOPERATION.—Station maintained and field data furnished by Rock Creek Conservation Co.

Discharge measurements of Rock Creek at Arlington, Wyo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 6	Cummings and Gordon.	1.1	[a] [b] 14	June 19	F. T. Cummings.....	3.2	622
Jan. 3	F. T. Cummings.....	1.05	[a] 13	28	.....do.....	2.5	185
26	.....do.....	1.6	[a] 14	July 5	.....do.....	2.4	169
Feb. 11	Cummings and Gordon.	1.5	[a] 13	5	.....do.....	2.4	155
Mar. 28	.....do.....	1.4	[a] 10	31	.....do.....	2.0	102
Apr. 28	M. W. Gordon.....	1.6	43	Sept. 22	M. W. Gordon.....	1.37	21
June 5	.....do.....	3.55	901				

[a] Discharge relation affected by ice. [b] Revised since last report.

Daily discharge, in second-feet, of Rock Creek at Arlington, Wyo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	13	13	9	18	985	135	57	22
2	11	13	9	22	1,160	135	64	22
3	11	15	18	30	1,160	122	50	22
4	16	16	18	44	1,120	155	44	18
5	22	14	18	39	985	145	34	18
6	18	11	22	44	898	140	34	18
7	12	12	18	34	690	118	39	22
8	16	16	18	39	545	107	44	18
9	12	13	15	64	512	86	39	18
10	10	12	18	101	652	80	34	18
11	16	13	18	112	730	74	30	18
12	14	11	18	91	855	74	34	22
13	17	11	18	81	690	83	30	22
14	18	11	22	81	770	74	34	22
15	16	13	30	91	812	65	30	26
16	12	18	34	112	690	65	26	34
17	8	13	30	135	652	91	26	26
18	9	13	26	189	730	82	30	22
19	13	12	26	274	652	56	30	22
20	15	12	26	340	730	50	26	26
21	13	13	30	392	640	54	30	30
22	13	.....	34	512	460	150	39	22
23	13	.....	34	730	420	78	30	18
24	13	.....	26	812	385	62	30	18
25	12	.....	30	812	325	55	26	18
26	14	.....	34	834	255	50	34	18
27	23	.....	30	855	210	50	34	22
28	14	.....	26	1,080	200	57	34	18
29	22	.....	22	940	175	57	30	18
30	14	.....	18	812	165	112	30	18
31	13	.....	.....	940	.....	91	26	.....

NOTE.—Discharge computed from a rating curve well defined between 15 and 1,300 second-feet, and applied by indirect method for shifting channels June 20 to July 31. Discharge relation affected by ice about Nov. 22 to Mar. 31. Mean daily discharge estimated from gage heights and results of five discharge measurements made in this period, as follows: Nov. 22–30, 15 second-feet; Dec. 1–31, 13 second-feet; Jan. 1–31, 13 second-feet; Feb. 1–28, 13 second-feet; and Mar. 1–31, 11 second-feet.

Monthly discharge of Rock Creek at Arlington, Wyo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	23	8	14.3	879
November	.....	.....	[a] 13.7	815
December	.....	.....	[b] 13	799
January	.....	.....	[b] 13	799
February	.....	.....	[b] 13	722
March	.....	.....	[b] 11	676
April	34	9	23.2	1,380
May	1,080	18	344	21,200
June	1,160	165	642	38,200
July	155	50	88.8	5,460
August	64	26	34.8	2,140
September	34	18	21.2	1,260
The year	1,160	.....	103	74,300

[a] Partly estimated. [b] Estimated.

NOTE.—See footnote to table of daily discharge.

SWEETWATER RIVER NEAR ALCOVA, WYO.

LOCATION.—In sec. 17, T. 29 N., R. 86 W., at Schoonmaker's ranch, 27 miles west of Alcova. Backwater from Pathfinder reservoir extends to a point 5 miles below station. Nearest tributary, Dry Creek, enters 6 miles below.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 28, 1913, to September 30, 1914.

GAGE.—Vertical staff; read morning and evening. Observer, H. D. Schoonmaker.

DISCHARGE MEASUREMENTS.—Made from nearby bridge during high water, and by wading at low stages.

CHANNEL AND CONTROL.—Slightly shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.3 feet at 6 a. m. April 20 (discharge, 845 second-feet); minimum stage recorded, 0.40 foot September 14–22, inclusive (discharge, 12 second-feet).

WINTER FLOW.—Ice causes backwater; observations temporarily discontinued.

DIVERSIONS.—Prior to July 1, 1914, there were adjudicated diversions of 121 second-feet from Sweetwater River, practically all above the station.

ACCURACY.—Results apparently good.

COOPERATION.—Station maintained in cooperation with the United States Reclamation Service.

Discharge measurements of Sweetwater River near Alcova, Wyo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 14	R. H. Fletcher.....	0.69	53	Apr. 22	R. H. Fletcher.....	2.43	479
Apr. 20	.....do.....	3.12	766	June 20	Robert Follansbee.....	1.41	235
21	.....do.....	2.67	566	July 29	M. D. Anderson.....	.63	45
21	.....do.....	2.59	539				

Daily discharge, in second-feet, of Sweetwater River near Alcova, Wyo., for the period Aug. 28, 1913, to Sept. 30, 1914.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	28	54	54	54	265	470	694	136	38	36
2	.....	25	54	54	.....	291	375	714	132	36	28
3	.....	28	54	54	.....	318	420	714	123	33	31
4	.....	28	54	54	.....	318	360	718	115	39	32
5	.....	28	54	54	.....	215	405	718	80	48	25
6	.....	28	54	54	.....	291	470	734	78	57	25
7	.....	25	54	54	.....	291	540	790	78	52	25
8	.....	25	54	54	.....	265	470	770	67	48	25
9	.....	25	54	54	.....	318	390	638	70	51	25
10	.....	25	54	54	.....	318	375	602	70	42	22
11	.....	25	54	54	.....	240	390	500	68	46	18
12	.....	25	54	54	.....	240	420	385	67	39	17
13	.....	25	54	52	.....	191	522	344	62	38	15
14	.....	25	54	54	.....	215	488	305	64	39	13
15	.....	25	54	54	.....	318	435	270	57	39	12
16	.....	25	54	54	.....	318	405	316	60	39	12
17	.....	25	54	54	.....	346	375	270	56	39	12
18	.....	25	54	54	.....	435	420	237	54	39	12
19	.....	25	54	54	.....	580	488	234	54	39	12
20	.....	28	54	54	.....	795	560	237	46	39	12
21	.....	28	54	54	.....	540	600	213	42	39	12
22	.....	28	54	54	.....	470	640	208	51	39	12
23	.....	28	54	54	.....	540	660	206	45	36	20
24	.....	28	54	54	.....	580	750	185	42	32	24
25	.....	32	54	54	.....	540	795	174	42	31	32
26	.....	32	57	54	.....	540	795	167	42	25	39
27	.....	39	62	54	.....	505	825	162	39	25	28
28	25	39	57	54	.....	470	830	151	38	25	32
29	25	39	56	54	.....	470	785	140	39	25	36
30	28	46	54	54	.....	470	675	140	39	25	39
31	32	.....	54	.....	.....	.....	660	.....	39	25	.....

NOTE.—Discharge computed from a fairly well defined rating curve which was applied directly, Aug. 28, 1913, to May 26, 1914, and July 5 to Sept. 30, 1914. May 27 to July 4, discharge determined by indirect method for shifting channel on account of scour and fill after high water. No gage records Dec. 2 to Mar. 31.

Monthly discharge of Sweetwater River near Alcova, Wyo., for the period Sept. 1, 1913, to Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1913.					
September	46	25	28.6	1,700	A.
October	62	54	54.5	3,350	A.
November	54	52	53.9	3,210	A.
1914.					
April	795	191	370	22,000	A.
May	830	360	542	33,300	B.
June	790	140	398	23,700	B.
July	136	38	64.4	3,960	A.
August	57	25	38.9	2,390	A.
September	39	12	22.8	1,360	A.

LARAMIE RIVER NEAR JELM, WYO.

LOCATION.—In sec. 15, T. 12 N., R. 77 W., at Boswell's ranch, 4 miles south of Jelm post office; one-fourth mile below the Colorado-Wyoming boundary.

DRAINAGE AREA.—365 square miles (measured from Clason's sectional map of Colorado, 1911).

RECORDS AVAILABLE.—May 7, 1911, to September 30, 1914. June 22, 1904, to October 31, 1905, a station was maintained at Decker's ranch, one-half mile south of the State line. The records at the two stations are practically comparable, as there are no tributaries nor diversions of importance between.

GAGE.—Water-stage recorder installed by State engineer of Colorado in 1911, datum same as that of vertical staff originally used.

DISCHARGE MEASUREMENTS.—Made from bridge, except during low water, when measurements are made by wading.

CHANNEL AND CONTROL.—Practically permanent.

EXTREME OF DISCHARGE.—Maximum stage recorded during year (water-stage recorder), 3.9 feet at 9 a. m. June 2 (discharge, 3,270 second-feet); minimum discharge occurs during winter months; observations discontinued.

1911–1914: Maximum stage recorded, 3.9 feet June 2, 1914 (discharge, 3,270 second-feet).

WINTER FLOW.—Ice causes backwater at the gage during the winter months; observations temporarily discontinued.

COOPERATION.—Complete records furnished by the State engineer of Colorado.

Discharge measurements of Laramie River near Jelm, Wyo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	M. E. Bunger	1.22	78	May 28	D. L. Bundy	3.60	2,480
12	R. I. Meeker	1.20	78	June 2	do	3.80	2,870
Nov. 25	do	1.06	a 66	9	do	3.10	1,170
May 16	Bundy and Woodhall	2.30	516	July 31	M. N. Grant, jr	1.55	165
23	do	3.45	1,490				

a Ice present.

Daily discharge, in second-feet, of Laramie River near Jelm, Wyo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	67	57	.....	155	2,410	472	155	80
2	67	57	.....	185	2,980	445	170	60
3	67	57	.....	185	2,690	365	170	60
4	102	57	.....	220	2,410	340	155	40
5	130	57	.....	238	2,280	445	130	70
6	102	57	.....	255	2,150	295	105	40
7	77	57	.....	220	1,660	295	105	50
8	77	67	.....	255	1,340	295	105	40
9	77	57	.....	295	1,150	275	105	30
10	77	57	.....	390	1,150	220	105	30
11	67	57	.....	472	1,340	202	105	30
12	77	50	80	472	1,340	220	105	30
13	77	57	92	418	1,440	202	105	28
14	77	57	105	530	1,660	185	105	25
15	67	50	105	500	1,440	185	105	25
16	67	42	105	500	1,150	155	105	25
17	77	57	118	630	1,070	170	105	25
18	67	50	105	780	1,070	238	105	25
19	57	57	130	905	1,070	220	130	25
20	67	50	142	1,340	1,230	185	105	25
21	57	50	155	1,500	950	185	105	30
22	50	50	202	1,560	1,010	202	105	25
23	57	57	155	1,620	860	185	80	25
24	67	67	155	2,100	780	170	80	25
25	57	57	155	1,890	700	155	80	25
26	57	57	155	1,540	665	155	105	25
27	77	57	155	1,780	560	155	105	40
28	57	67	170	2,280	530	130	80	40
29	57	57	155	2,150	472	130	80	60
30	67	50	155	2,150	500	202	60	60
31	67	.....	.....	2,150	.....	185	80	.....

NOTE.—Records of discharge furnished by the State engineer of Colorado.

Monthly discharge of Laramie River near Jelm, Wyo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	130	50	71.4	4,390
November	67	42	55.9	3,330
April 12-30	202	80	136	5,120
May	2,280	155	957	58,800
June	2,980	472	1,340	79,700
July	472	130	234	14,400
August	170	60	108	6,640
September	80	25	37.3	2,220

LARAMIE RIVER AT TWO RIVERS, WYO.

LOCATION.—In sec. 5, T. 17 N., R. 74 W, at highway bridge at Two Rivers post office. Nearest tributary, Little Laramie River, which enters one-fourth mile below.

DRAINAGE AREA.—1,210 square miles (measured from King's atlas).

RECORDS AVAILABLE.—May 6, 1911, to October 31, 1912; October 1, 1913, to September 30, 1914.

GAGE.—Bristol water-stage recorder referred to same datum as original staff gage.

DISCHARGE MEASUREMENTS.—Made from the bridge.

CHANNEL AND CONTROL.—Slightly shifting.

WINTER FLOW.—Ice causes backwater at the gage during the winter months and the observations temporarily discontinued.

DIVERSIONS.—By decree of district court dated December 27, 1912, there were adjudicated diversions of 414 second-feet from Laramie River between this station and the old station near Woods.

COOPERATION.—Station maintained and records furnished by the Laramie Water Co.

Discharge measurements of Laramie River at Two Rivers, Wyo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 16	R. I. Meeker	178	31	July 10	Geo. Ebner	244	124
25	do	207	[a] 38	18	do	275	186
Apr. 14	do	251	127	Aug. 1	do	301	210
May 15	do	360	374	5	do	265	147
June 13	Geo. Ebner	410	502	15	do	185	44
29	do	320	264	24	do	174	36

[a] Ice present.

Daily discharge, in second-feet, of Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	62	62	.....	190	1,430	231	242	30
2	62	68	.....	194	1,440	226	217	30
3	74	62	.....	204	1,460	231	222	29
4	74	62	.....	209	1,520	209	228	28
5	74	62	.....	196	1,580	185	238	29
6	74	62	.....	213	1,540	171	166	28
7	68	62	.....	217	1,440	168	131	27
8	56	68	.....	209	1,350	149	111	24
9	40	74	.....	200	1,190	128	86	23
10	25	68	.....	228	895	117	73	23
11	20	62	.....	299	667	115	65	24
12	35	62	.....	378	569	114	61	25
13	56	62	.....	373	504	110	53	24
14	68	62	131	370	475	106	49	22
15	74	40	125	368	464	97	45	22
16	62	.....	122	400	504	111	40	23
17	56	.....	131	447	513	130	51	22
18	51	.....	152	475	638	160	40	25
19	51	.....	158	539	600	173	40	32
20	51	.....	151	619	566	192	35	40
21	51	.....	138	711	585	202	32	76
22	35	.....	134	769	613	217	32	76
23	35	.....	160	851	616	233	30	113
24	40	.....	177	958	498	206	32	113
25	40	.....	198	1,060	439	233	32	107
26	35	.....	190	1,080	384	254	30	107
27	40	.....	186	1,210	361	226	34	162
28	40	.....	194	1,230	343	219	34	198
29	40	.....	196	1,280	275	217	30	198
30	45	.....	192	1,360	251	213	30	200
31	56	.....	.....	1,420	.....	222	30	.....

NOTE.—Records were furnished by the Laramie Water Co.

Monthly discharge of Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	74	20	51.3	3,150
November 1–15	74	40	62.5	1,860
April 14–30	198	122	161	5,430
May	1,420	190	589	36,200
June	1,580	251	790	47,000
July	254	97	180	11,100
August	242	30	81.9	5,040
September	200	22	60.7	3,610

NOTE.—Results changed slightly to conform to computation rules of the United States Geological Survey.

LITTLE LARAMIE RIVER AT TWO RIVERS, WYO.

LOCATION.—On section line between secs. 5 and 6, T. 17 N., R. 74 W., at highway bridge, one-half mile south of Two Rivers; nearest tributary, Mill Creek, enters about 12 miles above; no tributary between the station and the mouth, one-half mile below.

DRAINAGE AREA.—421 square miles (measured from King's atlas).

RECORDS AVAILABLE.—May 6, 1911, to October 31, 1912; October 1, 1913, to September 30, 1914.

GAGE.—Bristol water-stage recorder referred to staff gage which was moved 400 feet upstream April 25, 1913.

DISCHARGE MEASUREMENTS.—Made from bridge during high water; by wading at ordinary stages.

CHANNEL AND CONTROL.—Shifting.

WINTER FLOW.—Ice causes backwater at the gage during the winter months; observations are temporarily discontinued.

DIVERSIONS.—Prior to July 1, 1914, there were adjudicated diversions from Little Laramie River of 453 second-feet, all above the station.

COOPERATION.—Station maintained and records furnished by Laramie Water Co.

Discharge measurements of Little Laramie River at Two Rivers, Wyo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 16	R. I. Meeker	1.12	20	June 13	Geo. Ebner	3.15	314
Apr. 14	do	1.53	59	29	do	1.41	36
May 15	do	1.54	60	July 10	do	1.01	8.2
June 3	Geo. Ebner	5.05	1,330	Aug. 6	do	1.49	39
3	do	5.45	1,620	15	do	.89	4.9
9	do	3.90	517	24	do	.85	3.6

Daily discharge, in second-feet, of Little Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	6	17	.....	60	791	28	76	5
2	8	21	.....	84	975	27	65	4
3	13	17	.....	93	1,580	25	66	3
4	25	21	.....	65	1,740	20	75	3
5	25	25	.....	53	1,640	19	62	3
6	25	25	.....	42	1,400	17	46	2
7	21	33	.....	34	1,160	13	36	2
8	13	41	.....	33	915	12	27	2
9	10	45	.....	28	511	9	21	1
10	10	37	.....	22	337	8	18	1
11	13	29	.....	25	262	8	14	1
12	13	25	.....	44	291	6	11	1
13	17	21	.....	55	298	5	7	1
14	13	17	50	54	315	5	6	1
15	17	17	46	55	339	5	5	1
16	17	.....	50	57	332	5	4	1
17	17	.....	59	56	337	4	3	1
18	17	.....	66	59	269	3	3	1
19	17	.....	62	78	230	3	3	3
20	17	.....	53	90	216	3	3	3
21	17	.....	48	128	222	2	3	3
22	17	.....	48	191	224	4	3	3
23	17	.....	51	236	187	35	4	3
24	17	.....	46	262	143	32	3	3
25	17	.....	41	375	112	20	3	3
26	17	.....	43	443	90	10	3	3
27	17	.....	60	419	65	6	5	3
28	17	.....	74	449	49	5	7	2
29	17	.....	73	680	36	4	8	2
30	17	.....	69	826	31	10	7	2
31	17	.....	.....	784	.....	62	6	.....

NOTE.—Records furnished by the Laramie Water Co.

Monthly discharge of Little Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	25	6	16.2	996
November 1–15	45	17	26.1	775
April 14–30	74	41	55.4	1,870
May	826	22	190	11,700
June	1,740	31	503	29,900
July	62	2	13.4	824
August	76	3	19.5	1,200
September	5	1	2.2	133

NOTE.—Results changed slightly to conform to the computation rules of the United States Geological Survey.

BIRDWOOD CREEK NEAR SUTHERLAND, NEBR.

LOCATION.—In sec. 2, T. 15 N., R. 33 W., at highway bridge, 16 miles north of Sutherland. Nearest tributary, West Birdwood Creek, enters 2 miles below.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 26, 1913, to September 30, 1914.

GAGE.—Vertical staff, which was moved upstream September 1, 1913. Observer, C. J. McNamara.

DISCHARGE MEASUREMENTS.—Made from pile bent bridge.

CHANNEL AND CONTROL.—Somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.3 feet at 3 p. m. June 13 (discharge, 244 second-feet); minimum stage recorded, 2.96 feet September 23–30, inclusive (discharge, 144 second-feet).

WINTER FLOW.—Discharge relation practically unaffected by ice.

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions of 112 second-feet from Birdwood Creek below the station; none above station.

ACCURACY.—Although the channel is somewhat shifting, the flow is very uniform, as the creek is fed by springs, and sufficient discharge measurements have been obtained to make the estimates of daily discharge reliable.

COOPERATION.—Field data furnished by the State engineer.

Discharge measurements of Birdwood Creek near Sutherland, Nebr., made by C. J. McNamara, during the year ending Sept. 30, 1914.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 19	3.05	172	Mar. 1	2.97	177	June 22	3.25	233
Nov. 2	3.05	172	Apr. 5	2.95	174	July 14	2.89	150
Dec. 12	3.00	174	May 7	2.88	162	Sept. 5	3.00	152
Jan. 31	2.95	166	June 12	3.10	206			

Daily discharge, in second-feet, of Birdwood Creek near Sutherland, Nebr., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	172	172	172	185	168	178	176	188	184	174	182	156
2	172	172	172	185	168	178	176	200	214	174	182	156
3	172	172	172	185	168	176	176	184	192	178	182	152
4	172	172	172	185	168	176	176	180	184	174	182	152
5	172	172	172	185	168	176	176	176	192	174	182	156
6	172	172	172	185	168	176	176	168	180	174	182	152
7	172	172	172	185	209	176	176	172	180	174	182	162
8	172	172	172	185	209	176	176	176	180	174	182	162
9	172	172	172	185	209	176	176	180	176	174	182	164
10	172	172	172	185	209	176	176	176	176	174	182	162
11	172	172	174	185	209	168	176	176	184	174	186	162
12	172	172	174	185	209	168	176	176	184	174	186	162
13	172	172	174	178	209	178	176	176	244	152	186	162
14	172	172	185	174	168	172	176	176	200	150	182	162
15	172	172	185	154	168	172	176	184	184	192	182	162
16	172	172	185	154	168	172	176	184	180	172	182	162
17	172	172	185	164	168	172	176	180	180	168	182	156
18	172	172	185	168	168	180	176	184	180	182	178	156
19	172	172	192	168	168	180	176	180	180	182	178	156
20	172	172	192	168	168	180	176	184	184	172	192	156
21	172	172	192	168	168	180	176	184	176	172	182	156
22	172	172	192	168	170	180	176	180	234	182	176	148
23	172	172	200	168	172	180	200	214	194	182	178	144
24	172	172	200	168	173	180	184	176	190	192	172	144
25	172	172	200	168	174	176	176	176	184	182	182	144
26	172	172	200	168	176	176	176	176	176	172	192	144
27	172	172	200	164	178	176	176	176	176	182	242	144
28	172	172	185	164	178	176	176	180	176	182	162	144
29	172	172	185	164	.....	180	180	176	176	182	162	144
30	172	172	185	164	.....	180	184	184	176	182	158	144
31	172	.....	185	164	.....	176	.....	184	.....	182	162	.....

NOTE.—Discharge computed by the indirect method for shifting channels from four well-defined rating curves.

Monthly discharge of Birdwood Creek near Sutherland, Nebr., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	172	172	172	10,600
November	172	172	172	10,200
December	200	172	183	11,300
January	185	154	173	10,600
February	209	168	180	10,000
March	180	168	176	10,800
April	200	176	177	10,500
May	214	168	181	11,100
June	244	176	187	11,100
July	192	150	176	10,800
August	242	158	181	11,100
September	164	144	154	9,160
The year	244	144	176	127,000

SOUTH PLATTE RIVER[1] AT LAKE GEORGE, COLO.

LOCATION.—In sec. 19, T. 12 S., R. 71 W., at highway bridge, one-fourth mile below Lake George, in the Pike National Forest, about 2 miles above the mouth of Caylor Gulch; no tributary between the outlet of the lake and the station.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 22, 1910, to September 30, 1914.

GAGE.—Bristol water-stage recorder installed by State engineer in 1911, set to read at same datum as the original staff gage. During 1914 the water-stage recorder was not used, and the readings were taken from the staff gage, which was read once daily.

DISCHARGE MEASUREMENTS.—Made from bridge during high water and by wading at ordinary stages.

CHANNEL AND CONTROL.—Conditions in the channel will remain unchanged as long as the control—a 2-foot timber-crib dam 50 feet below the gage—remains permanent. One shift occurred during 1914.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.0 feet at 11 a. m. June 17 (discharge approximately 3,000 second-feet). Rise was due to breaking of dam; minimum discharge recorded, 5 second-feet January 20. Winter records are fragmentary.

1911–1914: Maximum stage recorded, 6.0 feet June 17, 1914 (discharge, approximately 3,000 second-feet); minimum stage recorded, 0.60 foot January 6, 1911 (discharge, 0.5 second-feet).

WINTER FLOW.—Ice causes backwater during the winter months, and measurements are made to determine the flow.

DIVERSIONS.—There are court decrees for diversions of 1,076 second-feet from the South Platte above Lake George. In addition, Antero reservoir has a decree for storage of 85,600 acre-feet from the South Platte and tributaries. All the water from Antero reservoir passes the Lake George station, as it is finally diverted from the South Platte. There are decrees for diversions of 1,926 second-feet from tributaries above Lake George.

REGULATION.—The discharge at the station is regulated naturally to some extent by the dam at the outlet of Lake George; the lake has an area of one-half square mile, and is used as an ice pond. It is regulated to a greater extent by Antero reservoir, 45 miles upstream.

ACCURACY.—Owing to the many interpolated discharge estimates and the fact that the mean stage is based on one reading, the results are apparently only fair.

COOPERATION.—Station maintained in cooperation with United States Forest Service and the State engineer.

Discharge measurements of South Platte River at Lake George, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 5	R. H. Fletcher	1.68	48.	June 7	Robert Follansbee	2.84	495
Jan. 20	do	1.24	4.9	Aug. 26	R. H. Fletcher	2.68	453
May 12	Thos. Grieve, jr	2.00	133				

[1] Formerly known as South Fork of South Platte River.

Daily discharge, in second-feet, of South Platte River at Lake George, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	a 140	a 57	26	(a)	.....	a 25	190	132	860	261	935	282
2	126	a 49	26	(a)	(a)	25	a 204	a 146	930	(a)	935	a 272
3	a 126	41	26	(a)	.....	a 25	217	160	930	(a)	a 954	261
4	126	52	a 26	.....	.....	a 25	120	146	825	(a)	972	217
5	a 111	52	26	(a)	.....	30	a 172	146	a 880	(a)	a 972	207
6	93	26	a 26	(a)	(a)	a 30	224	175	930	515	a 972	a 207
7	a 83	a 26	26	(a)	.....	30	a 222	a 154	500	548	972	a 207
8	a 74	26	26	.....	.....	a 34	a 219	132	415	428	935	207
9	65	30	a 26	(a)	(a)	a 38	217	a 120	a 428	a 445	a 774	a 198
10	65	a 33	26	.....	(a)	41	a 192	107	442	a 463	612	190
11	65	a 37	a 26	(a)	.....	a 55	166	a 117	a 471	a 480	548	190
12	65	41	26	(a)	(a)	69	a 136	127	500	a 498	a 532	a 195
13	52	52	26	.....	(a)	a 75	107	132	560	515	515	a 201
14	58	52	26	(a)	.....	a 80	190	132	860	(a)	455	207
15	58	a 43	a 26	(a)	.....	86	224	122	930	(a)	350	a 198
16	58	33	26	.....	(a)	a 86	132	184	1,080	(a)	a 335	190
17	a 50	26	26	(a)	.....	86	a 126	224	1,470	800	a 320	a 190
18	41	a 31	26	.....	(a)	96	120	244	645	(a)	303	a 190
19	41	a 36	a 26	.....	(a)	86	160	301	515	(a)	303	a 190
20	45	41	26	5	.....	69	132	382	a 495	(a)	a 303	a 190
21	a 45	a 38	26	(a)	(a)	a 82	310	a 371	a 475	(a)	303	a 190
22	45	a 35	a 26	(a)	(a)	a 95	a 287	360	455	(a)	a 311	a 190
23	a 41	a 32	a 26	(a)	.....	107	264	335	a 428	(a)	a 318	a 190
24	a 37	a 29	a 26	.....	(a)	a 96	184	500	400	(a)	326	a 190
25	a 33	a 26	a 26	.....	(a)	86	132	470	350	(a)	303	a 190
26	a 29	26	a 26	.....	.....	a 91	160	530	a 323	(a)	444	190
27	26	26	a 26	.....	(a)	96	120	500	a 296	(a)	312	190
28	26	a 26	a 26	(a)	.....	120	a 103	470	a 269	750	a 297	190
29	26	a 26	a 26	.....	(a)	132	86	530	242	935	282	a 190
30	33	26	a 26	.....	.....	107	78	560	254	972	a 282	190
31	65	.....	a 26	.....	.....	160	.....	720	.....	972	a 282	.....

a No gage record available; discharge, when given, is interpolated.

NOTE.—Daily discharge computed from three rating curves. One used from Oct. 1 to Dec. 31, 1913; a second, well-defined below and fairly well defined above 600 second-feet, used from Mar. 8, to June 17; and a third, used from June 18 to Sept. 30, being based on two measurements and the form of the previous curve. Discharge interpolated for days when the gage was not read as indicated above except for parts of July when no estimates were made; discharge relation affected by ice during during January and February.

Monthly discharge of South Platte River at Lake George, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	140	26	62.8	3,860	B.
November	57	26	35.8	2,130	B.
December	26	26	26.0	1,600	D.
March	160	25	73.0	4,490	C.
April	310	78	173	10,300	C.
May	720	107	282	17,300	B.
June	1,470	242	605	36,000	C.
August	972	282	531	32,600	C.
September	282	190	203	12,100	C.

NOTE.—See footnote to table of daily discharge.

SOUTH PLATTE RIVER BELOW NORTH FORK, AT SOUTH PLATTE, COLO.

LOCATION.—In sec. 25, T. 7 S., R. 70 W., in the Pike National Forest, at South Platte, about 300 feet below junction of North and South forks; no tributary between the forks and the station and none for several miles below.

DRAINAGE AREA.—2,610 square miles (measured from Hayden's atlas).

RECORDS AVAILABLE.—March 28, 1902, to September 30, 1914. Records at Platte Canyon and at Deansbury, a few miles below, extend back to 1887, with the exception of the years 1893 and 1894. The earlier records, 1887–1892, were obtained by the State engineer, and the records from 1895 to 1898 were taken under the direction of the Denver Power and Irrigation Co.

GAGE.—Bristol water-stage recorder installed by the State engineer March 14, 1910. From March 28, 1902, to May 7, 1905, the gage was at the highway bridge. On the latter date it was moved to its present site, 150 feet below, and probably set to read at a different datum. Datum of water-stage recorder the same as that of gage installed in 1905.

DISCHARGE MEASUREMENTS.—Made from car and cable during high water and by wading at low stages.

CHANNEL AND CONTROL.—Shifting during high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year (water-stage recorder), 7.65 feet at 11 a. m. June 2 (discharge, 3,200 second-feet); minimum discharge recorded, 104 second-feet March 11 and 12.

WINTER FLOW.—Ice causes backwater during a part of the winter months, and measurements are made to determine the flow.

DIVERSIONS.—None between this station and that on the North Fork at South Platte. Between South Platte and the station on the South Platte near Lake George Cheesman reservoir has court decrees for 80,000 acre-feet for municipal supplies. All this water passes the gaging station as it is diverted from the South Platte farther downstream. There are decrees for diversions of 1,400 second-feet from intervening tributaries and a reservoir decree for 46,000 acre-feet.

REGULATION.—Flow regulated somewhat by the Cheesman reservoir (capacity approximately 80,000 acre-feet) on the Squth Platte about 20 miles above the forks.

ACCURACY.—Although the control is shifting sufficient discharge measurements have been obtained to make the results reliable.

COOPERATION.—Station maintained in cooperation with the State engineer.

Discharge measurements of South Platte River below North Fork, at South Platte, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 5	R. H. Fletcher	2.92	[a]383	May 4	T. Grieve, jr	5.48	1,570
29	do	2.20	[a]139	8	Robert Follansbee	5.60	1,640
Jan. 12	M. E. Bunger	2.69	[a]126	28	R. H. Fletcher	6.90	2,900
21	do	3.35	[a]217	July 7	D. L. Bundy	4.35	[b]1,410
Feb. 5	do	2.10	[a]160	31	M. D. Anderson	6.55	3,040
24	do	1.70	120	Aug. 21	Robert Follansbee	3.98	1,120

[a] Discharge relation affected by ice.

[b] Made from bridge.

Daily discharge, in second-feet, of South Platte River below North Fork, at South Platte, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	442	241	135	195	117	126	a385	1,360	2,950	1,230	2,910	912
2	505	223	164	a159	160	128	a405	1,450	3,140	1,300	2,960	848
3	569	280	145	a181	156	128	a488	1,620	3,070	1,450	3,000	826
4	547	319	108	a152	153	102	a840	1,540	2,910	1,410	2,920	784
5	463	260	339	a162	160	108	a1,180	1,580	2,780	1,390	2,760	762
6	400	241	395	173	a146	113	a1,120	1,580	2,660	1,390	2,610	740
7	400	241	354	178	a142	122	977	1,620	2,520	1,380	2,470	740
8	380	206	314	168	a143	117	784	1,620	2,420	1,330	2,300	698
9	359	206	276	183	a159	128	891	1,730	2,280	1,300	2,240	676
10	339	190	a250	168	a166	128	870	1,770	2,230	1,220	2,110	654
11	319	206	a160	148	154	104	826	1,840	2,170	1,220	1,950	633
12	319	206	a160	128	164	104	826	1,890	2,100	1,260	1,850	612
13	870	223	a220	140	159	133	848	1,960	2,130	1,340	1,650	612
14	299	241	a145	165	163	157	805	1,960	2,100	1,540	1,570	676
15	223	206	117	165	154	177	891	2,080	2,160	1,690	1,500	676
16	223	177	117	180	166	206	870	2,120	2,300	1,760	1,360	676
17	241	190	124	195	183	242	719	2,260	2,500	1,760	1,300	654
18	206	190	128	210	128	280	a900	2,260	2,310	1,990	1,210	654
19	206	223	117	210	128	a290	a1,000	2,380	2,020	2,120	1,110	633
20	206	241	95	202	135	299	a1,100	2,470	1,960	2,240	1,110	590
21	223	280	a95	202	136	280	1,240	2,630	1,860	2,120	1,110	547
22	223	206	95	202	136	280	1,170	2,750	1,710	2,280	1,110	547
23	223	152	140	202	128	242	1,130	2,920	1,690	2,440	1,110	526
24	260	129	140	202	117	299	1,060	2,970	1,590	2,540	1,080	526
25	280	177	a140	202	106	260	1,040	3,050	1,530	2,400	998	547
26	241	169	a152	202	106	319	1,250	2,920	1,490	2,300	1,040	526
27	223	177	a152	202	113	319	1,100	2,900	1,360	2,290	1,170	505
28	223	190	a117	202	122	339	1,280	2,860	1,300	2,480	1,040	484
29	177	223	a140	152	.....	339	1,200	2,840	1,230	2,640	998	484
30	206	145	140	160	.....	319	1,320	2,960	1,190	2,780	977	505
31	241	.....	140	165	.....	350	.....	2,960	.....	2,900	977	.....

a No gage records; discharge interpolated.

NOTE.—Daily discharge determined as follows: Oct. 1 to Dec. 5, 1913, and Feb. 25 to Mar. 30, 1914, from a well-defined rating curve; Apr. 6 to Sept 30 by indirect method for shifting channels; Dec. 6 to Feb. 4, when discharge relation was affected by ice, estimated from discharge measurements, gage heights, temperature records, and comparison of records at this station with those obtained by Denver Union Water Co. at their intake. Estimates for days in April when gage was not read, based on records of Denver Union Water Co., an allowance being made for the slight difference in drainage area.

Monthly discharge of South Platte River below North Fork, at South Platte, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	870	177	324	19,900	A.
November	319	129	212	12,600	A.
December	395	95	171	10,500	C.
January	210	128	179	11,000	B.
February	183	106	143	7,940	B.
March	350	104	211	13,000	B.
April	1,320	385	950	56,500	B.
May	3,050	1,360	2,220	136,000	C.
June	3,140	1,190	2,120	126,000	C.
July	2,900	1,220	1,850	114,000	B.
August	3,000	977	1,690	104,000	B.
September	912	484	642	38,200	B.
The year	3,140	104	890	650,000	

NOTE.—See footnote to table of daily discharge.

SOUTH PLATTE RIVER AT JULESBURG, COLO.

LOCATION.—About sec. 33, T. 12 N., R. 44 W., at highway bridge, a mile south of Julesburg. No important tributaries between the station and the Colorado-Nebraska State line, one mile distant. All the tributaries for 100 miles or more above the station are intermittent streams.

DRAINAGE AREA.—20,600 square miles.

RECORDS AVAILABLE.—April 2, 1902, to November 16, 1906; May 12, 1908, to September 30, 1914.

GAGE.—Chain gage at the new highway bridge 2,000 feet upstream from the original station. The datum has remained unchanged since reestablihsment of station in 1908.

DISCHARGE MEASUREMENTS.—Made from the pile bridge during high water, and by wading at low stages.

CHANNEL AND CONTROL.—Shifting; frequent discharge measurements required.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.15 feet June 8 (discharge, 13,400 second-feet); minimum stage recorded, 0.4 foot July 31 and August 1 (discharge, 15 second-feet).

WINTER FLOW.—Ice causes backwater during the winter months.

DIVERSIONS.—Between South Platte and Julesburg there are court decrees for diversions of more than 11,500 second-feet from the South Platte. There are also numerous floodwater decrees.

ACCURACY.—Channel did not shift to any great extent during 1914 and sufficient discharge measurements were obtained to make discharge estimates fairly reliable.

COOPERATION.—During 1914 the station was maintained chiefly by the State engineer of Colorado and the State engineer of Nebraska.

Discharge measurements of South Platte River at Julesburg, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 19	Grieve and Hezmalhalch	0.80	42	June 30	A. F. Hewitt	2.35	1,040
May 5	D. L. Bundy	3.62	5,070	Aug. 5	F. Cogswell	.80	78
16	C. J. McNamara	3.75	6,800	Sept. 11	Robert Follansbee	1.40	345
June 27	do	2.75	1,760	28	C. J. McNamara	1.20	296

Daily discharge, in second-feet, of South Platte River at Julesburg, Colo., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	5,160	5,160	1,280	15	740	16	1,150	6,060	1,960	30	80	275
2	.....	6,060	4,780	1,150	20	740	17	1,350	6,610	2,210	30	120	275
3	.....	6,060	4,410	930	25	830	18	1,420	6,610	2,210	30	120	275
4	.....	5,160	5,160	560	40	830	19	1,580	7,160	2,680	30	140	300
5	.....	6,060	5,160	380	120	830	20	1,960	7,160	3,520	30	180	300
6	.....	7,160	7,160	275	325	830	21	2,210	5,160	4,780	25	200	300
7	.....	8,510	10,200	225	325	740	22	2,680	4,410	3,780	20	200	325
8	300	7,160	13,400	200	250	740	23	3,260	3,780	3,260	20	200	350
9	300	7,840	12,200	160	225	625	24	3,780	3,780	2,510	20	200	350
10	350	6,060	11,200	120	180	500	25	3,060	4,410	2,210	20	250	325
11	500	5,610	8,510	80	160	410	26	3,260	5,160	1,960	20	250	300
12	660	5,160	3,060	50	140	350	27	3,520	6,060	1,760	20	500	250
13	830	5,160	2,210	30	120	300	28	4,410	6,060	1,500	20	590	250
14	1,030	5,160	2,210	30	120	275	29	4,410	6,060	1,420	20	660	250
15	1,090	5,160	2,210	50	100	275	30	4,410	7,160	1,280	20	660	225
							31	.....	6,060	.....	15	740	.....

Monthly discharge of South Platte River at Julesburg, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 8-30	4,410	300	2,070	94,400
May	8,510	3,780	5,910	363,000
June	13,400	1,280	4,470	266,000
July	1,280	15	190	11,700
August	740	15	234	14,400
September	830	225	445	26,500

SOUTH PLATTE RIVER AT NORTH PLATTE, NEBR.

LOCATION.—At pile-bent bridge one-half mile south of North Platte. No tributaries between the station and the mouth 4 miles below.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 1 to September 30, 1914.

GAGE.—Vertical staff; read once daily. Observer, Fred Spurrier.

DISCHARGE MEASUREMENTS.—Made from pile-bent bridge.

CHANNEL AND CONTROL.—Data too meager to determine.

WINTER FLOW.—No data.

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions of 362 second-feet from South Platte River between Julesburg and North Platte.

ACCURACY.—Results above 30 second-feet are apparently fair. Discharge for September not computed because of lack of discharge measurements at the low stages recorded during the month.

COOPERATION.—Field data furnished by the State engineer.

Discharge measurements of South Platte River at North Platte, Nebr., during the year ending Sept. 30, 1914.

[Made by C. J. McNamara.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1911.	*Feet.*	*Sec.-ft.*	1912.	*Feet.*	*Sec.-ft.*
May 30	5.0	7,390	July 3	3.6	788
June 18	4.3	2,900	13	3.0	31

Daily discharge, in second-feet, of South Platte River at North Platte, Nebr., for the year ending Sept. 30, 1914.

Day.	June.	July.	Day.	June.	July.	Day.	June.	July.
1	6,700	1,450	11	11,400	200	21	4,600	0
2	6,700	1,200	12	8,200	116	22	4,600	6
3	7,400	1,000	13	6,000	31	23	6,700	6
4	8,200	800	14	5,000	31	24	4,600	0
5	9,000	800	15	4,000	31	25	4,600	0
6	9,000	800	16	4,000	20	26	4,000	0
7	9,800	600	17	4,000	14	27	3,400	0
8	10,600	325	18	2,500	6	28	2,750	0
9	11,400	325	19	4,000	3	29	2,100	0
10	11,800	450	20	4,600	0	30	1,450	0
						31		0

NOTE.—No gage heights are available (discharge interpolated) June 7, 14, 21, 28, July 5, 12, 19, July 26 to Sept. 3, Sept. 6, 13, 20, and 27. Discharge computed from a rating curve fairly well defined above 30 second-feet. See Accuracy.

Monthly discharge of South Platte River at North Platte, Nebr., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
June	11,800	1,450	6,100	363,000
July	1,450	0	265	16,300
August	0	0	0	0

TARRYALL CREEK NEAR JEFFERSON, COLO.

LOCATION.—In sec. 6, T. 9 S., R. 74 W., at Robbins ranch, about 10 miles southeast of Jefferson. Rock Creek enters half a mile below.

DRAINAGE AREA.—223 square miles (measured from Forest atlas).

RECORDS AVAILABLE.—June 27, 1912, to September 30, 1914. From October 18, 1910, to June 28, 1911, a station was maintained within a quarter of a mile of this point, but the relation between the two gages is not known.

GAGE.—Vertical staff; read morning and evening. Observer, Miss Rose Robbins.

DISCHARGE MEASUREMENTS.—Made from foot bridge during high water and by wading at ordinary stages.

CHANNEL AND CONTROL.—Shifting during 1914.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.6 feet during night of June 15 (discharge not estimated), minimum stage occurred during winter months when observations were discontinued.

1912–1914: Maximum stage recorded, 3.6 feet night of June 15, 1914 (discharge not estimated); minimum stage occurred during winter months when observations were discontinued.

WINTER FLOW.—Ice causes a large amount of backwater; observations temporarily discontinued during the winter.

DIVERSIONS.—There are court decrees for diversions of 314 second-feet from Tarryall Creek above the station and 220 second-feet below. The Tarryall Canal and Reservoir Co. has a provisional decree for storage of 68,000 acre-feet from Tarryall Creek and tributaries above the station, and a decree for a supply diversion amounting to 450 second-feet which has not yet been made. There are also decrees for diversions of 926 second-feet from tributaries above the station. The Boreas ditch diverts a small quantity of water from the headwaters of Blue River to Tarryall Creek at its headwaters.

ACCURACY.—Records are apparently good. Owing to the high altitude of the drainage basin (9,500 to 13,000 feet), there is considerable diurnal fluctuation during high water, owing to alternate melting and freezing, mean daily gage height, based on two readings a day, and the maximum stage for the 24 hours may therefore be somewhat in error.

COOPERATION.—Station maintained in cooperation with the Tarryall Canal and Reservoir Co.

Discharge measurements of Tarryall Creek near Jefferson, Colo., made by Robert Follansbee, during the year ending Sept. 30, 1914.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec. ft.*
May 5	0.71	110	June 4	2.09	339	Aug. 20	0.71	72
6	.48	73	5	1.87	292			

Daily discharge, in second-feet, of Tarryall Creek near Jefferson, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	Mar.	June.	July.	Aug.	Sept.
1	84	24	20	277	52	450	172	525	59
2	99	24	20	250	98	525	207	312	52
3	54	24	19	313	86	412	172	292	44
4	45	24	17	331	114	315	172	273	42
5	42	27	.....	214	138	297	216	211	41
6	38	27	.....	223	78	261	106	180	44
7	36	36	.....	90	68	207	98	163	42
8	32	47	.....	48	90	172	94	152	39
9	28	54	.....	36	95	155	73	143	37
10	27	45	.....	84	95	130	50	127	37
11	27	42	.....	54	98	146	48	113	39
12	27	38	.....	54	109	172	90	108	39
13	27	36	.....	82	87	189	261	99	44
14	27	31	.....	122	117	189	412	93	48
15	27	27	.....	127	143	433	146	89	44
16	27	27	.....	114	171	525	155	87	44
17	27	27	.....	71	144	243	216	79	39
18	27	27	.....	48	124	198	392	84	40
19	27	27	.....	71	140	180	207	79	44
20	27	27	.....	48	18e	189	172	72	34
21	61	27	.....	80	223	164	146	86	37
22	58	26	.....	90	241	146	353	90	36
23	36	24	.....	90	313	135	334	90	31
24	34	24	.....	82	277	119	261	79	29
25	31	21	.....	48	277	106	225	83	34
26	27	21	.....	48	232	97	216	97	34
27	27	20	.....	42	241	78	198	81	30
28	27	20	.....	44	328	74	279	65	28
29	27	20	.....	90	307	54	297	88	33
30	26	20	.....	95	248	54	225	66	34
31	26	.....	.....	.....	302	.....	525	73	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Dec. 4, 1913, and June 2 to Aug. 1, 1914, from a well-defined rating curve. Apr. 1 to May 27, 1914, from a rating curve based on two measurements and the form of the curve used in 1913. For other days when gage was read, by the indirect method for shifting channel. No gage records Oct. 27, 30 (discharge interpolated) Nov. 3, 27 (discharge interpolated), and Dec. 5 to Mar. 31.

Monthly discharge of Tarryall Creek near Jefferson, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	99	26	36.6	2,250	B.
November	54	20	28.8	1,710	B.
April	331	36	112	6,660	B.
May	328	52	168	10,300	B.
June	525	54	214	12,700	B.
July	525	48	210	12,900	C.
August	525	65	135	8,300	B.
September	59	28	39.3	2,340	B.

NORTH FORK OF SOUTH PLATTE RIVER AT GRANT, COLO.

LOCATION.—In sec. 9, T. 7 S., R. 74 W., at Grant post office, in the Pike National Forest, 250 feet above the mouth of Geneva Creek.

DRAINAGE AREA.—51 square miles (measured on Forest atlas).

RECORDS AVAILABLE.—July 18, 1910, to September 30, 1914.

GAGE.—Vertical staff; read morning and evening. Observer, Mrs. M. McFarland.

DISCHARGE MEASUREMENTS.—Made from footbridge and by wading.

CHANNEL AND CONTROL.—Somewhat shifting during 1914. No backwater from Geneva Creek.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.7 feet during night of June 1 (discharge, 525 second-feet); minimum discharge recorded, 5 second-feet December 11–13, January 17 to February 5–7, and February 12–14.

1911–1914: Maximum stage recorded, 4.7 feet during night of June 1, 1914 (discharge, 525 second-feet), minimum discharge recorded, 3.5 second-feet November 3, 1911.

WINTER FLOW.—Ice causes backwater during the winter months and measurements are made to determine the flow.

DIVERSIONS.—There are court decrees for diversions of 5.5 second-feet from the North Fork above the station and of 24 second-feet from tributaries entering above.

ACCURACY.—Owing to the high altitude of this station (8,570 feet), there is likely to be considerable diurnal fluctuation at certain seasons of the year, due to alternate melting and freezing; mean daily gage height, based on morning and evening readings, and the high-water stage for the 24 hours may therefore be somewhat in error; records apparently only fair.

COOPERATION.—Station maintained in cooperation with the State engineer.

Discharge measurements of North Fork of South Platte River at Grant, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 4	R. H. Fletcher	1.94	[a] 9.0	May 7	Robert Follansbee	1.86	42
30	do	1.82	[a] 5.8	July 6	D. L. Bundy	2.20	75
Jan. 9	Follansbee and Bunger	1.80	[a] 7.2	Aug. 20	Robert Follansbee	2.02	48
Feb. 4	M. E. Bunger	1.80	[a] 6.2				

[a] Ice at control.

Daily discharge, in second-feet, of North Fork of South Platte River at Grant, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	28	20	11	6	5	8	24	57	318	110	104	35
2	44	20	11	6	5	9	30	53	395	106	108	34
3	44	16	10	6	5	10	23	92	275	99	118	35
4	21	21	9	7	6	11	24	64	257	102	129	39
5	23	26	10	7	5	12	47	62	223	92	105	39
6	24	21	11	7	5	13	30	46	214	92	111	38
7	20	16	10	7	5	14	26	47	193	92	99	26
8	20	24	9	7	6	15	20	86	198	88	99	25
9	21	20	8	7	6	16	16	111	158	70	93	25
10	20	21	7	7	6	17	21	146	167	83	76	25
11	22	22	6	7	6	19	26	141	174	81	69	25
12	20	18	6	7	5	18	26	92	194	81	72	26
13	27	18	6	7	5	18	30	126	178	88	63	26
14	21	16	5	7	5	18	29	144	174	96	59	29
15	21	21	5	6	6	18	34	161	202	89	55	33
16	23	28	5	6	7	18	30	166	162	85	59	29
17	17	33	6	5	7	19	35	177	158	89	57	25
18	21	16	6	5	7	19	26	188	167	132	57	25
19	21	16	6	5	7	19	51	199	167	89	62	25
20	20	18	6	5	7	19	46	255	167	69	64	30
21	20	17	6	5	7	20	59	291	162	86	63	29
22	24	16	6	5	7	20	56	355	170	106	63	29
23	20	16	6	5	7	20	44	327	170	104	64	29
24	23	16	6	5	7	20	35	300	167	105	67	29
25	22	14	6	5	7	23	53	282	158	99	72	29
26	32	13	6	5	7	26	62	264	132	100	67	29
27	27	13	6	5	7	23	68	264	114	104	47	29
28	18	12	6	5	7	25	50	255	112	134	51	29
29	30	12	6	5	.....	20	62	246	110	130	47	24
30	24	11	6	5	.....	19	52	264	102	144	35	24
31	21	.....	6	5	.....	20	.....	282	.....	188	36	.....

NOTE.—Discharge determined as follows: Oct. 1 to Nov. 21, 1913, and Mar. 26 to June 2, 1914, from a rating curve well defined below and fairly well defined above 200 second-feet; June 3 to Sept. 30, by the indirect method for shifting channels; Nov. 22, 1913, to Mar. 25, 1914, when discharge relation was affected by ice, estimated from discharge measurements, gage heights, and records of temperature. No gage records Dec. 14–31, Jan. 8, 14, 15, Mar. 13 and 14; discharge interpolated.

Monthly discharge of North Fork of South Platte River at Grant, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	44	17	23.8	1,460	B.
November	28	11	18.4	1,090	B.
December	11	5	7.1	434	C.
January	7	5	5.9	361	C.
February	7	5	6.1	341	C.
March	26	8	17.6	1,080	D.
April	68	16	37.8	2,250	B.
May	355	46	179	11,000	B.
June	395	102	185	11,000	C.
July	188	69	101	6,210	B.
August	129	35	73.3	4,510	B.
September	39	24	29.1	1,730	B.
The year	395	5	57.3	41,500	

NOTE.—See footnote to table of daily discharge.

NORTH FORK OF SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

LOCATION.—One-third mile above South Platte. No tributary between station and mouth.

DRAINAGE AREA.—449 square miles (measured on Hayden atlas).

RECORDS AVAILABLE.—January 4, 1909, to September 30, 1910; April 1, 1913, to September 30, 1914.

GAGE.—Inclined staff; read once daily. Observer, Miss A. Vermillion.

DISCHARGE MEASUREMENTS.—Made from cable during high and medium stages and by wading at low stages.

CHANNEL AND CONTROL.—Somewhat shifting.

WINTER FLOW.—Ice causes backwater and discharge measurements are made to determine the winter flow.

DIVERSIONS.—There are court decrees for diversions of 20 second-feet from North Fork between Grant and South Platte, and 62 second-feet from intervening tributaries, exclusive of Geneva Creek. A number of small ice and fish ponds divert small quantities of water at various times.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.5 feet at 11 a. m. May 23 (discharge, 1,860 second-feet); minimum stage recorded, 1.60 feet at 11 a. m. November 30 and March 12 (discharge 36 second-feet).

ACCURACY.—As the mean daily gage heights are based on one reading a day, they may be somewhat in error. Results apparently only fair.

COOPERATION.—Station maintained in cooperation with the State engineer.

Discharge measurements of North Fork of South Platte River at South Platte, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 1	Robert Follansbee	1.98	90	May 4	T. Grieve, jr	3.78	574
Dec. 29	R. H. Fletcher	3.70	a 67	8	Robert Follansbee	3.95	727
Jan. 12	M. E. Bunger	3.20	a 54	28	R. H. Fletcher	4.95	1,420
21	do	3.16	a 70	July 7	D. L. Bundy	3.30	448
Feb. 5	do	1.89	a 65	31	M. D. Anderson	4.45	1,160
24	do	2.55	52	Aug. 21	Robert Follansbee	3.04	380

a Discharge relation affected by ice.

Daily discharge, in second-feet, of North Fork of South Platte River at South Platte, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	180	90	46	78	67	50	175	530	1,700	510	820	273
2	230	90	54	78	67	55	199	552	1,780	530	820	258
3	188	107	54	67	67	60	264	575	1,460	510	1,120	243
4	188	90	54	46	67	60	308	595	1,380	510	1,000	229
5	146	90	93	56	67	65	358	620	1,220	552	940	215
6	146	107	130	67	56	70	410	690	1,080	490	880	202
7	146	107	130	67	56	70	410	715	1,010	450	820	202
8	126	107	93	56	67	76	340	820	880	430	710	189
9	126	107	76	67	72	61	308	880	792	410	660	189
10	126	90	68	56	91	68	340	1,080	850	392	660	177
11	126	90	54	56	78	42	340	1,150	880	375	565	177
12	126	90	54	56	56	36	358	978	945	358	520	165
13	126	90	54	56	67	48	392	880	945	410	480	165
14	116	90	68	67	67	61	392	820	945	430	440	202
15	107	90	68	78	67	76	410	792	1,010	430	440	177
16	107	90	68	104	67	111	430	880	978	450	422	165
17	107	90	68	84	78	111	490	880	880	450	405	165
18	107	90	54	78	84	111	430	945	820	470	422	165
19	107	90	68	72	67	102	375	1,010	792	410	405	154
20	90	90	54	67	91	93	490	1,150	765	392	388	154
21	126	90	54	67	91	48	552	1,220	740	358	388	154
22	126	59	54	84	62	61	530	1,620	715	490	370	142
23	107	36	54	91	56	93	450	1,860	665	575	370	142
24	107	36	68	78	52	102	510	1,620	620	450	352	142
25	107	90	84	72	51	111	510	1,380	575	470	388	142
26	107	74	84	84	46	111	510	1,300	530	450	388	131
27	107	90	76	72	44	131	510	1,380	510	430	370	131
28	126	90	68	67	46	131	510	1,460	490	610	319	131
29	59	90	68	62	.....	131	490	1,460	470	660	319	142
30	107	36	68	56	.....	131	510	1,460	490	660	288	142
31	90	.....	76	67	.....	153	.....	1,620	.....	1,000	303	.....

NOTE.—Discharge determined as follows: Oct. 5 to Nov. 30, 1913, from a fairly well defined rating curve; Mar. 8 to July 27, from a rating curve well defined below 1,500 second-feet, applied by indirect method for shifting channels from Apr. 22 to May 5; July 28 to Sept. 30, from a well-defined rating curve. Ice at control Dec. 1 to Mar. 7; daily discharge estimated from discharge measurements, gage heights, and temperature records. No gage records Dec. 4–7 (discharge estimated) and Feb. 3 (discharge interpolated).

Monthly discharge of North Fork of South Platte River at South Platte, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	230	59	125	7,690	B.
November	107	36	85.9	5,110	C.
December	130	46	69.8	4,290	D.
January	104	46	69.6	4,280	D.
February	91	44	66.0	3,660	D.
March	153	42	84.8	5,210	C.
April	552	175	410	24,400	C.
May	1,860	530	1,060	65,200	B.
June	1,780	470	897	53,400	B.
July	1,000	358	488	30,000	C.
August	1,120	288	541	33,300	B.
September	273	131	176	10,500	B.
The year	1,860	36	341	247,000	

NOTE.—See footnote to table of daily discharge.

GENEVA CREEK AT GRANT, COLO.

LOCATION.—In sec. 9, T. 7 S., R. 74 W., in the Pike National Forest, at highway bridge, at Grant post office, 300 feet above the mouth of creek.

RECORDS AVAILABLE.—November 3, 1911, to September 30, 1914. From July 5, 1908, to November 3, 1911, a station was maintained at Sullivan's ranch, 3 miles above Grant. Except during the spring run-off, the flow at the two points is practically the same, as shown by simultaneous measurements.

DRAINAGE AREA.—74 square miles (measured on Forest atlas).

GAGE.—Vertical staff; read morning and evening. Observer, Mrs. J. M. McFarland.

DISCHARGE MEASUREMENTS.—Made from bridge during high water and by wading at ordinary stages.

CHANNEL AND CONTROL.—Somewhat shifting during 1914.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.3 feet during night of June 1 (discharge, 1,700 second-feet); minimum stage recorded, 0.70 foot at 8 a. m. March 3 and 20 (discharge, 12 second-feet).

1913–14: Maximum stage recorded, 4.3 feet during night of June 1, 1914 (discharge, 1,700 second-feet); minimum stage recorded, 0.70 foot March 3 and 20, 1914 (discharge, 12 second-feet).

WINTER FLOW.—Ice causes backwater; discharge measurements made to determine the approximate flow during winter months.

DIVERSIONS.—There is a court decree for a diversion of 1 second-foot from Geneva Creek above the station, and a temporary reservoir decree for 1,480 acre-feet from Geneva and Kerby creeks.

ACCURACY.—Owing to the high altitude of this station (8,570 feet), there is likely to be considerable diurnal fluctuation at certain seasons of the year, due to alternate melting and freezing; therefore the mean daily gage height, based on two readings a day, and the maximum gage height for the 24 hours may be somewhat in error. Results only fair except for low water, for which they are considered good.

COOPERATION.—Station maintained in cooperation with the State engineer.

Discharge measurements of Geneva Creek at Grant, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 4	R. H. Fletcher	1.22	a 18	May 7	Robert Follansbee	1.26	41
30	do	.90	a 16	July 6	D. L. Bundy	2.00	203
Jan. 10	Follansbee and Bunger	2.02	a 15	Aug. 20	Robert Follansbee	1.75	103
Feb. 4	M. E. Bunger	1.40	a 15				

a Discharge relation affected by ice.

Daily discharge, in second-feet, of Geneva Creek at Grant, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	75	28	22	15	16	14	17	26	1,140	302	425	88
2	84	27	22	15	15	13	15	31	1,060	325	670	74
3	66	30	19	15	15	13	22	113	855	260	715	76
4	60	30	18	15	15	18	20	66	960	280	510	78
5	61	30	20	14	15	17	30	66	785	260	410	78
6	56	25	20	14	14	17	19	60	648	302	355	81
7	40	28	19	15	14	17	25	82	615	280	285	60
8	39	30	18	15	14	20	25	58	582	260	300	61
9	42	27	17	15	15	17	22	203	460	260	295	78
10	43	30	17	15	17	17	32	222	582	280	275	53
11	44	26	16	15	17	17	25	240	648	325	260	57
12	40	25	16	15	19	17	25	222	715	302	180	58
13	50	25	14	16	17	13	28	222	680	350	158	58
14	46	22	12	17	15	17	66	203	648	375	155	57
15	44	30	12	18	17	17	49	222	715	402	165	76
16	38	39	14	19	18	15	50	240	582	402	122	83
17	32	28	14	19	18	13	45	280	582	325	122	60
18	35	23	16	19	18	17	30	350	582	402	117	55
19	39	25	16	17	19	22	40	430	582	325	120	45
20	40	25	16	17	18	12	50	520	582	260	120	55
21	37	25	16	17	18	14	45	582	582	280	120	46
22	43	27	16	17	16	17	105	995	582	325	158	48
23	36	37	16	17	17	19	109	925	582	302	104	52
24	38	37	16	17	18	14	102	820	582	302	97	52
25	42	33	16	17	19	22	92	820	648	302	126	52
26	37	31	15	17	16	15	66	680	430	302	128	53
27	43	33	15	17	15	17	33	785	302	350	92	52
28	33	27	15	17	16	20	33	715	302	260	101	35
29	30	26	15	18	.....	19	39	715	280	680	115	44
30	36	35	15	17	.....	18	36	855	302	490	104	34
31	30	.....	15	15	.....	15	.....	960	.....	785	88	.....

NOTE.—Discharge determined as follows: Oct. 1 to Nov. 30, 1913, and Feb. 19 to July 31, 1914, from a rating curve well defined between 40 and 300 second-feet and fairly well defined above 300 second-feet; Aug. 1–19, by the indirect method for shifting channels; Aug. 20 to Sept. 30, from a curve well defined below 100 second-feet; Dec. 1 to Feb. 18, when discharge relation was affected by ice, estimated from discharge measurements, gage heights, and records of temperature. No gage records Dec. 14 to Mar. 11; discharge interpolated.

Monthly discharge of Geneva Creek at Grant, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	84	30	44.5	2,740	B.
November	39	22	28.8	1,710	C.
December	22	12	16.4	1,010	C.
January	19	14	16.3	1,000	C.
February	19	14	16.5	916	C.
March	22	12	16.5	1,010	B.
April	109	15	43.2	2,570	B.
May	995	26	410	25,200	C.
June	1,140	280	620	36,900	C.
July	785	260	344	21,200	B.
August	715	88	226	13,900	B.
September	88	34	60.0	3,570	B.
The year	1,140	12	154	112,000	

NOTE.—See footnote to table of daily discharge.

CLEAR CREEK NEAR GOLDEN, COLO.

LOCATION.—In sec. 6, T. 4 S., R. 70 W., about 2 miles above Golden, and a short distance below the headgate of the Golden ditch. The only tributary of importance between the station and the mouth is Ralston Creek, which enters about 12 miles below.

DRAINAGE AREA.—Approximately 380 square miles.

RECORDS AVAILABLE.—December 4, 1908, to December 31, 1909; June 8 to September 24, 1911; January 26, 1912, to September 30, 1914.

GAGE.—Lallie water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from cable near the gage; by wading during low water.

CHANNEL AND CONTROL.—Somewhat shifting.

EXTREMES OF DISCHARGE.—1911–1914 maximum stage recorded (Lallie gage), 5.4 feet during greater part of day, June 1, 1914 (discharge, 2,900 second-feet); minimum discharge occurs during winter months when observations are discontinued.

WINTER FLOW.—Ice causes backwater, but discharge measurements are made to determine the approximate flow during the winter.

DIVERSIONS.—There is a court decree for a diversion of 53 second-feet from the headwaters of Fraser River to the West Fork of Clear Creek. During 1914 approximately 500 acre-feet were diverted. Above the Golden station there is a court decree for a diversion of 26 second-feet by the Golden ditch.

ACCURACY.—Natural conditions favorable for fairly accurate results; records apparently good, except during the extreme high-water period, when estimates are somewhat uncertain owing to lack of measurements.

COOPERATION.—Station maintained in cooperation with the Farmers' Reservoir Irrigation Co.

Discharge measurements of Clear Creek near Golden, Colo., during the year ending Sept. Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 21	T. Grieve, jr	1.63	125	Mar. 26	R. H. Fletcher	1.36	95
Nov. 4	R. H. Fletcher	1.60	149	Apr. 21	T. Grieve, jr	2.15	288
Dec. 27	do	2.92	[a] 76	May 11	R. H. Fletcher	3.60	1,040
Jan. 17	M. E. Bunger	1.40	105	Aug. 19	do	2.19	348
Feb. 10	do	2.20	[a] 58	Sept. 30	do	1.38	124
21	do	1.28	75				

[a] Discharge relation affected by ice.

Daily discharge, in second-feet, of Clear Creek near Golden, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	294	157	.....	.....	.....	.....	86	403	2,900	990	760	247
2	294	144	.....	.....	.....	.....	103	431	2,780	955	852	278
3	277	144	.....	.....	.....	.....	106	439	2,600	955	820	192
4	260	157	.....	.....	.....	.....	109	473	2,400	990	732	218
5	254	162	.....	.....	.....	.....	112	486	2,160	1,020	679	192
6	244	167	.....	.....	.....	.....	115	500	1,850	955	603	192
7	198	173	.....	.....	.....	.....	118	509	1,650	885	555	157
8	194	157	.....	.....	.....	.....	121	576	1,510	852	332	192
9	190	144	.....	.....	.....	.....	124	665	1,300	820	509	192
10	187	120	.....	.....	58	.....	126	950	1,420	820	465	218
11	184	149	.....	.....	.....	.....	136	985	1,600	820	423	168
12	180	152	.....	.....	.....	.....	162	880	1,650	790	423	168
13	177	149	.....	.....	.....	.....	172	720	1,900	760	383	168
14	173	154	.....	.....	.....	.....	177	690	2,000	760	364	146
15	170	149	.....	.....	.....	.....	174	720	2,050	705	328	192
16	170	132	.....	.....	.....	.....	198	810	1,600	679	328	192
17	157	132	.....	105	.....	.....	291	915	1,700	760	328	168
18	157	149	.....	.....	.....	.....	277	1,060	1,850	820	311	168
19	157	144	.....	.....	.....	.....	264	985	1,850	1,705	311	146
20	157	144	.....	.....	.....	.....	280	1,100	1,750	653	328	146
21	157	152	.....	.....	75	.....	312	1,300	1,700	653	346	157
22	163	102	.....	.....	.....	.....	333	1,680	1,510	790	364	157
23	166	89	.....	.....	.....	.....	330	1,950	1,420	790	328	157
24	170	100	.....	.....	.....	.....	328	1,950	1,420	653	311	146
25	170	127	.....	.....	.....	.....	325	1,900	1,300	593	278	136
26	132	116	.....	.....	.....	92	322	1,840	1,140	569	278	126
27	157	98	76	.....	.....	90	326	1,900	1,020	603	294	126
28	144	98	.....	.....	.....	85	330	1,950	1,140	603	278	116
29	98	144	.....	.....	.....	85	350	1,950	1,060	603	278	116
30	144	72	.....	.....	.....	76	375	1,780	1,060	643	294	116
31	157	.....	.....	.....	.....	83	.....	2,300	.....	885	278	.....

NOTE.—Discharge determined as follows: Oct. 1 to Nov. 30, 1913, from a well-defined rating curve; Mar. 26 to May 31, from a curve well defined below but uncertain above 1,000 second-feet; June 1 to Sept. 30, from a curve well defined below and fairly well defined above 800 second-feet. No gage records Oct. 8–14, 22, 23, Dec. 1–26, Dec. 28 to Jan. 16, Jan. 18 to Feb. 9, Feb. 11–20, Feb. 22 to Mar 25, Apr. 3–9, 23–25, and 27. Discharge recorded in table for days on which gage was not read, estimated or interpolated.

Monthly discharge of Clear Creek near Golden, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	294	98	185	11,400	B.
November	173	72	136	8,090	B.
March 26–31	92	76	85.2	1,010	B.
April	375	86	219	13,000	B.
May	2,300	403	1,120	68,900	B.
June	2,900	1,020	1,710	102,000	C.
July	1,020	569	777	47,800	C.
August	852	278	431	26,500	B.
September	278	116	170	10,100	B.

SOUTH BOULDER CREEK NEAR ROLLINSVILLE, COLO.

LOCATION.—In sec. 35, T. 1 S., R. 73 W., at highway bridge, a mile west of Rollinsville, in the Pike National Forest. Nearest important tributary, Jennie Creek, enters 4 miles above.

DRAINAGE AREA.—39 square miles (measured on topographic maps).

RECORDS AVAILABLE.—September 10, 1910, to September 30, 1914.

GAGE.—Vertical staff; read once daily. Observer R. R. Clark.

DISCHARGE MEASUREMENTS.—Made from bridge during high water and by wading at ordinary stages.

CHANNEL AND CONTROL.—Practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.75 feet at 6 p. m. June 2 (discharge, 542 second-feet); minimum stage recorded, 0.80 foot at 3 p. m. December 26 (discharge, 5 second-feet).

1911–1914: Maximum stage recorded, 3.75 feet June 2, 1914 (discharge, 542 second-feet); minimum discharge recorded, 5 second-feet November 17, 1912, and December 26, 1913.

WINTER FLOW.—Ice causes backwater; discharge measurements are made to determine the approximate flow during the winter months.

DIVERSIONS.—No court decrees for diversions above the station; records probably represent natural run-off.

ACCURACY.—Owing to the high altitude of the station (8,400 feet), alternate melting and freezing cause considerable diurnal fluctuation at certain seasons; it is probable therefore that the mean daily stage based on one reading (at different hours) a day may be considerably in error. For that reason the results are apparently only fair except for low water, for which they are considered good.

COOPERATION.—Station is maintained in cooperation with the United States Forest Service.

Discharge measurements of South Boulder Creek near Rollinsville, Colo., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 26	R. H. Fletcher	0.98	9.9	May 13	R. H. Fletcher	2.05	152
Mar. 4	do	.93	10	Aug. 28	Robert Follansbee	1.22	30
May 12	do	2.20	176				

[a] Discharge relation affected by ice.

Daily discharge, in second-feet, of South Boulder Creek near Rollinsville, Colo., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	a 35	30					25	62	a b 505	a 226	a 101	a 33
2	37	28					a 27	a 60	a b 542	a 237	97	31
3	39	a 27		(a)			34	74	498	228	a 93	29
4	41	30				a 10	a 40	a 88	a 455	220	85	27
5	43	32			(a)		37	a 98	a 405	212	78	24
6	a 45	a 35					34	81	a 392	203	71	22
7	a 57	35		(a)			a 31	a 64	a 392	a 195	a 64	20
8	54	35					a 37	a 93	a 355	a 175	a 57	a 17
9	51	35				(a)	32	a 171	a 318	a 165	a 24	15
10	48	35					a 27	a c 172	a 306	a 237	a 45	14
11	a 45	35	(a)			(a)	a 31	174	a 282	205	a 51	13
12	48	a 35		(a)			a 27	a 175	a 330	172	a 55	a 12
13	a 51	33					a 29	a 146	a 380	a 140	a 57	16
14	44	a 31					a 55	a 165	380	138	a 51	a 20
15	38	a 35					a 60	180	a 380	137	48	a 20
16	a 31	31			(a)	(a)	a 64	a 195	374	a 136	44	a 17
17	a 27	28		(a)			a 55	227	a 368	a 146	a 40	a 10
18	a 20	a 24					60	a 259	a 355	a 132	a 45	12
19	25	a 24					a 64	a 355	a 405	114	42	14
20	30	24				(a)	a 62	a 259	380	a 93	39	16
21	a 35	24			(a)		a 64	a 455	355	a 93	36	a 19
22	35	24					a 60	a 430	330	a 78	a 33	a 19
23	a 35	24	(a)	(a)			a 67	424	a 306	94	31	19
24	a 35	24		(a)			a 57	418	a 330	a 110	30	19
25	a 35	24			(a)		a 93	411	a 306	a 104	a 29	a 19
26	35	a 24	a 5	a 10			a 78	a 405	a 282	110	32	a 19
27	35	23				(a)	a 64	a 430	a 248	116	a 35	16
28	a 35	21				(a)	64	a 455	248	122	a 29	a 13
29	34	a 20					64	a 405	a 248	128	30	14
30	32	a 20	(a)	(a)			a 64	a 442	237	134	31	a 14
31	a 31							450		a 140	32	

[a] Gage read. [b] Dam broke on tributary above. [c] Backwater from log.

NOTE.—Daily discharge computed from a rating curve well defined below 400 second-feet. Discharge interpolated for days for which gage was not read. Discharge relation affected by ice about Nov. 30 to Mar. 28 and discharge estimated from two discharge measurements, gage-height observation on Dec. 26, when control was free from ice, and other gage records, as follows: Mean discharge Dec. 1–31, 12 second-feet; Jan. 1–31, 10 second-feet; Feb. 1–28, 10 second-feet; Mar. 1–31, 12 second-feet.

Monthly discharge of South Boulder Creek near Rollinsville, Colo., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	57	20	38.3	2,360	C.
November	35	20	28.3	1,680	C.
December	.....	.....	a 12	738	
January	.....	.....	a 10	615	
February	.....	.....	a 10	555	
March	.....	.....	a 12	738	
April	93	25	50.2	2,990	B.
May	455	60	252	15,500	C.
June	542	237	356	21,200	C.
July	237	78	153	9,410	C.
August	101	24	49.5	3,040	B.
September	33	10	18.4	1,090	B.
The year	542	.....	82.8	59,900	

a Estimated.

NOTE.—See footnote to table of daily discharge.

LOUP RIVER AT COLUMBUS, NEBR.

LOCATION.—In sec. 23, T. 17 N., R. 1 W., at railroad bridge at Columbus. No tributaries between the station and the mouth of the river, 3 miles below.

DRAINAGE AREA.—13,500 square miles.

RECORDS AVAILABLE.—October 13, 1894, to September 30, 1914.

GAGE.—Vertical staff gage, fastened to piling a short distance above the railroad bridge. Installed June 25, 1914, to replace a staff gage, fastened to pier of the railroad bridge and used November 23, 1913, to June 14, 1914, when it was washed out. Original gage, a vertical staff near site of present gage but set at different datum, was used October 13, 1894, to June 24, 1904, when a chain gage was installed on the highway bridge 1½ miles downstream; set to read the same as the original staff gage but owing to the slope of the river the datum of the chain gage was 8.56 feet lower. The chain gage was used until November 21, 1913. Observer, W. D. Benson.

DISCHARGE MEASUREMENTS.—Made from railroad bridge.

CHANNEL AND CONTROL.—Extremely shifting; frequent measurements are necessary.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.1 feet at 6 p. m. June 17 (gage washed out soon after; discharge not estimated); minimum discharge occurs during winter months when records are temporarily discontinued.

WINTER FLOW.—Ice causes backwater and observations temporarily discontinued during the winter.

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions of 364 second-feet for irrigation, and 4,700 second-feet for power from Loup River above the station, and of 2,011 second-feet for irrigation and 5,170 second-feet for power from tributaries entering above.

ACCURACY.—Although the channel and control are extremely shifting, sufficient measurements have been obtained to permit estimates of discharge, except during high water; results apparently fair.

COOPERATION.—Field data furnished for 1914 by the State engineer.

Discharge measurements of Loup River at Columbus, Nebr., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 4	D. P. Weeks, jr	4.52	2,210	May 24	D. P. Weeks, jr	4.07	3,220
Nov. 9	do	4.65	2,500	31	do	3.75	2,910
23	do	3.70	4,560	June 9	do	4.00	2,730
29	W. M. Jefferys	3.60	2,370	23	do	4.00	11,600
Dec. 12	do	3.20	3,750	July 13	do	2.50	1,740
Mar. 17	D. P. Weeks, jr	3.75	2,690	25	do	3.37	2,810
29	do	3.80	3,260	Aug. 6	do	3.15	1,920
Apr. 5	do	3.50	2,550	17	do	3.05	2,160
19	do	3.58	2,220	Sept. 1	do	3.46	2,470
25	do	3.50	1,930	8	do	3.30	2,240
May 3	do	3.96	3,550	20	do	3.53	2,020
9	do	3.65	2,780				

Daily discharge, in second-feet, of Loup River at Columbus, Nebr., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,080	2,220	.....	3,120	3,200	2,570	.....	1,730	2,470
2	1,680	2,220	.....	2,950	3,420	2,780	.....	1,730	2,330
3	1,850	1,960	.....	2,880	3,610	2,730	.....	1,730	2,330
4	1,960	2,510	.....	2,760	3,890	2,360	.....	1,830	2,260
5	2,080	2,860	.....	2,530	3,800	2,110	.....	1,830	2,150
6	2,080	2,350	.....	2,420	3,410	2,000	3,800	2,020	2,150
7	2,080	2,220	.....	2,420	3,020	1,940	2,780	1,830	2,200
8	2,220	2,220	.....	2,310	2,900	1,870	2,280	1,670	2,240
9	1,960	2,220	.....	2,310	2,780	2,500	2,100	1,590	3,270
10	2,080	2,220	.....	2,380	2,320	.....	2,100	1,520	.....
11	2,080	1,960	.....	2,400	2,390	.....	2,060	1,590	.....
12	2,220	1,960	.....	2,400	2,430	.....	2,030	1,590	.....
13	2,350	2,080	.....	2,450	3,030	.....	1,900	.....	2,270
14	2,670	2,080	.....	2,500	2,780	.....	1,900	.....	3,330
15	2,220	2,510	.....	2,330	2,610	.....	1,820	.....	2,830
16	2,280	2,220	.....	2,160	2,450	.....	1,740	2,050	2,600
17	2,350	2,220	2,690	2,130	2,460	.....	1,700	2,160	2,270
18	2,220	1,850	3,000	2,080	2,480	.....	1,670	2,320	2,270
19	2,350	2,670	2,980	2,220	2,420	.....	1,630	1,800	2,120
20	2,080	2,860	2,900	2,550	2,680	.....	1,570	1,800	2,000
21	2,510	2,860	2,900	2,070	2,640	.....	1,550	1,820	1,960
22	2,350	3,710	2,750	2,090	2,860	.....	1,550	5,800	1,960
23	2,080	4,560	2,720	2,120	4,000	.....	1,530	3,650	1,960
24	2,220	4,190	2,670	2,140	3,220	.....	2,170	3,320	1,960
25	2,220	3,820	2,580	1,930	4,600	.....	2,840	3,020	1,870
26	2,220	3,460	2,750	2,660	4,240	.....	2,450	2,600	1,870
27	2,860	3,100	2,780	3,150	3,880	.....	2,180	2,660	1,870
28	2,470	2,740	2,960	3,900	3,520	.....	1,830	3,030	1,820
29	2,080	2,370	3,200	3,300	3,350	.....	1,600	5,100	1,780
30	1,960	2,500	3,120	3,350	3,200	.....	1,600	3,850	1,780
31	1,850	.....	3,120	.....	3,150	.....	1,600	3,570	.....

NOTE.—No gage heights are available Oct. 16, 28, 30, Nov. 22, 23, Dec. 22, 25, 26, 30, Jan. 1 to Mar. 16, Apr. 22, 23, May 6, 17, 26, June 7, 11, 15-24, July 1, 5, 12, 17, 24, Aug. 14, 15, and Sept. 7.

Discharge was computed by the indirect method for shifting control. No results are given for December on account of high water and uncertainty of effect of ice, nor for June 10 to July 5, Aug. 13-15, or Sept. 10-12 on account of high water and shifting control.

Monthly discharge of Loup River at Columbus, Nebr., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	2,860	1,680	2,180	134,000
November	4,560	1,850	2,620	156,000
March 17–31	3,200	2,580	2,870	85,400
April	3,900	1,930	2,530	151,000
May	4,600	2,320	3,120	192,000
June 1–9	2,780	1,870	2,320	41,400
July 6–31	3,800	1,530	2,000	103,000

NOTE.—See footnote to table of daily discharge.

ELKHORN RIVER AT ARLINGTON, NEBR.

LOCATION.—In sec. 13, T. 17 N., R. 9 E., at highway bridge, one-half mile from Arlington. Nearest tributary, Bell Creek, enters 2 miles below.

DRAINAGE AREA.—5,980 square miles.

RECORDS AVAILABLE.—July 11, 1913, to September 30, 1914. From April 28, 1899, to November 21, 1903, a station was maintained at the old bridge just above the present site.

GAGE.—Vertical staff; read morning and evening. Observer, Gerald Berry.

DISCHARGE MEASUREMENTS.—Made from single-span bridge.

CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.3 feet at 8 a. m. May 28 (discharge, 4,440 second-feet); minimum discharge recorded, 180 second-feet at 6 p. m. August 7 (observations discontinued during winter months).

1913–1914: Maximum stage recorded, 5.3 feet May 28, 1914 (discharge, 4,440 second-feet); minimum discharge recorded 165 second-feet September 5, 6, 9, 10, 1913.

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions from Elkhorn River of 12 second-feet for irrigation and 438 second-feet for power above the station, and a diversion of 500 second-feet for power below.

ACCURACY.—Owing to the shifting channel and insufficient high-water measurements estimates of discharge are apparently only fair.

COOPERATION.—Station maintained in cooperation with the State engineer, by whom the field data were furnished.

Discharge measurements of Elkhorn River at Arlington, Nebr., during the year ending Sept. 4, 1914.

[Made by D. P. Weeks, jr.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Mar. 20	2.45	618	May 30	4.67	3,550	Aug. 5	2.06	391
Apr. 24	2.48	510	July 13	1.95	531	Sept. 3	1.88	291

Daily discharge, in second-feet, of Elkhorn River at Arlington, Nebr., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	413	400	554	.....	836	919	3,590	1,160	320	296
2	406	400	572	.....	884	822	2,800	1,060	320	266
3	399	480	640	.....	868	798	2,360	950	320	242
4	357	480	610	.....	892	798	1,800	869	320	260
5	460	480	680	.....	900	946	1,550	796	368	260
6	378	480	850	.....	990	1,010	1,450	764	332	260
7	371	480	870	.....	999	1,110	1,410	732	284	330
8	364	480	890	.....	900	973	1,660	672	230	380
9	428	440	860	.....	870	734	1,400	665	230	445
10	385	400	880	1,080	880	846	1,750	630	230	1,180
11	343	400	850	900	880	846	2,300	602	230	660
12	406	440	870	860	820	870	2,140	574	210	492
13	329	480	890	820	730	782	1,980	532	242	660
14	322	480	860	780	700	758	2,640	525	254	866
15	350	480	880	700	670	710	4,190	504	230	1,230
16	308	480	850	820	650	654	4,230	466	230	909
17	336	480	923	780	600	576	4,030	460	205	712
18	364	480	840	740	650	548	3,230	436	215	597
19	357	480	840	740	550	534	2,430	430	215	558
20	350	480	1,000	660	550	590	1,740	406	220	538
21	274	480	420	566	550	814	1,920	400	210	476
22	336	580	790	496	510	830	2,300	400	230	445
23	329	580	590	566	466	1,310	1,750	382	242	420
24	322	530	590	620	499	1,850	1,290	355	220	400
25	315	530	740	628	520	1,630	1,460	355	220	385
26	350	530	.....	700	492	2,030	2,860	550	230	348
27	400	530	.....	652	1,680	2,960	2,560	460	230	348
28	400	530	.....	804	1,320	4,290	2,390	400	230	325
29	400	530	.....	836	1,680	3,710	1,990	300	230	325
30	400	580	.....	788	1,160	3,540	1,410	280	230	325
31	400	.....	.....	828	.....	3,700	.....	280	242	.....

NOTE.—Discharge computed by indirect method for shifting channel from four fairly well defined rating curves.

Monthly discharge of Elkhorn River at Arlington, Nebr., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	460	274	366	22,500	C.
November	580	400	487	29,000	A.
December 1–25	1,000	420	774	38,400	C.
March 10–31	1,080	496	744	32,500	
April	1,680	466	823	49,000	
May	4,290	534	1,370	84,200	
June	4,230	1,290	2,290	136,000	
July	1,160	280	561	34,500	
August	368	205	249	15,300	
September	1,230	242	498	29,600	

REPUBLICAN RIVER AT CULBERTSON, NEBR.

LOCATION.—In sec. 20, T. 3 N., R. 31 W., at highway bridge south of Culbertson. Nearest tributary, Frenchman River, enters a short distance below.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 15, 1913, to September 30, 1914.

GAGE.—Vertical staff; read once daily.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Shifting.

WINTER FLOW.—Ice causes backwater; records temporarily discontinued during the winter months.

DIVERSIONS.—There are adjudicated decrees amounting to 165 second-feet from Republican River in Colorado and approved diversions of 523 second-feet in Nebraska above the station.

COOPERATION.—Field data furnished by the State engineer.

Daily discharge not computed owing to shifting channel.

Discharge measurements of Republican River at Culbertson, Nebr., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 7	D. P. Weeks, jr		0	May 21	D. P. Weeks, jr	1.2	128
Dec. 3	W. M. Jefferys	1.1	132	June 18	do	.49	46.5
Mar. 13	D. P. Weeks, jr	1.2	143	July 17	do	.00	[a]1.5
Apr. 11	do	1.35	109	Sept. 28	do	.08	2.7

[a] Discharge estimated.

Daily gage height, in feet, of Republican River at Culbertson, Nebr., for the year ending Sept. 30, 1914.

[La Vaughn Crowell, observer.]

Day.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		0.9		1.3	1.6		0.1		0.05
2		.9		1.3	1.9		.1		.05
3		1.1		1.3	1.6		.1		
4		1.2		1.3	1.4		.1		
5		1.3		1.3	1.3		.1		
6		1.5		1.3	1.2				
7		1.6		1.3	1.2				.1
8		1.2		1.3	1.2				.1
9		.9		1.3	1.2				.1
10	1.6	.9		1.3	1.2				.1
11	1.8	.9		1.3	1.2				.1
12	1.8	.9		1.3	1.1	1.3			
13	1.9			1.3	1.1			0.1	.1
14	1.9			1.3	1.1			.2	.1
15	1.9		1.2	1.2	1.1			.1	.2
16	1.9		1.3	1.2	1.1				.2
17	1.9		1.3	1.2	1.1				.2
18	1.9		1.3	1.2	1.2	.5			.2
19	2.0		1.3	1.2	1.2	.8			.1
20	1.1		1.3	1.2	1.2	.8			.05
21	1.2		1.5	1.2	1.2	.8			
22	1.1		1.4	1.2	1.2	.7			.1
23			1.3	1.2	1.2	.7			.1
24			1.3	1.2	1.2	.7			.05
25			1.3	1.2	1.1	.5			.05
26			1.3	1.2	1.1	.5			.05
27			1.3	1.2	1.0	.4		.3	.05
28			1.4	1.2	1.0	.3		.1	.05
29			1.3	1.3	1.1	.3		.1	
30	.9		1.3	1.4	1.1	.2		.1	.1
31			1.3		1.1			.05	

REPUBLICAN RIVER AT BOSTWICK, NEBR.

LOCATION.—On line between secs. 22 and 23, in T. 1 N., R. 8 W., at highway bridge about a mile southwest of Bostwick. Nearest tributary, a small intermittent stream, which enters a short distance below.

DRAINAGE AREA.—23,300 square miles.

RECORDS AVAILABLE.—June 6, 1904, to September 30, 1914. From June 20, 1896, to November 30, 1903, a station was maintained at Superior, 10 miles downstream. As there are no important tributaries nor diversions between, the records at the two points are very nearly comparable.

GAGE.—Chain gage; read once daily. Observer, J. W. Keifer.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8 feet at 7 a. m. June 17 (discharge, 7,540 second-feet); minimum stage recorded, 0.85 foot at 7 a. m. October 5 and 6 (discharge, 20 second-feet).

WINTER FLOW.—Ice causes backwater during the winter months; observations temporarily discontinued.

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions of 927 second-feet from Republican River between the Culbertson and the Bostwick stations; none below.

ACCURACY.—Owing to the shifting channel, the estimates are apparently only fair.

COOPERATION.—Field data furnished by the State engineer.

Discharge measurements of Republican River at Bostwick, Nebr., during the year ending Sept. 30, 1914.

[Made by D. P. Weeks, jr.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 8	0.98	34	Apr. 12	1.88	398	July 18	1.85	486
Dec. 4	1.30	132	May 22	2.88	1,380	Aug. 20	1.32	190
Mar. 14	2.05	516	June 20	3.80	2,250	Sept. 29	.92	64

Daily discharge, in second-feet, of Republican River at Bostwick, Nebr., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	30	31	228	.....	620	780	448	1,180	500	740	430	145
2	26	31	130	.....	620	780	415	840	465	580	342	180
3	22	31	130	.....	550	550	415	550	3,460	500	342	430
4	22	31	130	.....	480	860	415	790	990	430	315	315
5	20	31	130	.....	480	1,210	448	500	660	430	265	265
6	20	40	480	.....	480	1,030	448	1,950	580	4,660	220	242
7	130	40	550	.....	700	780	448	1,170	430	4,240	220	220
8	66	40	328	.....	700	780	415	900	400	2,480	315	180
9	66	40	328	.....	620	700	415	900	430	2,920	290	180
10	66	31	385	.....	.....	620	415	820	500	2,810	220	180
11	40	31	480	.....	.....	550	415	660	370	2,150	180	180
12	31	40	515	.....	.....	550	415	580	430	1,800	180	145
13	31	40	480	480	.....	550	415	580	2,810	1,350	145	205
14	22	40	448	480	.....	550	448	500	2,370	990	145	265
15	22	40	415	480	.....	550	448	500	6,120	820	145	400
16	22	40	415	620	.....	480	415	465	7,120	740	258	180
17	22	40	355	620	.....	480	415	465	7,540	580	370	180
18	22	40	355	620	620	480	415	580	5,880	465	400	220
19	22	40	355	480	.....	480	385	540	2,920	430	265	180
20	22	40	.....	415	620	415	355	465	2,810	430	200	128
21	22	40	.....	480	620	415	355	820	1,850	400	180	110
22	31	40	.....	480	.....	415	328	1,450	1,750	370	220	81
23	31	40	.....	480	.....	415	328	740	1,550	342	242	81
24	22	40	.....	480	.....	448	300	580	1,260	315	265	81
25	22	40	.....	550	.....	448	300	1,300	1,080	315	265	81
26	22	40	.....	480	860	415	275	820	900	740	265	81
27	22	40	.....	480	860	415	250	740	780	430	220	81
28	22	40	.....	550	860	415	275	820	660	1,600	180	60
29	40	66	.....	550	.....	415	385	990	660	900	145	60
30	31	228	.....	620	.....	448	355	990	740	660	145	60
31	22	.....	.....	620	.....	448	.....	580	.....	500	145	.....

NOTE.—Discharge determined by indirect method for shifting channels. No gage records Jan. 1–12, 14, Feb. 10–17, 19, 22–25, Aug. 16, 23, Sept. 6 and 13; discharge interpolated Jan. 14, Aug. 16, 23, Sept. 6 and 13.

Monthly discharge of Republican River at Bostwick, Nebr., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	130	20	32.6	2,000
November	228	31	45.0	2,680
December 1–19	550	130	349	13,200
January 13–31	620	415	524	19,700
March	1,210	415	577	35,500
April	448	250	385	22,900
May	1,950	465	799	49,100
June	7,540	370	1,930	115,000
July	4,660	315	1,160	71,300
August	430	145	243	14,900
September	430	60	173	10,300

FRENCHMAN RIVER AT CULBERTSON, NEBR.

LOCATION.—In sec. 17, T. 3 N., R. 31 W., at highway bridge at Culbertson. No tributary between the station and the mouth.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 15, 1913, to September 30, 1914.

GAGE.—Vertical staff; read once daily.

DISCHARGE MEASUREMENTS.—Made from pile bent bridge.

CHANNEL AND CONTROL.—Very shifting.

EXTREMES OF STAGE.—Maximum stage during year, 6.0 feet, June 13, as determined from high-water mark; minimum stage recorded, 0.75 foot, September 15 to 30, inclusive.

WINTER FLOW.—Discharge relation affected by ice.

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions from Frenchman River, above the station, of 404 second-feet for power and 1,085 second-feet for irrigation. There are also approved diversions of 50 second-feet from Stinking Water River, which enters above.

COOPERATION.—Field data furnished by State engineer.

Owing to the shifting channel and somewhat inaccurate gage heights no estimates of discharge have been made.

Discharge measurements of Frenchman River at Culbertson, Nebr., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 7	D. P. Weeks, jr	1.45	33.2	June 19	D. P. Weeks, jr	2.02	223
Dec. 3	W. M. Jefferys	1.5	17.0	July 17	do	1.15	32.1
Mar. 13	D. P. Weeks, jr	2.4	191	Aug. 19	do	1.0	29.3
Apr. 11	do	1.9	99	Sept. 28	do	.8	11.5
May 21	do	1.9	102				

Daily gage height in feet, of Frenchman River at Culbertson, Nebr., for the year ending Sept. 30, 1914.

[La Vaughn Crowell, observer.]

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.3	1.2	1.3	.....	1.9	1.9	1.6	1.1	0.9	1.0
2	1.2	1.2	1.3	.....	1.9	2.1	1.4	1.1	1.0	1.0
3	1.3	1.1	1.5	.....	1.9	2.2	1.4	1.1	.95	.95
4	.....	.....	1.5	.....	1.9	2.0	1.4	1.2	.9	.95
5	.....	.....	1.6	.....	1.9	1.9	1.1	1.3	.9	.9
6	.....	.....	1.9	.....	1.9	1.6	1.1	1.2	.9	.9
7	.....	1.4	2.3	.....	1.9	1.5	.....	1.2	.9	.9
8	.....	1.5	2.3	.....	1.9	1.4	.....	1.2	.8	.85
9	.....	1.5	2.2	.....	1.9	1.4	.....	1.2	.8	.85
10	.....	1.5	2.3	.....	1.9	1.4	.....	1.2	.7	.8
11	.....	1.5	2.3	.....	1.8	1.4	.....	1.2	.7	.75
12	.....	1.5	2.3	.....	1.7	1.4	1.7	1.2	.7	.8
13	.....	1.5	2.3	.....	1.6	1.3	6.0	1.2	.8	.8
14	.....	1.3	2.2	.....	1.5	1.3	2.9	1.2	.8	.8
15	.....	1.3	2.1	1.9	1.4	1.4	2.6	1.1	.9	.75
16	1.1	1.3	2.1	1.9	1.4	1.4	2.3	1.1	.9	.75
17	1.2	1.3	2.1	1.9	1.4	1.5	2.2	1.1	1.0	.75
18	1.2	1.3	2.1	1.9	1.4	1.6	2.2	1.1	.95	.75
19	1.2	1.3	2.2	1.8	1.4	1.6	2.2	1.0	.9	.75
20	1.2	1.3	2.2	1.9	1.4	1.6	2.1	1.0	.9	.75
21	1.2	1.3	2.1	1.9	1.4	2.2	2.1	1.0	.9	.75
22	1.2	1.3	2.4	1.9	1.4	2.1	2.0	1.0	.9	.75
23	1.2	.....	2.1	2.0	1.4	2.0	2.0	1.1	.8	.75
24	1.2	.....	2.1	1.9	.....	1.9	1.9	1.05	.9	.75
25	1.2	.....	2.1	1.9	.....	1.6	1.9	1.0	.9	.75
26	1.2	.....	2.1	1.9	.....	1.6	1.8	1.0	.95	.75
27	1.2	.....	2.1	1.9	1.6	1.6	1.6	1.0	.9	.75
28	1.2	.....	.....	1.9	1.6	1.6	1.5	1.0	1.0	.75
29	1.2	.....	.....	1.9	1.6	1.6	1.5	.9	1.05	.75
30	1.2	.1.3	.....	1.9	1.7	1.6	1.4	.9	1.05	.75
31	1.2	.....	.....	1.9	.....	1.6	.....	.9	1.0	.....

BIG BLUE RIVER AT BEATRICE, NEBR.

LOCATION.—At Sixth Street Bridge at Beatrice. Nearest tributary, a small stream entering from the north a mile or more below.

DRAINAGE AREA.—3,363 square miles (United States Weather Bureau).

RECORDS AVAILABLE.—October 15, 1910, to September 30, 1914. Records of gage heights have been kept by the United States Weather Bureau for June, 1905, and from January 1 to July 31 of each year since then.

GAGE.—Chain gage owned by the United States Weather Bureau; read once daily at about 8 a. m.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 16.3 feet at 8 a. m. June 17 (discharge, 12,300 second-feet); minimum stage recorded, 1.7 feet at 8 a. m. October 12 (discharge, 62 second-feet).

WINTER FLOW.—Ice causes some backwater during a part of the winter.

DIVERSIONS.—Prior to September 1, 1914, there were approved diversions from the Big Blue above Beatrice of 1,206 second-feet for power, and of 1,000 second-feet for power below the station.

REGULATION.—Low-water flow regulated slightly by operation of mill about a mile upstream.

ACCURACY.—Owing to shifting channel, and uncertainty regarding the accuracy of the gage heights, the results are apparently only fair.

COOPERATION.—Field data furnished by the State engineer.

Discharge measurements of Big Blue River at Beatrice, Nebr., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 12	D. P. Weeks, jr.	2.30	253	July 20	D. P. Weeks, jr.	2.05	196
Dec. 5	W. M. Jefferys	2.55	334	Aug. 22	do	2.85	397
Mar. 21	D. P. Weeks, jr.	2.45	248	22	do	2.65	333
Apr. 18	do	2.48	244	Sept. 5	D. D. Price	2.30	244
May 17	do	2.27	208	30	D. P. Weeks, jr.	2.50	328
June 15	do	12.70	7,990				

Daily discharge, in second-feet, of Big Blue River at Beatrice, Nebr., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	185	143	355	326	326	575	2,010	358	550	550	550	340
2	143	89	360	380	326	682	1,340	322	765	710	415	340
3	163	230	375	410	300	982	918	232	765	655	375	275
4	143	165	350	353	300	1,560	682	260	600	950	340	305
5	123	280	410	380	326	1,490	628	232	825	765	340	305
6	105	250	570	276	.....	1,450	575	210	1,600	765	275	200
7	185	297	675	326	.....	1,160	435	232	2,980	600	305	710
8	89	322	755	326	.....	885	395	290	5,590	600	305	275
9	123	250	570	300	.....	825	358	232	6,360	600	220	275
10	105	297	470	353	.....	765	358	232	4,130	500	200	275
11	123	273	440	300	.....	710	275	260	2,900	435	340	275
12	62	297	410	300	.....	600	245	260	2,280	358	375	455
13	89	273	410	300	.....	500	275	232	3,820	358	275	655
14	163	297	353	326	.....	415	275	260	5,360	395	245	1,020
15	105	297	380	353	.....	305	305	210	7,600	322	275	1,750
16	62	297	353	300	.....	305	305	275	10,800	358	210	2,630
17	143	297	353	230	.....	375	220	220	6,060	322	232	3,010
18	143	297	326	208	.....	340	220	275	3,580	358	260	2,630
19	105	297	353	252	400	375	180	245	3,580	322	260	2,240
20	89	273	326	230	350	340	220	275	3,660	322	322	1,260
21	105	297	252	326	320	322	220	290	2,360	245	340	982
22	163	273	380	326	320	290	200	290	1,600	275	415	682
23	105	273	300	326	.....	290	275	290	1,220	305	340	575
24	207	273	353	300	.....	290	275	260	1,020	340	275	525
25	185	273	326	326	.....	322	340	290	825	305	305	435
26	207	322	380	353	.....	322	220	305	1,300	275	260	435
27	143	297	300	300	.....	260	220	245	1,300	340	322	435
28	123	297	353	300	.....	290	415	455	1,080	340	290	395
29	163	273	410	326	.....	260	275	550	710	395	322	358
30	163	297	410	326	.....	1,340	340	885	600	500	210	322
31	163	.....	353	300	.....	2,390	.....	455	.....	600	322	.....

NOTE.—Discharge determined as follows: Oct. 1, 1913, to Feb. 5, 1914, and Feb. 19–22, 1914, from a well-defined rating curve; Mar. 1 to Sept. 30, 1914, by the indirect method for shifting channels, from a rating curve well defined between 180 and 1,900 second-feet and extended as a tangent above 1,900 second-feet. No gage records Feb. 6-18 and 23–28; mean discharge Feb. 1–28 estimated at 325 second-feet.

Monthly discharge of Big Blue River at Beatrice, Nebr., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	207	62	135	8,300
November	322	89	270	16,100
December	755	252	400	24,600
January	410	208	314	19,300
February	.....	.....	a325	18,000
March	2,390	260	678	41,700
April	2,010	180	433	25,800
May	885	210	304	18,700
June	10,800	550	2,860	170,000
July	950	245	457	28,100
August	550	200	307	18,900
September	3,010	200	812	48,300
The year	10,800	62	605	438,000

a Estimated.

NOTE.—See footnote to table of daily discharge.

LITTLE BLUE RIVER AT FAIRBURY, NEBR.

LOCATION.—In sec. 26, T. 2 N., R. 2 E., at highway bridge 1½ miles south of Fairbury. Nearest tributary, a small stream entering one-half mile above.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 23, 1908, to September 30, 1914.

GAGE.—Chain gage; read once daily. Observer, Clark Hulbert.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.6 feet at 2 p. m. June 14 (discharge, 4,480 second-feet); minimum stage recorded, 2.20 feet at 8 a. m. August 9 (discharge, 100 second-feet); observations temporarily discontinued during winter months.

WINTER FLOW.—Ice causes backwater for only a short time during the winter months.

DIVERSIONS.—Prior to September 1, 1914, there was an approved diversion of 1.5 second-feet from the Little Blue above Fairbury. No diversion from Little Blue River below Fairbury.

REGULATION.—Dam of the Fairbury Roller Mills, about a mile above, may regulate the flow somewhat during the low-water season and cause daily fluctuation. The mean daily gage heights are based on one reading a day.

ACCURACY.—Estimates of discharge have been made by indirect method for shifting channels and are apparently only fair.

COOPERATION.—Field data furnished by the State engineer.

Discharge measurements of Little Blue River near Fairbury, Nebr., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 12	D. P. Weeks, jr.	2.35	128	June 15	D. P. Weeks, jr.	8.95	2,790
Dec. 4	W. M. Jefferys	2.65	174	July 20	.....do	2.55	150
Mar. 14	D. P. Weeks, jr.	2.67	200	Aug. 22	.....do	2.80	231
Apr. 18	.....do	2.60	208	Sept. 29	.....do	2.32	132
May 17	.....do	2.36	150				

Daily discharge, in second-feet, of Little Blue River near Fairbury, Nebr., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	92	136	250	.....	210	173	334	1,270	130	162
2	78	123	162	.....	186	173	304	1,100	120	159
3	86	154	250	.....	192	170	555	1,060	113	154
4	94	140	295	.....	186	163	580	696	113	159
5	87	142	780	.....	180	182	780	420	127	148
6	96	143	1,080	.....	173	167	510	355	120	130
7	89	144	595	.....	190	204	392	307	124	130
8	89	162	505	.....	187	208	324	274	106	145
9	99	148	370	.....	173	194	264	240	100	130
10	91	132	295	.....	187	180	284	220	193	188
11	92	148	232	.....	190	187	328	202	172	234
12	93	148	232	.....	174	180	815	193	127	165
13	103	123	214	.....	174	163	2,600	184	113	162
14	104	135	178	205	177	154	4,420	172	360	435
15	105	135	196	200	165	160	3,200	158	340	452
16	116	123	196	208	192	148	2,360	158	275	320
17	107	135	178	195	174	148	1,060	161	249	260
18	98	123	178	200	200	140	744	175	215	262
19	109	123	196	195	174	155	530	158	238	215
20	110	135	214	208	173	148	444	150	201	180
21	121	148	162	203	188	152	392	150	176	162
22	112	148	214	160	173	152	377	155	330	162
23	123	135	178	183	178	143	388	142	282	154
24	124	135	162	192	190	169	334	112	234	141
25	115	148	214	170	182	158	314	150	230	147
26	116	135	214	188	162	148	288	134	211	136
27	117	135	135	188	200	175	268	124	197	129
28	130	148	214	185	188	189	260	130	183	126
29	131	162	250	175	184	780	244	124	170	129
30	120	196	232	198	188	345	568	134	162	126
31	149	.....	178	198	.....	345	.....	120	148	.....

NOTE.—Discharge determined by the indirect method for shifting channels. No gage records Jan. 1 to Mar. 13.

Monthly discharge of Little Blue River near Fairbury, Nebr., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	149	78	106	6,520
November	196	123	141	8,390
December	1,080	135	282	17,300
March 14–31	208	160	192	6,850
April	210	162	183	10,900
May	780	140	198	12,200
June	4,420	244	809	48,100
July	1,270	112	294	18,100
August	360	100	189	11,600
September	452	126	187	11,100

MISCELLANEOUS MEASUREMENTS.

Measurements of stream flow at points other than regular gaging stations in the Missouri River basin for the year ending September 30, 1914, and those that have not been published for other years are given in the following table:

Miscellaneous measurements in Missouri River basin in 1913–14.

Date.	Stream.	Tributary to or diverts from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Mar. 3, 1914	Gibbon River	Madison River	Norris soldier station, Wyo.		34.4
Sept. 14, 1914	do	do	do		46.4
Sept. 6, 1914	Two Medicine canal[a]	Two Medicine River	Near Family, Mont., on road Browning to Family.		23
Oct. 17, 1913	South fork of Birch Creek.	Birch Creek	Above flow line of Swift dam reservoir near Dupuyer, Mont.[b]		61
Dec. 5, 1913	do	do	do		49
Jan. 2, 1914	do	do	do		41
Oct. 17, 1913	South branch of south fork of Birch Creek.	South fork of Birch Creek.	do		4.4
Dec. 5, 1913	do	do	do		4.3
Jan. 2, 1914	do	do	do		3.0
Oct. 16, 1913	North Fork of Birch Creek.	Birch Creek	do		32
Dec. 4, 1913	do	do	do		21
Jan. 2, 1914	do	do	do		17.2
Oct. 16, 1913	Bear Creek	North Fork of Birch Creek.	do		2.0
Dec. 4, 1913	do	do	do		1.2
Jan. 2, 1914	do	do	do		0.9
May 4, 1914	Teton River	Marias River	Former gaging station at highway bridge about 1½ miles southwest of Chouteau, Mont.	3.2	78
June 26, 1914	do	do	do	2.91	48
May 5, 1914	Spring Creek	Teton River	Former gaging station, one-half mile southwest of Strabane post office, Mont.	3.89	8.5
June 26, 1914	do	do	do	3.77	3.1
Aug. 13, 1914	do	do	do	3.65	0.8
Mar. 7, 1914	Yellowstone River	Missouri River	About 3 miles below outlet Yellowstone Lake.		669
Sept. 16, 1914	do	do	Fishing Bridge, Yellowstone National Park.		1,030
Mar. 6, 1914	Trout Creek	Yellowstone River	Mouth		8.9
Sept. 16, 1914	do	do	do		10.2
Sept. 16, 1914	Small Creek	do	About 1 mile below Fishing Bridge, Yellowstone National Park.		2.2
Mar. 6, 1914	Alum Creek	do	Mouth		25
Mar. 6, 1914	Antelope Creek	do	do		5.4
Sept. 16, 1914	do	do	do		5.4
May 11, 1914	Woodbine Creek	Stillwater River	Former gaging station in the SE. ¼ sec. 32, T. 5 S., R. 15 E., 7 miles south of Nye, Mont.	2.64	21.2
Aug. 3, 1904	Heart River	Missouri River	Mandan, N. Dak.		23
Sept. 28, 1904	do	do	do		11
Oct. 26, 1904	do	do	do		13
Mar. 26, 1905	do	do	do.[c]		69
July 1, 1905	do	do	do.[c]		110
Aug. 3, 1905	do	do	do.[c]		96
Oct. 15, 1905	do	do	do		11
Oct. 15, 1905	do	do	do		13.1

[a] U. S. Reclamation Service.
[b] See station description of Birch Creek at Swift dam p. 51 for location of Swift dam.
[c] Made from highway bridge a mile south of Mandan.

Miscellaneous measurements in Missouri River basin in 1913–14.

Date.	Stream.	Tributary to or diverts from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Apr. 8, 1906	Heart River	Missouri River	Mandan, N. Dak.[a]		416
Aug. 26, 1906	do	do	do.[b]		59
Sept. 13, 1906	do	do	do.[a]		34
July 21, 1907	do	do	do.[a]		205
July 25, 1907	do	do	do.[a]		534
Aug. 9, 1908	do	do	do.[b]		25.9
July 5, 1912	do	do	do.[b]		108
Sept. 15, 1913	do	do	do.[b]		8.6
June 27, 1914	do	do	do.[c]	−0.49	6,490
June 29, 1905	Dogtooth Creek	Cannonball River	Near Timmer, N. Dak.		3.5
July 1, 1905	do	do	do		3.2
Oct. 17, 1905	do	do	do		1.0
Apr. 10, 1906	do	do	do		39
Aug. 24, 1906	do	do	do		2.2
Sept. 15, 1906	do	do	do		2.9
Aug. 5, 1908	do	do	do		.4
Nov. 4, 1911	do	do	do		1.3
Apr. 5, 1912	do	do	do		70
July 4, 1912	do	do	do		3.8
Apr. 11, 1913	do	do	do		10.2
June 20, 1913	do	do	do		2.5
Aug. 12, 1913	do	do	do		.4
Aug. 14, 1913	do	do	do		20.8
Sept. 16, 1913	do	do	do		.5
June 25, 1914	do	do	do		40
Aug. 11, 1914	do	do	do		3.1
Sept. 7, 1914	do	do	do		1.0
Apr. 3, 1912	Oak Creek	Grand River	Wakpala, S. Dak.		211
May 2, 1912	do	do	do		6
July 3, 1912	do	do	do		1
June 18, 1913	do	do	do		0.2
Aug. 16, 1913	do	do	do		Dry.
June 25, 1914	do	do	do		19.3
Aug. 7, 1914	do	do	do		.5
Sept. 8, 1914	do	do	do		.0
Sept. 18, 1914	Cascade Creek	Cheyenne River	Cascade Springs, S. Dak.		23
Sept. 18, 1914	Fall River	do	Hot Springs, S. Dak.		19
June 10, 1914	North Platte River	Platte River	Saratoga, Wyo.	7.36	5,780
July 29, 1914	Sheep Creek	Medicine Bow River	Deep Lake Outlet, Wyo.		5.3
Sept. 11, 1914	do	do	do		2.0
Jan. 22, 1913	Rock Creek	do	150 feet below mouth of Deep Creek, sec. 25, T. 18 N., R. 79 W., Wyo.		15
May 17, 1913	do	do	do		138
June 11, 1913	do	do	do		444
July 11, 1913	do	do	do		127
Sept. 11, 1913	do	do	do		18
Jan. 6, 1914	do	do	do		11
Jan. 31, 1914	do	do	do		12
Mar. 20, 1914	do	do	do		8.5
June 18, 1914	do	do	do		524
July 11, 1914	do	do	do		105
Aug. 15, 1914	do	do	do		25
Sept. 10, 1914	do	do	do		13
Jan. 22, 1913	Deep Creek	Rock Creek	Sand Lake outlet, sec. 16, T. 17 N., R. 79 W.		1.2
May 16, 1913	do	do	do		35
June 9, 1913	do	do	do		65
July 12, 1913	do	do	do		9.7
Sept. 12, 1913	do	do	do		.9
Jan. 6, 1914	do	do	do		.7
Feb. 2, 1914	do	do	do		1.9
Mar. 21, 1914	do	do	do		.8
June 11, 1914	do	do	do		59
July 30, 1914	do	do	do		6.4
Sept. 11, 1914	do	do	do		.9
Sept. 22, 1914	do	do	do		1.0
May 8, 1914	West Fork of Rock Creek.	do	Ranger station near Red Lodge, Mont.	6.0	42.7

[a] Made from highway bridge a mile south of Mandan.
[b] Made by wading.
[c] Made from highway bridge one-fourth mile above dam.

The following measurements were made on the canals diverting water from Teton River. The total gives the total diversion from the river on the dates indicated. The canals all head on the north bank between Strabane and Chouteau, Mont. The canals are given in order beginning at Strabane and going downstream. Measurements were made where the canals cross the Chouteau-Strabane road.

Date.	Canal.	Discharge.
1914.		*Sec.-ft.*
May 5	Teton Cooperative canal	Dry.
	Upper Farmer's ditch (snow and seepage)	0.5
	Krofft ditch	*a* 2.0
	Peebles' ditch	Dry.
	Fairburn's ditch	2.3
	El Dorado ditch	12.8
	Monkman ditch	*a* 0.2
	Farmer's ditch	14.8
	Cashman's (formerly Ralston's) ditch at flume	Dry.
	Daly ditch	Dry.
	Burton ditch	19.5
		52.1
June 26	Teton Cooperative canal	Dry.
	Upper Farmer's ditch	0.9
	Krofft ditch	7.0
	Peebles' ditch	Dry.
	Fairburn's ditch	*a* 1.5
	El Dorado ditch	17.6
	Monkman ditch	2.7
	Farmer's ditch	58.8
	Cashman's ditch	7.4
	Daly's ditch	*a* 2.5
	Burton ditch	62.0
		160.4
Aug. 13	Farmer's ditch	57.3
	Daly ditch	3.6
	Burton ditch	7.8

a Estimated.

INDEX.

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART VI. MISSOURI RIVER BASIN

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, underground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, professional papers, and annual reports.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features as indicated below:

Part I. North Atlantic basins.
II. South Atlantic and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific basins in California.
XII. North Pacific basins; in three volumes.

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below:

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local office of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., Customhouse.
Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
St. Paul, Minn., Old Capitol Building.
Austin, Tex., Old Post Office Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Phoenix, Ariz., 417 Fleming Building.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Tacoma, Wash., 406 Federal Building.
Portland, Oreg., 416 Couch Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., 619 Federal Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications may be obtained by applying to the Director, United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 3,400 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; W=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to Sept., 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.

Stream-flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
22d A, pt. 4	Monthly discharge	1900.
W 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W 75	Monthly discharge	1901.
W 82 to 85	Complete data	1902.
W 97 to 100	do	1903.
W 124 to 135	do	1904.
W 165 to 178	do	1905.
W 201 to 214	do	1906.
W 241 to 252	do	1907–8.
W 261 to 272	do	1909.
W 281 to 292	do	1910.
W 301 to 312	do	1911.
W 321 to 332	do	1912.
W 351 to 362	do	1913.
W 381 to 394	do	1914.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The following table gives by years and drainage basins the numbers of the papers on surface-water supply published from 1899 to 1915. The data for any particular station will in general be found in the reports covering the years during which the station was maintained. For example, data from 1902 to 1914, for any station in the area covered by Part III are published in Water-Supply Papers 83, 98, 128, 169, 205, 243, 263, 283, 303, 323, 353, and 383, which contain records for the Ohio River basin for those years.

43175°—WSP 386—17——15

Number of water-supply papers containing results of stream measurements, 1899–1914.

Year.	I North Atlantic slope (St. John River to York River).	II South Atlantic and eastern Gulf of Mexico (James River to the Mississippi).	III Ohio River.	IV St. Lawrence River and Great Lakes.	V Hudson Bay and upper Mississippi River.	VI Missouri River.	VII Lower Mississippi River.	VIII Western Gulf of Mexico.	IX Colorado River.	X Great Basin.	XI Pacific slope in California.	XII North Pacific slope basins.		
												Pacific slope in Washington and upper Columbia River.	Snake River basin.	Lower Columbia River and Pacific slope in Oregon.
1899[a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900[g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[b] 97, 98	98	97	[k] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332A	332B	332C
1913	351	352	353	354	355	356	357	358	359	360	361	362A	362B	362C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39. Estimates for 1899 in Twenty-first Annual Report, Part IV.
[b] James River only.
[c] Gallatin River.
[d] Green and Gunnison rivers and Grand River above junction with Gunnison.
[e] Mohave River only.
[f] Kings and Kern rivers and south Pacific slope basins.
[g] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Estimates for 1900 in Twenty-second Annual Report, Part IV.
[h] Wissahickon and Schuylkill rivers to James River.
[i] Scioto River.
[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[k] Tributaries of Mississippi from east.
[l] Lake Ontario and tributaries to St. Lawrence River proper.
[m] Hudson Bay only.
[n] New England rivers only.
[o] Hudson River to Delaware River, inclusive.
[p] Susquehanna River to Yadkin River, inclusive.
[q] Platte and Kansas rivers.
[r] Great Basin in California except Truckee and Carson river basins.
[s] Below junction with Gila.
[t] Rogue, Umpqua, and Siletz rivers only.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

The exceptions to this rule occur in the records for Mississippi River, which are given in four parts, as indicated on page III, and in the records for large lakes, where it is simpler to take up the streams in regular order around the rim of the lake than to cross back and forth over the lake surface.

PART VI. MISSOURI RIVER BASIN.

PRINCIPAL STREAMS.

The principal streams in the Missouri River basin are Red Rock, Beaverhead, and Jefferson rivers, which may be considered a continuous river forming the head of the Missouri; and, below the mouth of the Jefferson, Madison, Gallatin, Prickly Pear, Little Prickly Pear, Dearborn, Sun, Marias, Judith, Musselshell, Milk, Yellowstone, Muddy, Little Missouri, Cheyenne, Niobrara, Platte (including North Platte and South Platte), Kansas, Osage (Marais des Cygnes), and Gasconade rivers. These streams drain wholly or in part the States of Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming.

In addition to the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. xxvi.)

NOTE.—Dash after a dash indicates that station was being maintained September 30, 1914; period after a date indicates discontinuance. Tributaries are shown by indention.

GAGING STATIONS.

Red Rock Creek (head of Missouri River) above Red Rock reservoir, near Monida, Mont., 1911.
Red Rock Creek below Red Rock reservoir, near Monida, Mont., 1911—
Red Rock Creek at Lima, Mont., 1907–1911.
Red Rock Creek at Red Rock, Mont., 1890.
Beaverhead River (continuation of Red Rock River) at Barratts, Mont., 1907—
Beaverhead River at Dillon, Mont., 1907.
Jefferson River (continuation of Red Rock-Beaverhead River) near Silverstar, Mont., 1910—
Jefferson River at Sappington, Mont., 1894–1905.
Missouri River at Toston, Mont., 1890; 1910—
Missouri River near Townsend, Mont., 1891–1901; 1903–4.
Missouri River at Canyon Ferry, Mont., 1889.
Missouri River near Craig, Mont., 1890–91.
Missouri River at Cascade, Mont., 1902—
Missouri River at Great Falls, Mont., 1897–1905.
Missouri River at Fort Benton, Mont., 1910—
Missouri River near Williston, N. Dak., 1905–1907.
Missouri River at Mannhaven, N. Dak., 1904.
Missouri River at Washburn, N. Dak., 1905.
Missouri River at Bismarck, N. Dak., 1904–5.

[1] Records for 1889–90 published at Sun River above Augusta, Mont.

Missouri River tributaries—Continued.
- Two Medicine River (head of Marias River) near Midvale, Mont., 1902–3.
- Two Medicine River at Family, Mont., 1907—
- Marias River near Shelby, Mont., 1902–1906; 1911—
  - Badger Creek near Family, Mont., 1907—
  - Birch Creek at Swift dam, near Dupuyer, Mont., 1913—
  - Birch Creek near Dupuyer, Mont., 1907—
  - Birch Creek at Nelson's ranch, near Dupuyer, Mont., 1914—
  - Birch Creek at Hall's ranch, near Dupuyer, Mont., 1913—
  - Birch Creek at Robare, Mont., 1914—
    - Dupuyer Creek at Dupuyer, Mont., 1908–1912.
    - Dupuyer Creek near Valier, Mont., 1912—
  - Cut Bank Creek at Cut Bank, Mont., 1905—
  - Dry Fork of Marias River near Valier, Mont., 1912—
  - Teton River at Strabane, near Belleview, Mont., 1904–1906; 1908—
  - Teton River at Chouteau, Mont., 1904–1906; 1913.
    - Deep Creek at Frazier's ranch, near Chouteau, Mont., 1912.
    - Deep Creek near Chouteau, Mont., 1911—
      - Willow Creek near Chouteau, Mont., 1912—
  - Spring Creek near Strabane, Mont., 1913.
  - Muddy Creek near Bynum, Mont., 1912—
    - Blackleaf Creek near Bynum, Mont., 1912—
- Judith River near Lewistown, Mont., 1910.
- Musselshell River, North Fork (head of Musselshell River), near Delpine, Mont., 1909–1911.
- Musselshell River, North Fork, near Martinsdale, Mont., 1907—
- Musselshell River at Harlowton, Mont., 1907–
- Musselshell River at Shawmut, Mont., 1902–1907.
- Musselshell River at Lavina, Mont., 1906.
  - Checkerboard Creek near Delpine, Mont., 1909–1912; 1913–
  - South Fork of Musselshell River near Martinsdale, Mont., 1907–
  - American Fork near Harlowton, Mont., 1907–1911; 1913.
    - Lebo Creek near Harlowton, Mont., 1907–1911; 1913.
  - Boxelder Creek:
    - Flatwillow Creek near Flatwillow, Mont., 1911–
- Milk River, South Fork (head of Milk River), near Browning, Mont., 1905–
- Milk River at international boundary, 1913–
- Milk River at Havre, Mont., 1898–
- Milk River at Chinook, Mont., 1897.
- Milk River at Malta, Mont., 1902–
- Milk River at Hinsdale, Mont., 1908–
  - North Fork of Milk River near Browning, Mont., 1911–12.
  - North Fork of Milk River near Kimball, Alberta, 1913–
  - Fort Belknap canal near Chinook, Mont., 1903–
  - Winter-Anderson canal near Chinook, Mont., 1906; 1908.
  - Lodge Creek [1] at Chinook, Mont., 1906–1908.
    - Reser ditch near Chinook, Mont., 1905–
    - West Fork ditch near Chinook, Mont., 1905–
  - Battle Creek [2] near Chinook, Mont., 1905–
    - Cook canal near Chinook, Mont., 1905–
    - Matheson canal near Chinook, Mont., 1905–

[1] Formerly called West Fork of Milk River.
[2] Formerly called North Fork of Milk River.

Missouri River tributaries—Continued.
Yellowstone River tributaries—Continued.
Big Horn River tributaries—Continued.
Bull Lake Creek near J. K. ranch, Wyo., 1909.
Dry Creek at Crowheart, Wyo., 1909.
Popo Agie River near Lander, Wyo., 1911–12.
Little Popo Agie River at Hudson, Wyo., 1907–1909; 1911–12.
Little Wind River at Fort Washakie, Wyo., 1908–9.
Little Wind River above Arapahoe, Wyo., 1906–1909; 1911–12.
Little Wind River below Arapahoe, Wyo., 1906–1909; 1911–12.
Trout Creek at Wind River, Wyo., 1909.
North Fork of Little Wind River—
St. Lawrence Creek near Wind River, Wyo., 1909.
Owl Creek near Thermopolis, Wyo., 1910–1912.
No Wood River at Bonanza, Wyo., 1910–1912.
Tensleep Creek near Tensleep, Wyo., 1910–1912.
Paintrock Creek near Hyattsville, Wyo., 1912.
Paintrock Creek near Bonanza, Wyo., 1910–1912.
Greybull River near Meeteetse, Wyo., 1897; 1903; 1910–1912.
Wood River near Meeteetse, Wyo., 1910–1912.
Shoshone River at Cody, Wyo., 1902–1909.
Shoshone River at Corbett dam, Wyo., 1908–
Shoshone River at Lovell, Wyo., 1897–1899.
South Fork of Shoshone River at Marquette, Wyo., 1903; 1905–
Soap Creek near St. Xavier, Mont., 1911–
Rottengrass Creek near St. Xavier, Mont., 1911–
Little Big Horn River in sec. 28, T. 8 S., R. 35 E., near Wyola, Mont., 1911–
Little Big Horn River near Crow Agency, Mont., 1905–6; 1911–
Prairie Dog ditch near Story, Wyo., 1903.
Lodgegrass Creek near Lodgegrass, Mont., 1911–
Tongue River near Dayton, Wyo., 1903; 1911–12.
Tongue River at Carneyville, Wyo., 1911–12.
Goose Creek at Sheridan, Wyo., 1895–1897; 1911–12.
Little Goose Creek at Sheridan, Wyo., 1896–7; 1911–12.
Powder River, South Fork (head of Powder River) near Kaycee, Wyo., 1911.
Middle Fork of Powder River near Kaycee, Wyo., 1911–12.
North Fork of Powder River near Kaycee, Wyo., 1911.
Clear Creek at Buffalo, Wyo., 1896–1900; 1902–1904; 1911–12.
Clear Creek near Buffalo, Wyo., 1911–12.
Piney Creek at Kearney, Wyo., 1902–1906; 1911–12.
Cruez ditch near Story, Wyo., 1903.
Muddy River near Williston, N. Dak., 1904–1909.
Little Missouri River near Alzada, Mont., 1904; 1906; 1911–
Little Missouri River at Camp Crook, S. Dak., 1903–1906.
Little Missouri River at Medora, N. Dak., 1903–1908.
Knife River near Broncho, N. Dak., 1903–
Painted Woods Creek near Washburn, N. Dak., 1909–10.
Turtle Creek near Washburn, N. Dak., 1909–10.
Heart River near Richardton, N. Dak., 1903–
Apple Creek near Bismarck, N. Dak., 1905.
Cannonball River near Stevenson, N. Dak., 1903–1908; 1911–
Grand River, North Fork (head of Grand River), at Haley, N. Dak., 1908–
Grand River near Seim, S. Dak., 1904–1906.
Grand River near Wakpala, S. Dak., 1911–

Missouri River tributaries—Continued.
North Platte River at North Platte, Nebr., 1895–
Platte River near Lexington, Nebr., 1902–1906.
Platte River near Elm Creek, Nebr., 1914–
Platte River near Columbus, Nebr., 1895–
Platte River near Fremont, Nebr., 1913–
Platte River near Leshara, Nebr., 1911.
Platte River near South Bend, Nebr., 1903.
Little Grizzly Creek at Hebron, Colo., 1904–5.
Roaring Fork of North Platte River near Hebron, Colo., 1904–5.
North Fork of North Platte River at Higho, Colo., 1904–5.
Middle Fork of North Platte River—
Michigan Creek near Walden, Colo., 1904–5.
Michigan Creek near Cowdrey, Colo., 1904–5.
Canadian River at Cowdrey, Colo., 1904–5.
Mullen Creek near French, Wyo., 1911.
Big Creek near Downington, Wyo., 1911–12.
Douglas Creek near Keystone, Wyo., 1914–
French Creek near French, Wyo., 1911–12.
Brush Creek near Saratoga, Wyo., 1911–12.
Encampment River near Peryam's ranch, Wyo., 1900.
Encampment River at Encampment, Wyo., 1911–12.
Cow Creek near Saratoga, Wyo., 1911–12.
Spring Creek near Saratoga, Wyo., 1911–12.
North Spring Creek near Saratoga, Wyo., 1913–
Jack Creek at Matheson's ranch, near Saratoga, Wyo., 1913–
Jack Creek at Blydenburg's ranch, near Saratoga, Wyo., 1912.
Jack Creek at Burdick's ranch, near Saratoga, Wyo., 1911–12.
Pass Creek near Walcott, Wyo., 1911.
Medicine Bow River near Medicine Bow, Wyo., 1901; 1911–12.
Rock Creek at Arlington, Wyo., 1911–
Rock Creek near Rock River, Wyo., 1911–12.
Sweetwater River near Splitrock, Wyo., 1902–3.
Sweetwater River near Alcova, Wyo., 1913–
Boxelder Creek near Careyhurst, Wyo., 1911.
Laramie River at Glendevey, Colo., 1904–5; 1910–1913.
Laramie River near Jelm, Wyo., 1904–5; 1911–
Laramie River near Woods Landing, Wyo., 1895–1900; 1911.
Laramie River and Pioneer canal near Woods, Wyo., 1912; 1914–
Laramie River at Two Rivers, Wyo., 1911–
Laramie River near Wheatland, Wyo., 1912.
Laramie River near Uva, Wyo., 1895–1900; 1903.
McIntyre Creek near Gleneyre, Colo., 1904–5.
Little Laramie River near Hatton, Wyo., 1902–3.
Little Laramie River near Filmore, Wyo., 1911–12.
Little Laramie River near Laramie, Wyo., 1903.
Little Laramie River at Two Rivers, Wyo., 1911–
Sibylee Creek near Wheatland, Wyo., 1912.
North Laramie River near Wheatland, Wyo., 1912.
North Laramie River at Uva, Wyo., 1911–12.
Chugwater Creek at Chugwater, Wyo., 1911–12.
Horse Creek near Little Horse Creek, Wyo., 1911–12.
Horse Creek near Lagrange, Wyo., 1911–12.
Birdwood Creek near Sutherland, Nebr., 1913–
South Platte River at Fairplay, Colo., 1910-

Missouri River tributaries—Continued.
Platte River tributaries—Continued.
South Platte River at Lake George, Colo., 1910–
South Platte River at Cheeseman Lake, Colo., 1899; 1901.
South Platte River above North Fork, at South Platte, Colo., 1905–1912.
South Platte River at South Platte, Colo., 1902–
South Platte River near Deansbury (Platte Canyon), Colo., 1887–1892; 1895–1900.
South Platte River at Denver, Colo., 1895–1913.
South Platte River near Kersey, Colo., 1901–1903; 1905–1913.
South Platte River near Orchard, Colo., 1895–1900.
South Platte River at Julesburg, Colo., 1902–1906; 1908–
South Platte River near Big Spring, Nebr., 1902–3.
South Platte River at North Platte, Nebr., 1914–
Middle Fork of South Platte River at Fairplay, Colo., 1910–1912.
Tarryall Creek near Como, Colo., 1911.
Tarryall Creek near Jefferson, Colo., 1910–
Tarryall Creek near Hayman, Colo., 1910–1912.
Jefferson Creek at Jefferson, Colo., 1910–1912.
Michigan Creek near Jefferson, Colo., 1910–1912.
Goose Creek near Cheeseman Lake, Colo., 1899.
North Fork of South Platte River at Grant, Colo., 1910–
North Fork of South Platte River at Cassells, Colo.,1908–1913.
North Fork of South Platte River at South Platte, Colo., 1909–10; 1913–
Geneva Creek above Jackwhacker Creek, near Grant, Colo., 1909–1911.
Geneva Creek at Old Geneva smelter, near Grant, Colo., 1909–1911.
Geneva Creek at Sullivan's ranch, near Grant, Colo., 1908–1911.
Geneva Creek at Grant, Colo., 1911–
Smelter Creek at Old Geneva smelter, near Grant, Colo. 1909–1911.
Duck Lake Creek near Grant, Colo., 1909–1911.
Scott Gomer Creek at Sullivan's ranch, near Grant, Colo. 1909–1913.
Bear Creek near Morrison, Colo., [1] 1888–1891; 1895–1902.
Clear Creek at Idaho Springs, Colo., 1910–1912.
Clear Creek at Forkscreek, Colo., 1899–1912.
Clear Creek near Golden, Colo., 1908–9; 1911; 1913–
St. Vrain Creek at Lyons, Colo., [1] 1888–1892; 1895–1903; 1909–1913.
Boulder Creek at Orodell, Colo., [2] 1887–1890; 1907–1913.
Boulder Creek near Boulder, Colo., [1] 1888–1892; 1895–1901; 1907–1909.
South Boulder Creek near Rollinsville, Colo., 1910–
South Boulder Creek at Eldorado Springs (near Marshall), Colo., 1888–1892; 1895–1901; 1909–1913.
Community canal near Marshall, Colo., 1909.
Big Thompson Creek near Arkins, Colo., [1] 1888–1890; 1895–1903; 1904–1911.
Handy ditch near Arkins, Colo., 1899–1900; 1903.
Cache la Poudre River near Elkhorn, Colo., 1909–1911.
Cache la Poudre River near Fort Collins, Colo., 1909–1911.

[1] Published only in Water-Supply Paper 74.
[2] Published as "North Boulder Creek above Boulder" in Thirteenth Ann. Rept., pt. 3.

Missouri River tributaries—Continued.
Platte River tributaries—Continued.
South Platte River tributaries—Continued.
Cache la Poudre River at mouth of canyon near Fort Collins, Colo., 1884–1901; 1910–1913.
Cache la Poudre River near Greeley, Colo., 1903.
Crow Creek:
Middle Fork of Crow Creek near Hecla, Wyo., 1902–3.
Middle Loup River (head of Loup River) near St. Paul, Nebr., 1895; 1897; 1899; 1903.
Loup River at Columbus, Nebr., 1894–
North Loup River near St. Paul, Nebr., 1895; 1897; 1899; 1903.
Elkhorn River at Norfolk, Nebr., 1896–1903.
Elkhorn River at Arlington, Nebr., 1899–1903; 1913–
Elkhorn River at Waterloo, Nebr., 1911–1913.
South Fork of Elkhorn River near Norfolk, Nebr., 1896.
Republican River, North Fork (head of Kansas River), near Haigler, Nebr., 1896.
Republican River, North Fork, near Benkelman, Nebr., 1894–95; 1903–1906.
Republican River at Culbertson, Nebr., 1913–
Republican River at Bostwick, Nebr., 1904–
Republican River near Superior, Nebr., 1896–1903.
Republican River at Junction, Kans., 1895–1905.
Kansas River near St. George, Kans., 1904.
Kansas River near Topeka, Kans., 1904.
Kansas River at Lecompton, Kans., 1899–1906.
Kansas River near Lawrence, Kans., 1895–1899.
South Fork of Republican River at Benkelman, Nebr., 1895; 1903–1906.
Frenchman Creek near Wauneta, Nebr., 1895–96.
Frenchman Creek near Palisade, Nebr., 1894–1896.
Frenchman Creek at Culbertson, Nebr., 1913–
Smoky Hill River at Ellsworth, Kans., 1895–1905.
Smoky Hill River at Solomon, Kans., 1904.
Beaver (Ladder) Creek near Scott City, Kans., 1904–5.
Saline River near Beverly, Kans., 1895–1897.
Saline River near Salina, Kans., 1897–1903.
Solomon River at Beloit, Kans., 1895–1897.
Solomon River near Niles, Kans., 1897–1903.
Big Blue River (head of Blue River) at Beatrice, Nebr., 1910–
Blue River at Manhattan, Kans., 1895–1905.
Little Blue River near Fairbury, Nebr., 1908–
Osage (Marais des Cygnes) River at Ottawa, Kans., 1902–1905.
Gasconade River at Arlington, Mo., 1903–1906.
Piney Fork of Gasconade River near Houston, Mo., 1908–9.
Piney Fork of Gasconade River near Hooker, Mo., 1903. (Also called Big Piney Creek.)
Little Piney Creek near Arlington, Mo., 1903.

REPORTS ON WATER RESOURCES OF THE MISSOURI RIVER BASIN.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*5. Irrigation practice on the Great Plains, by E. B. Cowgill. 1897. 39 pp., 12 pls. 10c.

Describes reservoirs for storm and pumped waters, ditching, methods of distributing water, cultivation and subirrigation, duty of water, and winter irrigation.

*9. Irrigation near Greeley, Colo., by David Boyd. 1897. 90 pp., 21 pls.

Treats of topography, rainfall, and water supply in the valley of Cache la Poudre River, a tributary of the South Platte; describes the canals and reservoir systems, construction and operation of canals, and agricultural practice; discusses also the legislative and judicial control of the waters; speaks of the use of the underground waters, effect of alkali waters on soil, pumping of underground waters, and artesian wells.

*12. Underground waters of a portion of southeastern Nebraska, by N. H. Darton. 1898. 56 pp., 21 pls.

Discusses physiography, geology, underground waters of moderate depth, and water horizons in Lancaster, Seward, northern Saline, York, Fillmore, Hamilton, Clay, Hall, Adams, Buffalo, Kearney, Phelps, northern Gosper, and eastern and central Dawson counties; reviews briefly the prospects for obtaining deeper-seated waters.

*23. Water-right problems of the Bighorn Mountains, by Elwood Mead. 1899. 62 pp., 7 pls. 10c.

Discusses water divisions, districts, appropriations, reservoirs, and administrative questions

29. Wells and windmills in Nebraska, by E. H. Barbour. 1899. 85 pp., 27 pls. 15c.

Describes home-made windmills; discusses briefly action of water underground, transmission and storage of windmill power, precipitation, surface waters for irrigation, supply for cities and towns, salt water, and blowing wells.

34. Geology and water resources of a portion of southeastern South Dakota, by J. E. Todd. 1900. 34 pp., 10 pls. 10c.

Describes areas in Turner, Hutchinson, Bonhomme, Yankton, and Clay counties, including typical sections of the valleys of James and Vermilion rivers.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.).

70. Geology and water resources of the Patrick and Goshen Hole quadrangles, in eastern Wyoming and western Nebraska, by G. I. Adams. 1902. 50 pp., 11 pls. 15c.

Describes the geologic formations, surface features, water supply (surface and underground), irrigation, and agricultural products of a part of the Great Plains; discusses settlement and occupancy of the lands, and in an appendix gives the text of the "desert-lands" act, the Carey Act, and an act for the construction of reservoirs on public land for the watering of stock.

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses under South Platte, Arkansas, Rio Grande, San Juan, Grand, and Green River irrigation divisions, drainage, and irrigation, and gives records of stream flow.

90. Geology and water resources of part of the lower James River Valley, South Dakota, by J. E. Todd and C. M. Hall. 1904. 47 pp., 23 pls. 35c.

Describes topography, geologic formations, and surface and underground waters of Davison, Hanson, Sanborn, Beagle, and Miner counties, and portions of Kingsbury, Jerauld, Aurora, and McCook counties, S. Dak.

93. Proceedings of first conference of engineers of Reclamation Service, with accompanying papers, compiled by F. H. Newell, Chief Engineer. 1904. 361 pp. 25c. [Inquiries concerning this report should be addressed to the Reclamation Service.] Contains:

Irrigation in North Dakota by pumping, by F. A. Wilder. Discusses the use of lignite as a fuel for the operation of farm engines.

South Dakota investigations, by Raymond F. Walter. Mentions surveys of reservoir sites on creeks north of Rapid City and the water supply of the Belle Fourche project.

Work on North Platte River in Wyoming, by John E. Field.

Investigations in Wyoming, by Jeremiah Ahern. Describes the Lake De Smet project and the Shoshone project.

Reclamation and water storage in Nebraska, by O. V. P. Stout. Describes North Platte River and discusses its possible use for irrigation. Gives tables showing monthly discharge of the river from 1895 to 1902 and the volume of storage necessary to insure water to meet possible demands. Describes also Frenchman, Loup, and Niobrara rivers.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Gives notes on early floods in Mississippi Valley, and describes floods on Kansas River and its tributaries (Blue, Republican, Solomon, Saline, and Smoky Hill rivers); gives an account of the losses and suggests methods of flood prevention; contains also discharge tables and compares flood and ordinary data.

102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains brief reports on wells and springs of Minnesota and Missouri. The reports comprise tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use, and quality; many miscellaneous analyses.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains a brief report on the "Spring system of the Decaturville dome, Camden County, Mo.," by E. M. Shepard. Some of these springs are of immense size and present many points of interest.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief reports as follows:

Missouri, by E. M. Shepard.

Iowa, by W. H. Norton.

Each of these reports describes briefly the topography of the area, the relation of the geology to the water supplies, and gives list of pertinent publications; lists also principal mineral springs.

117. The lignite of North Dakota and its relation to irrigation, by F. A. Wilder. 1905. 59 pp., 8 pls. 10c.

Describes the thickness, extent, variations, and fuel value of the lignite and its use for pumping water, the area, soils, and lignite of the river flats, and the status of irrigation in the State.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c. [Inquiries concerning this report should be addressed to the Reclamation Service.]

Contains brief account of the organization of the hydrographic (water-resources) branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service.

A brief report on "Irrigation development in North Dakota," by H. A. Storrs. Discusses the feasibility of pumping water from the Missouri to irrigate bench lands along its banks.

147. Destructive floods in United States in 1904, by E. C. Murphy. 15c. Contains:

Belle Fourche River flood, South Dakota, from report of R. F. Walter. Describes floods on Belle Fourche River (tributary to the Missouri through Cheyenne River) and on Cache la Poudre River and Crow Creek (tributaries of the South Platte).

149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 to 61; mentions also principal publications relating to deep borings.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives accounts of floods in eastern Missouri and South Dakota, and estimates of flood discharge and frequency on Kansas, Loup, and Platte rivers; contains also index to literature on floods in American streams.

*184. The underflow of the South Platte Valley, by C. S. Slichter and H. C. Wolff. 1906. 42 pp. 5c.

Describes investigations of velocity, direction, quantity of underflow and the underflow ditch at Ogalalla, Nebr., gives chemical analyses of the water, and discusses disadvantages of underflow canals; describes also the investigation at North Platte, Nebr., and gives suggestions for construction of small pumping plants.

*195. Underground waters of Missouri, their geology and utilization, by E. M. Shepard. 1907. 224 pp., 6 pls. 30c.

Describes the topography and geology of the State, the waters of the various formations, and discusses the water supplies by districts and counties; gives statistics of city water supplies, analyses of waters, and many well records.

*215. Geology and water resources of a portion of the Missouri River valley in northeastern Nebraska, by G. E. Condra. 1908. 59 pp., 11 pls. 40c.

Describes topography, rock formations, mineral resources, streams, springs, shallow and artesian wells, soils, crops, and timber, in Boyd, Knox, Cedar, Dixon, and Dakota counties, and part of Holt County.

*216. Geology and water resources of the Republican River valley and adjacent areas, Nebraska, by G. E. Condra. 1907. 71 pp., 13 pls. 15c.

Describes topography, drainage, temperature, rainfall, winds, rock systems, surface and underground waters, water powers, soils, crops, and timbers of Dundy, Hitchcock, Redwillow, Furnas, Harlan, Franklin, Webster, Nuckolls, Thayer, and Jefferson counties.

221. Geology and water resources of the Great Falls region, Montana, by C. A. Fisher. 1909. 89 pp., 7 pls. 20c.

Describes the topographic features, geologic formation, streams, lakes, swamps, springs, and artesian wells of a portion of the Great Plains in Cascade, Teton, Fergus, Chouteau, and Lewis and Clark counties; discusses the chemical character of the waters (analyses), water powers, irrigation, temperature, rainfall, and agriculture, and gives details of water supplies by districts.

*227. Geology and underground waters of South Dakota, by N. H. Darton. 1909. 156 pp., 15 pls. 40c.

Describes physical features, geologic formations, water horizons, and, by counties, deep wells and well prospects; gives notes on construction and management of artesian wells.

*230. Surface water supply of Nebraska, by J. C. Stevens. 1909. 251 pp., 6 pls. 35c.

Discusses relation of rainfall to run-off and evaporation and seepage near Kearney; describes the river basins, and gives results of observations at gaging stations.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examinations, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Missouri, North Platte, and Platte rivers.

*258. Underground-water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains brief report entitled "The utilization of the underflow near St. Francis, Kans.," by H. C. Wolff; discusses the water-bearing material, velocity, amount, rate of movement, and quality of the waters; arrangement and method of sinking the wells, selection and installation of pumps, engines and cost of pumping, storage reservoirs and loss by evaporation.

273. Quality of the water supplies of Kansas, by H. N. Parker, with a preliminary report on stream pollution by mine waters in southeastern Kansas, by E. H. S. Bailey. 1911. 375 pp., 1 pl. 30c.

Describes the topographic and geologic features of the State and the artesian basins; discusses the significance of mineral constituents and classification of waters; gives details concerning quality of underground water by counties and surface water by drainage basins.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and method of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of samples of water from streams in Missouri River basin.

293. Underground water resources of Iowa, by W. H. Norton, W. S. Hendrixson, H. E. Simpson, O. E. Meinzer, and others. 1912. 994 pp., 18 pls. 70c.

Describes the relief, drainage, temperature, and precipitation of the State and the geologic formations; discusses the geologic occurrence of underground waters, artesian phenomena and yield of artesian wells, the chemical composition of underground waters, municipal, domestic, and industrial water supplies, and mineral waters; gives details concerning topography, geology, underground waters, and city and village supplies by districts and counties.

367. Profile surveys of Missouri River from Great Falls to Three Forks, Montana, prepared under the direction of R. B. Marshall, chief geographer. 1914. 8 pp., 1 pl. (13 sheets). 50c.

Gives a brief description of the general features of the Missouri River basin, a list of the gaging stations that have been maintained between Three Forks and Great Falls, and of the publications containing the results of stream-flow measurements.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II, Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xiv, 395 pp., 30 plates and maps. $1.25. Contains:

* Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurements, rainfall, and evaporation, and describes the more important streams.

* Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

* The arid lands, pp. 201–289. Includes statement of the Director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation, and a report on artesian irrigation on the Great Plains, including a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

* Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

* Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2.00 Contains:

* Report upon the location and survey of reservoir sites during the fiscal year ended June 30, 1891, by A. H. Thompson, pp. 1–212, Pls. LIV–LVII. Describes reservoir sites in Meagher, Lewis and Clark, Beaverhead, Madison, Chouteau, Cascade, and Fergus counties, Mont., and for each site gives the location, brief description of the drainage basin, height of dam, capacity of reservoir, and the area of segregated land.

* Hydrography of the arid regions, by F. H. Newell, pp. 213–361, Pls. LVIII–CVI. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River basin.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III, Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

* Water supply for irrigation, by F. H. Newell, pp. 1–99, Pls. CVIII–CX. Discusses areas irrigated and irrigable, fluctuations in rivers and lakes, cost and value of water supply, and describes the location and area, topography, land classification, extent of irrigation, precipitation, and water measurements on the Missouri and its tributaries.

* Engineering results of irrigation survey, by H. M. Wilson, pp. 351–427, Pls. CXLVII–CLXXXII. Describes the reservoirs, canal lines, areas of lands reclaimable, and estimated revenue from irrigation works on the Sun River system, Montana.

Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, xix, 598 pp., 42 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV–XXXIX. Describes the general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Water resources of a portion of the Great Plains, by Robert Hay, pp. 535–588, Pls. XL–XLII. Describes an area comprising between 5,000 and 6,000 square miles and including parts of three counties of Kansas, five counties of Nebraska, and six of Colorado, drained to the Missouri through Platte and Kansas rivers; discusses the lakes, streams, and springs of the area, the underflow of the river bottoms, and the water-bearing strata under the higher lands; treats also of the sources of the water supply, rainfall, rate of percolation, volume; valley, upland, and deep wells; waterless wells, artesian flow, and blowing wells; and the temperature of the well waters; describes briefly the topography and geology of the region and the utilization of the water supply.

Seventeenth Annual Report of the United States Geological Survey, 1895–96, Charles D. Walcott, Director. 1896. 3 parts in 4 vols. *Pt. II. Economic geology and hydrography, xxv, 864 pp., 113 pls. $2.35. Contains:

Preliminary report on artesian waters of a portion of the Dakotas, by N. H. Darton, pp. 603–694, Pls. LXIX–CVII. Gives an outline of the geologic relations; describes the water horizons and the extent of the artesian water, and gives details concerning wells and prospects by counties; discusses the origin, amount, pressure, head, and composition of the artesian waters, the use of artesian water for power, and gives details concerning artesian irrigation by counties; contains also remarks on the construction and management of artesian wells.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. *Pt. IV, Hydrography, x, 756 pp., 102 pls. $1.75 Contains:

*New developments in well boring and irrigation in eastern South Dakota, by N. H. Darton, pp. 561–615, Pls. XXXVIII–XLVII. Discusses progress in well sinking and irrigation by artesian waters in 1896 in Aurora, Beadle, Bonhomme, Brule, Buffalo, Charles Mix, Davison, Douglas, Hanson, Hutchinson, Jerauld, Sanborn, Spink, and Yankton counties, South Dakota, and in areas west of the Missouri River; treats also of the temperature and volume of flow of the deeper artesian waters and gives chemical analyses of waters from Missouri River and from artesian wells in the Sanborn basin.

*Reservoirs for irrigation, by J. D. Schuyler, pp. 617–740, Pls. XLVIII–CII. Describes reservoir sites on Goose Creek, Tarryall Creek, and South Fork of South Platte River in Colorado; gives tables of reservoir capacity and areas.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Pts. II, III, IV, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. * Pt. IV, Hydrography, viii, 814 pp., 118 pls. $1.85. Contains:

*Preliminary report on the geology and water resources of Nebraska, west of the 103d meridian, by N. H. Darton, pp. 719–785, Pls. LXXIV–CXVIII. Describes topography and drainage of the area, the general geology of Nebraska, and the geology of the area covered by the report, the water horizons, and deep-seated waters; discusses springs, streams, irrigation, climate, and timber, and gives list of elevations.

——— *Pt. V, Forest Reserves, pp. xvii–400, 110 pls. (16 maps in separate case· paper, 75c.; cloth, $1.00). $1.25. Contains:

*Black Hills Forest Reserve, by H. S. Graves, pp. 67–164, Pls. XIV–XXXVI.

*Big Horn Forest Reserve, by F. E. Town, pp. 165–190, Pls. XXXVII–XLII.

Yellowstone Park Forest Reserve, southern part, from notes by T. S. Brandegee, pp. 213–216.

These reports contain many descriptions of the streams of the forest reserves.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Pts. II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest Reserves, xix, 498 pp., 159 pl., 8 maps in separate case. $2.80. Contains:

*Pikes Peak, Plum Creek, and South Platte reserves, by J. G. Jack, pp. 39–115, Pls. VIII–XLVII. Describes briefly the drainage of the forest reserves.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Charles D. Walcott, Director. 1900. (Pts. III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, 768 pp., 156 pls. $2.35. Contains:

*Preliminary description of the geology and water resources of the southern half of the Black Hills and adjoining regions in South Dakota and Wyoming, by N. H. Darton, pp. 489–599, Pls. LVIII–CXII. Describes the topography and geology of an area comprising about 5,500 square miles in southwestern corner of South Dakota, in the adjoining portion of Wyoming. Discusses the geologic formations and their contained waters, the deep borings at Edgemont and other places, the surface waters (Cheyenne and Fall River, Beaver, Lame Johnny, French, Battle Spring, Hat, Cascade, Stockade Beaver, and Beaver creeks), and irrigation, the soils, mineral resources, climate, temperature, and timber.

*The High Plains and their utilization, by W. D. Johnson, pp. 601–741, Pls. CXIII–CLVI. Describes the area lying in an irregular belt about midway across the long eastward slope of the Great Plains and including parts of Wyoming, Colorado, Nebraska, Kansas, New Mexico, Oklahoma, and Texas; discusses the origin and structure of the High Plains, the precipitation, temperature, and other factors of climate, experiments with irrigation, and the use of mountain streams, local storm-water storage, and artesian waters. Concluded in the Twenty-second Annual Report, Pt. IV, pp. 631–669, Pls. LI–LXV.

——— *Pt. V, Forest Reserves, 711 pp., 143 pls., 39 maps in separate case. $3.85. Contains:

*Lewis and Clarke Forest Reserve, Montana, by H. B. Ayres, pp. 27–80, Pls. II–XXXII. Briefly describes the valleys of the streams.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Kansas and Missouri, and detailed records of wells in Greeley County, Kansas, and Randolph County, Missouri. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming, and detailed records of wells in Geary and Wyandotte counties, Kansas; Jackson County, Missouri; Teton County, Montana; and Beadle and Miner counties, South Dakota. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

*17. Preliminary report on the geology and water resources of Nebraska west of the one hundred and third meridian, by N. H. Darton. 1903. 69 pp., 43 pls. 50c.

Describes topography and general geology of Nebraska, the streams, springs, and deep-seated waters, and irrigation; gives list of elevations.

*32. Preliminary report on the geology and underground water resources of the central Great Plains, by N. H. Darton. 1905. 433 pp., 72 pls. $1.80.

Describes topography, drainage, stratigraphy, historical geology, and the water horizons; discusses deep wells and prospects (by counties and towns) in South Dakota (see Water-Supply Paper 227), Nebraska, central and western Kansas, eastern Colorado, and eastern Wyoming, discusses also the occurrence of coal, petroleum, and natural gas, salt, gypsum, gold, iron ore, and other minerals.

*53. Geology and water resources of the Bighorn basin, Wyoming, by C. A. Fisher. 1906. 72 pp., 16 pls.

Describes the topography of the region, the stratigraphic, structural, and historical geology, and the underground waters, coal, oil, and gas, building stone, and other mineral resources; discusses briefly irrigation and mineral waters.

65. Geology and water resources of the northern portion of the Black Hills and adjoining regions in South Dakota and Wyoming, by N. H. Darton. 1909. 105 pp., 24 pls. 40c.

Describes the topography of the region and the stratigraphic, structural, and historical geology of the sedimentary rocks; discusses their mineral resources, including underground water, coal, gypsum, etc.; contains also information concerning the surface waters.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute the Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The

[1] Index maps showing areas in the Missouri River basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy, except folio 193, which sells for 75 cents a copy. A discount of 40 per cent is allowed on an order for folios or for folios together with topographic maps amounting to $5 or more at the retail rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

*24. Three Forks, Montana. 5c.

55. Fort Benton, Montana.
Under "Economic geology," gives a brief paragraph on the artesian waters.

*56. Little Belt Mountains, Montana.
Describes the hot waters of White Sulphur Springs, of which it gives an analysis.

87. Camp Clark, Nebraska. 5c.
Gives table of average rainfall in western Nebraska 1886–1897 and, under "Economic geology," discusses underground waters and water for irrigation.

88. Scotts Bluff, Nebraska. 5c.
Gives table of average rainfall from 1886–1897; discusses underground waters and water supply for irrigation.

96. Olivet, South Dakota. 5c.

97. Parker, South Dakota. 5c.

99. Mitchell, South Dakota. 5c.

100. Alexandria, South Dakota. 5c.

113. Huron, South Dakota. 5c.

114. De Smet, South Dakota. 5c.
Nos. 96, 97, 99, 100, 113, and 114 give an account of the water horizons of the main artesian supply, and the limits of the artesian area; and discusses causes of apparent decline in pressure; each contains an artesian water map showing areas in which wells may be expected to flow.

*127. Sundance, Wyoming-South Dakota.
Discusses surface and underground waters; gives analyses of water from well at Jerome, South Dakota.

128. Aladdin, Wyoming-South Dakota-Montana. 5c.

*150. Devils Tower, Wyoming.
Discusses the rainfall, the streams, and the geologic formations that furnish underground waters.

156. Elk Point, South Dakota-Nebraska-Iowa. 5c.

165. Aberdeen-Redfield [1] (Northville, Aberdeen, Redfield, and Bryan quadrangles), South Dakota. 5c.
Describes the relief and drainage and geology of an area in eastern South Dakota comprising nearly all of Spink County and portions of Falk, Hand, Edmunds, and Beadle counties.

168. Jamestown-Tower [1] (Jamestown, Eckelson, and Tower quadrangles), North Dakota. 5c.

In Nos. 156, 165, and 168 is a map showing areas in which flowing artesian wells may probably be obtained.

181. Bismarck,[1] North Dakota. 5c.

Describes the streams, shallow dug wells, tubular wells, and flowing wells.

196. Philipsburg, Montana. 25c.

Mentions the use of water for irrigation and for power development.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of the various sections of the country. Notable among those pertaining to the Missouri River basin are the reports of the Chief of Engineers, United States Army, of the State geologist of Kansas, the State Drainage Commission of Minnesota, the Commission on Conservation of the State of Montana, the State Board of Irrigation of Nebraska, the superintendent of the Department of Irrigation, Forestry, Fish, and Game of North Dakota, and the State engineer of Wyoming. The following reports deserve special mention:

The Missouri River and its utmost source, by J. V. Brower. St. Paul, 1897.

Geological report of the exploration of the Yellowstone and Missouri rivers, by F. V. Hayden. Washington, 1869.

Preliminary examination of reservoir sites in Wyoming and Colorado: 55th Cong., 2d session, House Doc. 141.

Report of the Commission appointed by his excellency the governor of the State of Colorado to revise the laws of the State [of Colorado] regulating the appropriation, distribution, and use of water. Denver, 1890.

Some aspects of irrigation development in Colorado, by G. G. Anderson: Colorado Sci. Soc. Proc., vol. 9, 1909.

Special report on well waters in Kansas, by Erasmus Haworth; Kansas Univ. Geol. Survey Bull. 1.

Report of Board of Irrigation Survey and Experiment [Kansas] for 1895–96. Topeka, 1897.

Water supplies of Kansas, by C. A. Haskins and C. C. Young: Univ. of Kansas Bull. 10, vol. 16, 1915.

Report of the commission on conservation [State of Montana] on bills relating to public lands, water rights, and the protection and preservation of the forests. Helena, 1911.

Irrigation laws of the State of Wyoming; compiled in the office of the State engineer.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations:

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by H. M. Wilson. 1896. 57 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines; also storage reservoirs to retain pumped water until needed for irrigation.

[1] Issued in two editions—library and octavo. Specify edition desired.

*3. Sewage irrigation, by G. W. Rafter. 1897. 100 pp., 4 pls. (See Water-Supply Paper 22.) 10c.

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, Kans.; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl. 10c.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, makes comparisons of wheels of several types, and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper No. 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

*32. Water resources of Puerto Rico, by H. M. Wilson. 1899. 48 pp., 17 pls. 15c.

Describes briefly topography, climate, rivers, irrigation methods, soils, forestation, water power, and transportation facilities.

*41. The windmill; its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls.

*42. The windmill; its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp., 2 pls. 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls.

Gives elevations and distances along rivers of the United States, including Missouri, Jefferson, Bighole, Beaverhead, Madison, Gallatin, Osage, Kansas, Republican, Platte, Yellowstone, Milk, and James rivers; also brief descriptions of many of the streams. Arrangement geographic. Many river profiles are scattered through other reports on surface waters in various parts of the United States.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901–2. (See also Nos. 64, 94, and 95.)

64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow, and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of underground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of underground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing wells; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

77. The water resources of Molokai, Hawaiian Islands, by Waldemar Lindgren. 1903. 62 pp., 4 pls. 10c.

Describes briefly the topography, geology, coral reefs, climate, soils, vegetation, forests, and fauna of the island, the springs, running streams and wells, and discusses the utilization of the surface and underground waters.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws of measurements of stream flow; gives formulas for rainfall, run-off, and evaporation; discusses effect of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c.

Contains, in addition to an account of the organization of the hydrographic [water-resources] branch of the United States Geological Survey, and the reports of the conference, the following papers of more or less general interest:

Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas A. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. (See also No. 95.)

*95. Accuracy of stream measurements (second, enlarged edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. (See also No. 94.)

103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.

The California or "stovepipe" method of well construction, by Charles S. Slichter.

Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.

Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

Notes on the hydrology of Cuba, by M. L. Fuller.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard, and gives results of various experiments in disposing of the waste. The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., and the contamination of rock wells and of streams by waste oil and brine.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amount, and temperature of waters, permeability and storage capacity of rocks, water-bearing formations, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting underground waters in eastern United States.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

Scope indicated by title.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M. L. Fuller. 1905. 128 pp. 10c.

Scope indicated by title.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal., and on Long Island, N. Y., gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls.

Scope indicated by title.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains brief reports of general interest as follows:

Drainage of ponds into drilled wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c.

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest.

Proposed State code of water laws, by Morris Bien.
Power engineering applied to irrigation problems, by O. H. Ensign.
Estimates on tunneling in irrigation projects, by A. L. Fellows.
Collection of stream-gaging data, by N. C. Grover.
Diamond-drill methods, by G. A. Hammond.
Mean-velocity and area curves, by F. W. Hanna.
Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.
Effect of aquatic vegetation on stream flow, by R. E. Horton.
Sanitary regulations governing construction camps, by M. O. Leighton.
Necessity of draining irrigated land, by Thos. H. Means.
Alkali soils, by Thos. H. Means.
Cost of stream-gaging work, by E. C. Murphy.
Equipment of a cable gaging station, by E. C. Murphy.
Silting of reservoirs, by W. M. Reed.
Farm-unit classification, by D. W. Ross.
Cost of power for pumping irrigating water, by H. A. Storrs.
Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in United States in 1904, by E. C. Murphy. 206 pp., 18 pls. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and areas of cross section.

150. Weir experiments, coefficients, and formulas, by R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

*151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls. 10c.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron, chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Scope indicated by title.

*155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuation due to rainfall and evaporation, barometric changes, temperature changes, changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground water developments, and to indeterminate causes.

*160. Underground water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905; lists of publications relating to underground waters, and contains the following brief reports of general interest:
Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of fluorescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

*163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation, treatment of slop, sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, * * * with a history of the sewage-disposal problem, by C.-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and recent tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification by intermittent sand filtration and in beds of coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and resulting litigation; discusses effect of acid-iron liquors on sewage-purification processes, recovery of copperas from acid-iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls. 5c.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amounts and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* the State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls. 40c.

Scope indicated by amplification of title.

*196. Water supply of Nome region, Seward Peninsula, Alaska, 1906, by J. C. Hoyt and F. F. Henshaw. 1907. 52 pp., 6 pls. 15c.

Gives results of measurements of flow of Alaskan streams, discusses available water supply for ditch and pipe lines and power development; presents notes for investors.

*200. Weir experiments, coefficients, and formulas, revision of paper No. 150, by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

Scope indicated by title.

*218. Water-supply investigations in Alaska, 1906–7 (Nome and Kougarok regions, Seward Peninsula; Fairbanks district, Yukon-Tanana region), by F. F. Henshaw and C. C. Covert. 1908. 156 pp., 12 pls. 25c.

Describes the drainage basins, gives results of observations at the gaging stations, and discusses the water supply of the ditches and pipe lines and possibilities of development; gives also meteorological records.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1909. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

228. Water-supply investigations of the Yukon-Tanana region, Alaska, 1907 and 1908 (Fairbanks, Circle, and Rampart districts), by C. C. Covert and C. E. Ellsworth. 1909. 108 pp., 7 pls. 20c.

Describes the drainage basins; gives results of observations at gaging stations; discusses the water supplies of the ditches and pipe lines and possibilities of hydraulic development.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

*234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall, by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parker.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool scouring, bleaching and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer, and glue.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one-hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture and gives résumé of Federal and State water-power legislation in the United States.

*255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs, and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of under ground water, artesian conditions, and oil and gas bearing formations; gives history of well-drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties; contamination of well waters, and methods of prevention; tests of capacity and measurement of depth; and costs of sinking wells.

*258. Underground-water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of the Rio Grande and of Pecos, Gallinas, and Hondo rivers.

280. Gaging stations maintained by the United States Geological Survey, 1888–1910, and Survey publications relating to water resources, compiled by B. D. Wood. 1912. 102 pp. 10c.

314. Surface water supply of Seward Peninsula, Alaska, by F. F. Henshaw and G. L. Parker, with a sketch of the geography and geology by P. S. Smith, and a description of methods of placer mining by A. H. Brooks. 1913. 317 pp., 17 pls. 45c.

Contains results of work at gaging stations.

*315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of waterworks systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water, and municipal water softening.

318. Water resources of Hawaii, 1909–1911, by W. F. Martin and C. H. Pierce. 1913. 552 pp., 15 pls. 50c.

Describes the general features of the islands and gives results of measurements of streams and of observations of rainfall and evaporation; contains a gazetteer.

334. The Ohio Valley flood of March–April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

336. Water resources of Hawaii, 1912, by C. H. Pierce and G. K. Larrison. 50c.

Contains results of stream measurements on the islands in 1912.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 76 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

342. Surface water supply of the Yukon-Tanana region, Alaska, by C. E. Ellsworth and R. W. Davenport. 1915. 343 pp., 13 pls. 45c.

Presents results of 6 years' observations of the water supply of the Yukon-Tanana region, discusses climate and precipitation, and gives station records.

*345. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer. 30c.

*(e) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53–65. Scope indicated by title.

(f) The discharge of Yukon River at Eagle, Alaska, by E. A. Porter and R. W. Davenport, pp. 67–77, pls. iv–v. 5c.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of the geyser water of Yellowstone National Park, hot springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri, and Oklahoma, Montana, Colorado and Utah, Nevada and Arizona, and California.

371. Equipment for current-meter gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls. 20c.

Describes methods of installing automatic and other gages and of constructing gage wells, shelters, and structures for making discharge measurements and artificial controls.

372. A water-power reconnaissance in south-central Alaska, by C. E. Ellsworth and R. W. Davenport, with a section on southeastern Alaska, by J. C. Hoyt. 1915. 173 pp., 22 pls. 20c.

373. Water resources of Hawaii, 1913, by G. K. Larrison. 1915. 190 pp. 20c.

Contains results of stream measurements on the islands in 1913.

*375. Contributions to the hydrology of the United States, 1915. N. C. Grover, chief hydraulic engineer.

Contains three papers presented at the conference of engineers of the water-resources branch in December, 1914, as follows:.

(c) Relation of stream gaging to the science of hydraulics, by C. H. Pierce and R. W. Davenport, pp. 77–84.

(e) A method for correcting river discharge for a changing stage, by B. E. Jones, pp. 117–130.

(f) Conditions requiring the use of automatic gages in obtaining records of stream flow, by C. H. Pierce, pp. 131–139.

400. Contributions to the hydrology of the United States, 1916. N. C. Grover, chief hydraulic engineer.

(a) The people's interest in water-power resources, by G. O. Smith, pp. 1–8.

(c) The measurement of silt-laden streams, by Raymond C. Pierce, pp. 39–51.

(d) Accuracy of stream-flow data, by N. C. Grover and J. C. Hoyt, pp. 53–59.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883–84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125–173, pl. xxi. Scope indicated by title.

*Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Irrigation in India, by H. M. Wilson, pp. 363–561, pls. cvii to cxlvi. (See Water-Supply Paper 87.)

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III, Irrigation, xi, 486 pp., 77 plates. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–349, pls. cxi to cxlvi. Discusses the economical aspects of irrigation, alkaline drainage, silt, and sedimentation; gives brief history of legislation; describes perennial canals in Idaho-California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, xx, 597 pp., 73 pls. $2.10. Contains:

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, pls. iii and iv. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, papers chiefly of a theoretic nature, v, 958 pp., 172 plates. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, pls. vi to xvi. Discusses the amount of water stored in sandstone, in soil, and in other rocks, the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous medium and through sands, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, pl. xvii. Scope indicated by title.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Parts II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, vii, 660 pp., 75 pls. $1.40. Contains:

*Hydrography of Nicaragua, by A. P. Davis, pp. 563–637, pls. lxiv to lxxv. Describes the topographic features of the boundary, the lake basin, and Rio San Juan; gives a brief résumé of the boundary dispute; discusses rainfall, temperature, and relative humidity, evaporation, resources, and productions, the ship-railway and canal projects; gives the history of the investigations by the Canal Commission, and results of measurements on the Rio Grande, on streams tributary to Lake Nicaragua, and on Rio San Juan and its tributaries.

Twenty-second Annual Report of the United States Geological Survey, 1900–1901. Charles D. Walcott, Director. 1901. (Parts III and IV, 1902.) 4 parts, *Pt. IV, Hydrography, 690 pp., 65 pls. $2.20. Contains:

*Hydrography of the American Isthmus, by A. P. Davis, pp. 507–630, pls. xxxvii to l. Describes the physiography, temperature, rainfall, and winds of Central America; discusses the hydrography of the Nicaragua Canal route and the Panama Canal route; gives estimated monthly discharge of many of the streams, and rainfall, and evaporation tables for various points.

PROFESSIONAL PAPERS.

*72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee river basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 263 pp., 3 pls. 70c.

The results of an investigation which was carried on in a specially equipped laboratory at Berkeley, Cal., and was undertaken for the purpose of learning "the laws which control the movement of bed load and especially to determine how the quantity of load is related to the stream slope and discharge and to the degree of comminution of the débris."

A highly technical report.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses so far as available.

*319. Summary of the controlling factors of artesian flows, by Myron L. Fuller 1908. 44 pp., 7 pls. 10c.

Describes underground reservoirs, the sources of underground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

*479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural water; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses, discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

INDEX BY AREAS AND SUBJECTS.

[A=Annual Reports; M=Monograph; B=Bulletin; P=Professional Paper; W=Water-Supply Paper; G F=Geologic folio.]

[1] Many of the reports contain brief subject bibliographies. See abstracts.

[2] Many analyses of river, spring, and well waters are scattered through publications as noted in abstracts.

INDEX OF STREAMS.